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SAVING THE BIG CATS

Keeping the original Group C Jaguars racing

PLUS

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Porsche 917

The beast that spawned a Le Mans legend

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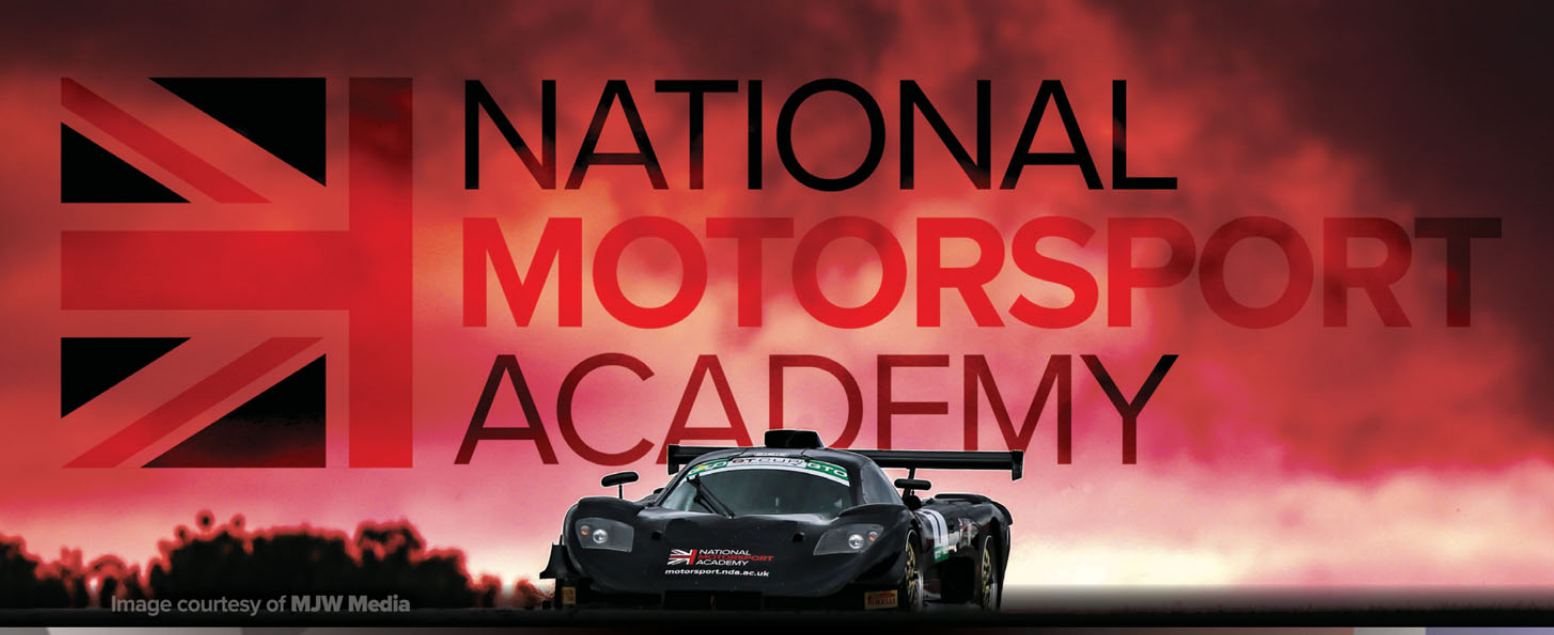

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MAY	25/26	Masters Historic Festival	Brands Hatch
MAY/JUNE	31/2	Sonoma Speed Festival	Sonoma Raceway
JUNE	8/9	Masters Historic Race Weekend	Donington Park
JUNE	28/30	Grand Prix de France Historique	Magny Cours
JULY	12/14	Sommet des Legendes	Circuit Mont Tremblant
JULY	12/14	Formula 1 Rolex British Grand Prix*	Silverstone
JULY	18/21	The WeatherTech International Challenge with Brian Redman	Road America
JULY	26/28	Silverstone Classic	Silverstone
AUGUST	9/11	AvD Oldtimer Grand Prix	Nurburgring
AUGUST	10/11	Monterey Pre-Reunion	WeatherTech Raceway Laguna Seca
AUGUST	15/18	Rolex Monterey Motorsports Reunion	WeatherTech Raceway Laguna Seca
SEPTEMBER	6/8	Historic Grand Prix	Zandvoort
SEPTEMBER	27/29	Spa Six Hours	Spa
NOVEMBER	1/3	Formula 1 United States Grand Prix*	Circuit of the Americas
NOVEMBER	13/17	HSR Classic 24 Hour**	Daytona International Speedway
DECEMBER	5/8	Sebring Historics**	Sebring International Raceway

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7 RACE SERIES

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Saluting the Bicester vision

Historic racing basically serves two purposes. One is for the owners of such cars to let their hair down and compete in a car of their dreams; the other is for the spectators. It is the second element which has grown exponentially over the last two decades thanks to clever promotion, marketing and the skills of series organisers.

It has also led to the rise of an industry that services these cars, the bit we are most interested in as a magazine. The likes of Bicester Heritage, for example, which recently hit the headlines for the launch of the UK's first 'automotive resort', could not really have happened 20 years ago as there simply wasn't the market.

Bicester Heritage is actually very inspirational and packed with history. The first aeroplane to fly into it was a Bristol Boxkite in 1911, five years before it was occupied by the Royal Flying Corps, which then became part of the newly-formed Royal Air Force on April 1, 1918.

As RAF Bicester, it was transformed into a state-of-the-art Bomber Station in the 1920s. In October 1939, it saw the first prototype Handley Page Halifax bomber take off from its runway. Home to No. 13 Operational Training Unit RAF under the control of RAF Bomber Command, it then became part of Fighter Command in 1943, hosting Spitfires and De Havilland Mosquitoes, although no offensive missions were flown from this base.

It then became the base for the Glider Pilot Regiment for glider pilots and their tug aircrews, training there before D-Day, Arnhem and the Rhine Crossing. As the battle moved towards Berlin, RAF Bicester was transformed into a busy maintenance unit dealing with both aeroplanes and motor transport, becoming a non-flying unit in 1944 for maintenance, and later a Motor Transport depot.

After the war, RAF Bicester was gently mothballed, the buildings falling into disrepair. The structures were left to deteriorate and were in a very poor condition, with 18 of the buildings placed on English Heritage's "heritage at risk" register. The site was noted, however, as "the best-preserved bomber airfield" of its type.

Salvation came in March 2013 when Bicester Airfield was acquired from the Ministry of Defence by Bicester Heritage. Over the six years since then, the site has been rejuvenated, restoring the RAF's Technical Site for modern purpose and creating not just a destination, but a thriving hub of industry geared to supporting the wider motoring community. The red brick buildings have been refurbished and restored. The hangars, tree-lined avenues and airfield now provide an authentic period setting for specialists, vehicle owners, enthusiasts and visitors to meet, share their passions and immerse themselves in a classic age.

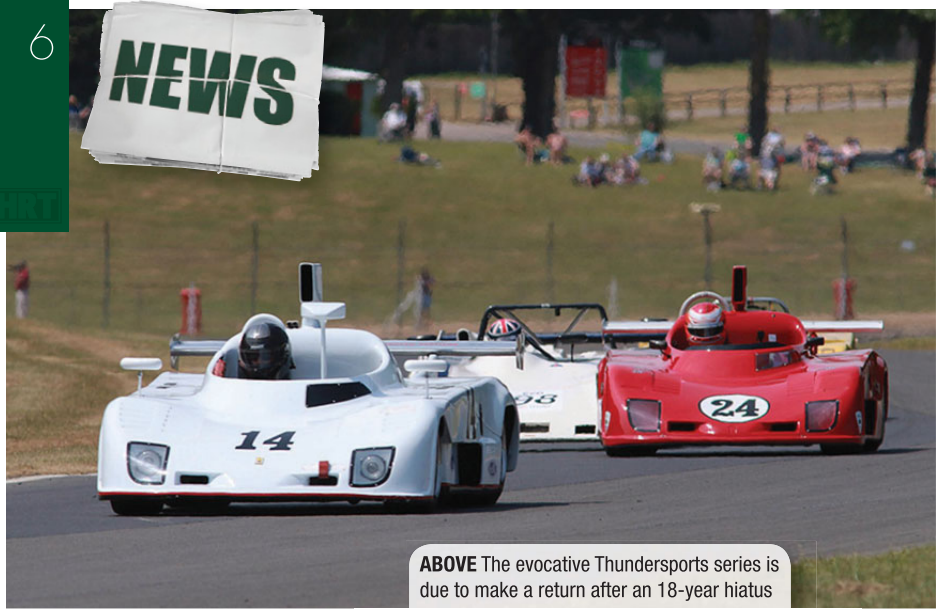
However, Bicester Heritage is not resting on its laurels. In March it unveiled 'Bicester Motion', its masterplan for the creation of the UK's first automotive resort, with an ambition to become one of the country's top 20 tourist and leisure destinations.

Having successfully developed the concept of a Centre for Excellence, experience and community for the historic automotive sector, Bicester Heritage, which occupies just 5% of the site, will now become a component of a larger landmark development named Bicester Motion. This expansion will ensure that the historic airfield location it calls home will fulfil its original and continued purpose as a focal point for cutting edge technology.

As Bicester Motion launches across 444 acres, the new resort hopes to offer leisure, culture and tourism experiences within one destination. Consisting of multiple zones, the Bicester Motion concept comprises of the recently-announced 344-room hotel and conference development, and an additional 770,000 ft of operational business and leisure accommodation.

Were it not for the increasing demand from the historic vehicle sector to keep its cars in fine fettle, backed by Bicester Heritage's vision and courage to proceed with such a project, the world would be a poorer place. HRT

William Kimberley
Editor



ABOVE The evocative Thundersports series is due to make a return after an 18-year hiatus

HSCC revives Thundersports brand

THE Historic Sports Car Club (HSCC) is to bring back the pre '80 Endurance Series, the famous Thundersports, following an 18-year hiatus.

It will be rebranded as HSCC Thundersports and include pairs of half-hour races on the Silverstone and Brands Hatch Grand Prix circuits as well as a double-header at Spa-Francorchamps.

Cars of the type used in the World Endurance Championship, the FIA GT Championship and FIA 2-litre Sports Car Championship will race, along with Can-Am sports-racing cars from the heyday of the category in the 1970s. Just as in period, Sports 2000s will be encouraged into the series with a dedicated class covering all Ford Pinto-engined cars from right through until 1990.

The new title will evoke memories of the popular Thundersports series of the 1980s, which was created by John Webb at Brands Hatch. First run in 1983, the series was open to a wide range of sports and sports-racing cars before folding in 1989.

The brand was then continued by HSCC in the 1990s for the RJB Mining Thundersports Championship and used from 1992 to 2001.

"The Thundersports title will bring back great memories for many people and we're keen to re-create those fantastic races with strong and varied grids of spectacular sports and sports-racing cars," enthused HSCC CEO, Andy Dee-Crowne. "We can also offer competitors excellent value for money track time at three of the world's finest race tracks. Back in the day, Thundersports was chosen to support the Formula 1 World Championship at Brands Hatch and we'll be back on the Brands GP circuit at the end of June." HRT

Heritage Touring Cars to provide Bathurst support

ABOVE Classic Touring Cars will get to relive their heyday in support of the Bathurst 6 Hours

HERITAGE Touring Cars is set to bring more than 25 classic touring cars back to Bathurst's Mount Panorama in tribute to the circuit's remarkable history. The historic racing association is set to provide a support race to the Bathurst 6 Hour.

Heritage Touring Cars is making its return with a 26-car field of genuine cars that raced throughout the 1970s and 1980s in Group C and Group A Touring Car races.

The field includes a broad spread of entries across both categories, from Ed Singleton's Group C Ford Falcon XC to the ex-Colin Bond Ford Sierra RS500 driven by Steve Webb and ex-Dick Johnson Shell Sierra of Terry Lawler.

Bathurst legend Bob Holden returns in one of the same AE82 Corollas that he raced when the car was new, while a V12 Jaguar XJS set to be driven by Anthony Pallas will likely be a fan favourite. Heritage Touring Cars will contest three races across the Bathurst 6 Hour programme. HRT

Bicester Heritage reveals 'Bicester Motion' plan

BICESTER Heritage has unveiled its masterplan for the creation of the UK's first automotive resort, which it hopes will become one of the UK's top 20 tourist and leisure destinations.

Having developed the concept of a Centre for Excellence, experience and community for the historic automotive sector, Bicester Heritage will now become a part of a larger development dubbed Bicester Motion. This expansion means that the historic airfield location at its heart will continue to fulfil its original purpose as a focal point for cutting edge technology.

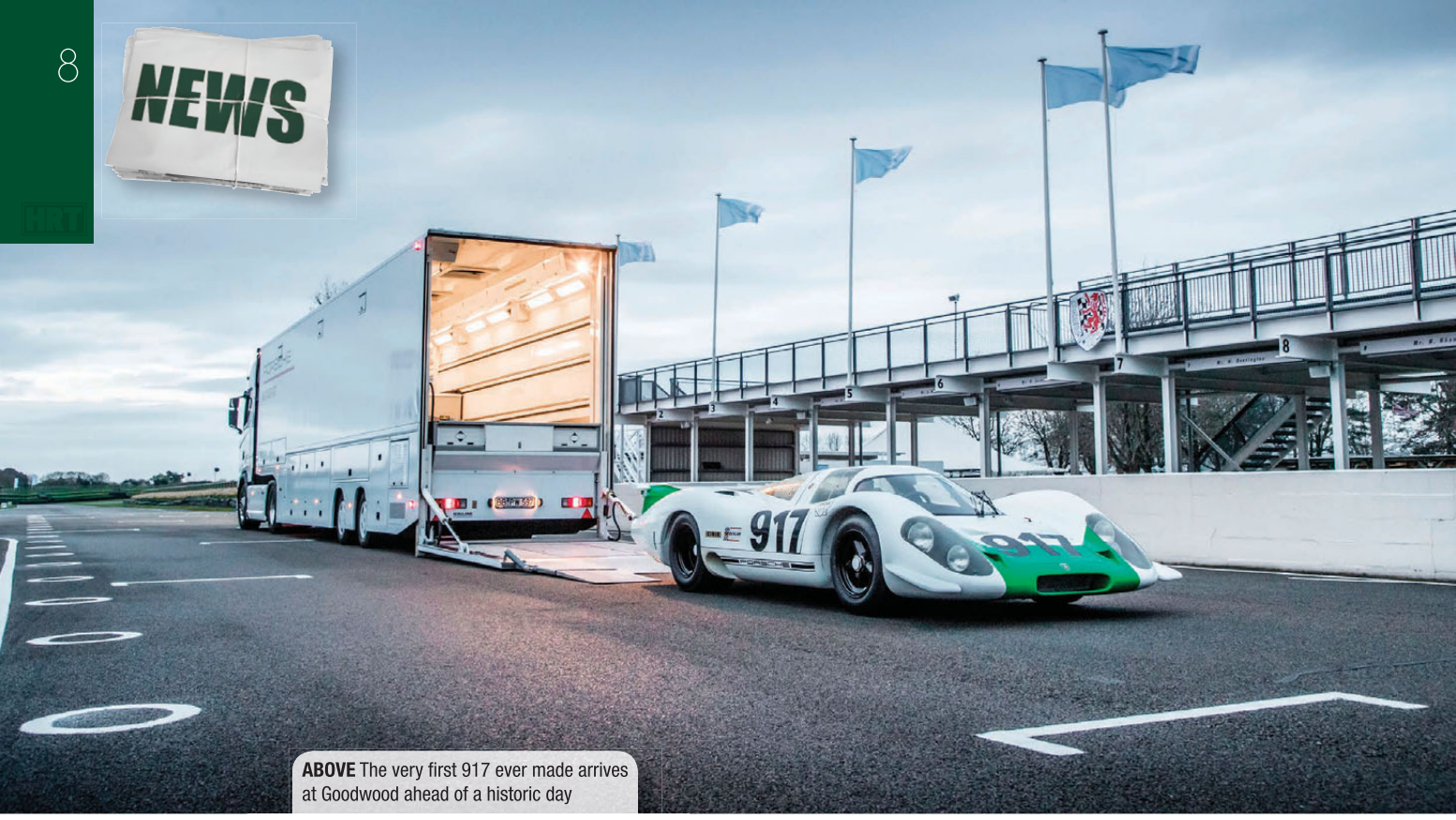
Bicester Motion will occupy a total of 444 acres, and will offer leisure, tourism and culture experiences in one destination split into multiple zones. It builds on the recently announced 344 room hotel and conference development, and an additional 770,000 square feet of operational business and leisure accommodation across the site. This, along with the 30+ businesses coming to the development, looks set to provide over 2,000 skilled jobs to the area.

Bicester says that its visitors will be able to become "fully immersed in the breadth of automotive culture", from enjoying existing on-site historic vehicle specialists, through to future electric and autonomous technology. The development will also be dedicated to driving experiences, and aspires to include a brand experience centre offering drivers the chance to get behind the wheel both on and off road. Close to the brand centre, the aim is to transform the dilapidated quarry and former industrial areas into the Bicester Reserve, enabling visitors to also enjoy the site's currently inaccessible natural areas.

"The automotive industry is in a fascinating state of flux owing to changing customer habits and requirements, alongside the technology shift in drivetrains and autonomy," explained Bicester Motion chief executive Dan Geoghegan. "Bicester Motion will enable both new and existing manufacturers to interact more effectively with their clientele. It will help build those relationships in a revolutionary way by providing an immersive environment that offers a lifestyle experience beyond just cars on tracks or visiting a showroom. The automotive world is changing, and we plan to offer a first-of-its-kind resort that will have multi-generational appeal.

"Being around 90 minutes from 50 per cent of the UK population makes the Bicester Motion location second to none, furthermore Oxfordshire receives 27.6 million visitors per annum. Of those, 7 million visitors head to Bicester Village a stone's throw away, with arguably the most desirable national and international demographic to the automotive industry." HRT

ABOVE Bicester Heritage has revealed an exciting future for its development



ABOVE The very first 917 ever made arrives at Goodwood ahead of a historic day

Fifty years of Porsche 917 celebrated at Goodwood

THE Goodwood Members' Meeting was the site of four Porsche motorsport firsts. For the first time, Porsche presented four driving examples of the 917 around the historic Goodwood Circuit. Among them was the first 917, chassis 001, which has recently undergone a complete restoration.

Also attending the meeting on the back of a restoration was 917/30-001. This Vaillant-liveried car was the newest of all the 917s on display, and had a wheelbase extended by 184 mm compared to a conventional 917. The car won on its debut at the hands of Vic Elford in the Interserie race at Hockenheim.

Joining these two freshly restored cars was the 917 KH chassis 15, in Gulf livery, and the 917/30 Spyder. The Gulf car is one of the most iconic 917s, though the make is also remembered for the short-tail version that brought Porsche its first outright success at Le Mans in 1970, a feat repeated the following season by a car in Martini colours. In this guise, it covered a distance of 5,335 km, a record which stood for 39 years.

Finally, a regular attendee at Goodwood, the Sunoco-liveried 917/30 Spyder develops in the region of 1,200 hp from its 5.3-litre V12. This power, combined with a weight of just 850 kg, allows the racer to reach a top speed of 375 km/h.

At Goodwood, the cars were driven by Le Mans winners Richard Attwood and Neel Jani, along with former F1 and LMP1 racer Mark Webber. Following the 917s' showing at the Members' Meeting, the cars were taken to re-join the Porsche Museum in Stuttgart, which is honouring 50 years of the 917 with a special exhibition. HRT

Porsche 917 Page 54


THE GREATEST RACING CAR EVER?

Bailey Morris launches custom propshafts for historics

UK-based propshaft-maker Bailey Morris has announced the launch of Heritage & Speed, a brand-new range of custom-made propshafts designed specifically for the motorsport and classic car markets.

The new range, which has been created using Bailey Morris' 40 years of experience in the automotive sector, fills a niche in the current market by offering branded aftermarket propshafts specifically tailored for motorsport and classic car customers. In filling this gap, the new range will offer: custom propshafts; lightweight propshafts and components; heavy duty propshafts and components; technical sales support; and bespoke finishing and design. HRT

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ABOVE Laguna Seca is set to come alive with historics in August, thanks to the Monterey Motorsports Reunion

IMSA cars to star at Monterey Motorsports Reunion

OWNERS of some of the world's most iconic historic race cars have been issued letters of acceptance into the Rolex Monterey Motorsports Reunion, enabling them to compete at the Laguna Seca event in August.

More than 500 historic and period-correct race cars are set to compete in 14 groups, with entrants spanning more than 100 years, from the National Speedway Roadster and Fiat S74 from 1911, to a 2014 Lola Toyota Rebellion LMP1 prototype.

The Motorsports Reunion is also set to celebrate the 50th anniversary of the International Motor Sports Association, with historic IMSA cars being thrust into the limelight as the event's featured marque.

Ultimately, more than 145 IMSA cars were accepted into four IMSA-focused groups with some of the series' most iconic cars, such as the 1991 AAR Toyota Eagle MkIII, 1976 Dekon Monzas, Greenwood Corvettes, and Riley and Scott Mk IIIs.

The Rolex Monterey Motorsports Reunion, which was bestowed with the 2017 FIA Founding Members Club Heritage Cup, and the Pebble Beach Concours d'Elegance are the cornerstones of the famed Monterey Classic Car Week, which last year drew 67,128 car enthusiasts over four days of racing.

The 2019 Reunion will also feature a raft of book signings, interviews with Grand Marshal Hurley Haywood and other driving greats, car shows, demonstration laps, a marketplace full of exhibitors and a special tribute to the 100th anniversary of Bentley. This is in addition to the open paddock with rows after rows filled with significant cars from motorsport history, including a full grid of historic Formula 1 cars that ran between 1966 and 1985. HRT

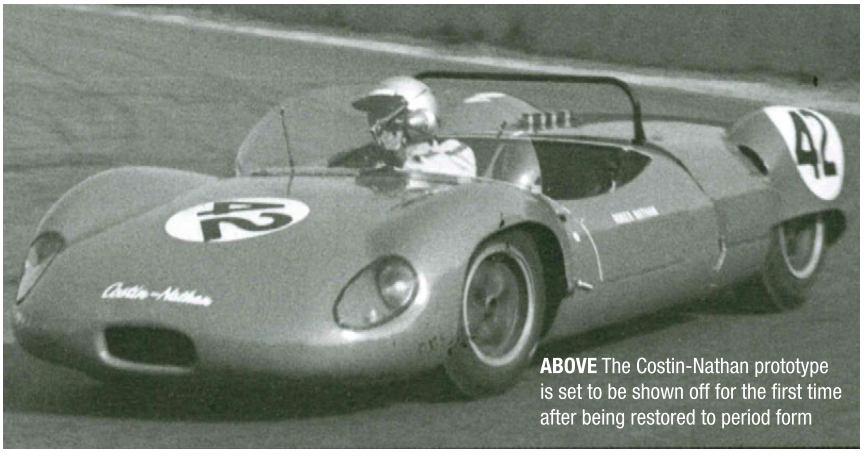
Historic Costin-Nathan set for spring unveiling

A unique Costin-Nathan racing prototype will make its public debut and be fired up at Beaulieu's Silver Spring Autojumble on May 18th and 19th, as part of a celebration of the new National Motor Museum exhibit.

The hand-built car, which overcame the might of its bigger rivals half a century ago, is set to be started up by its original creator, driver, and restorer, Roger Nathan. The car, which features unusual wooden construction and is powered by a highly tuned Hillman Imp engine, was created in 1965 by Nathan, in conjunction with automotive engineer Frank Costin.

In 1966, in the hands of Nathan, the prototype made its mark by beating the bigger teams to win the Coupes de Paris race at the Montlhéry circuit.

The car was rediscovered in 2016, and was sold at auction to an American buyer, who commissioned Nathan to restore it. The unveiling at Beaulieu marks the end of the extensive restoration. HRT



ABOVE The Costin-Nathan prototype is set to be shown off for the first time after being restored to period form

NEWS

VSCDA to celebrate Formula Ford's American 50th

THE Vintage Sports Car Drivers Association is to host a 50th anniversary celebration for Formula Ford at Road America on September 11-15. The FF50th will be the star attraction of the VSCDA's marquee event, the Elkhart Lake Vintage Festival.

The celebrations will last five days, including free practices, qualifying sessions and several feature races. The event, which is open to Kent-powered Formula Fords of all ages, will be made up of three race groups allowing a total entry of 200 cars, with tyre rules and licensing requirements being honed for maximum inclusivity.

The event will be supported by the Blue Oval, a prospect described by Alex Rorke, the VSCDA's president, as "thrilling".

"With Ford's support, we have added a third race group," he said. "Between Ford's sponsorship and the dedication of event chairs Mike and Deb Korneli, it's going to be a spectacular weekend for racers and spectators."

Formula Ford, which was originally conceived as a relatively accessible and affordable route into single-seater motorsport, boasts scores of notable alumni, including Emerson Fittipaldi, Ayrton Senna, Nigel Mansell and Michael Schumacher from Formula 1, and Michael Andretti, Chip Ganassi, Jimmy Vasser and defending Indy 500 winner Will Power in IndyCar.

Away from the track, the festival will also feature road course re-enactments on the very roads that were used for racing before the construction of Road America. The Gather on the Green Concours d'Elegance competition, meanwhile, will enable spectators to get up close to some incredible machinery. HRT

LEFT Fifty years of Formula Ford in the USA is set to be celebrated by the VSCDA

Record interest in HSCC Historic Formula 2

THE Historic Sports Car Club has reported record levels of interest in the Historic Formula 2 series, and is hoping to fill a 40-car grid at this year's Silverstone Classic.

A host of F2 regulars have already signed up for the season, while a number of newcomers will also join the grid. Among them will be Le Mans and international GT driver Wolfgang Kaufmann, in his newly-acquired ex-Stephen South March 782, Australian Martin Bullock in a Chevron B34 and Frenchman Gerard Gamand, who is returning to the series with his 1972 Pygmée MDB17, after a gap of nearly a decade.

Silverstone's event will be joined by races at Hockenheim, Brands Hatch GP, Magny-Cours, Zandvoort and Dijon, with participation set to be up on 2018's 50 drivers in total.

"Historic Formula 2 is attracting unparalleled levels of interest ahead of 2019," said Andy Dee-Crowne, HSCC CEO. "We're delighted to welcome a host of new drivers, but we are also very, very pleased to be welcoming back many of the drivers who have loyally supported the championship since the HSCC took over the management of Historic F2 more than a decade ago." HRT

ABOVE The HSCC is enjoying record levels of interest in its Historic F2 series

"COSSIE V2" RISES FROM THE ASHES

When Ken Block's Escort Cosworth burned out, the YouTube star seized the chance to perform a modern reworking of his rally favourite. **Hal Ridge** reports

ABOVE An aggressive modern WRC-style aero package sets the car apart from its predecessor

As the saying goes, every cloud has a silver lining, and in this instance that is certainly the case. Those were probably not Ken Block's immediate thoughts however, as he scrambled out of the burning wreckage of his car on a New England Forest Rally stage last year.

Block and his Hoonigan team acquired a period Ford Escort Cosworth to be part of the Gymkhana 10 series, before taking it into the woods to go rallying. A podium on the car's maiden Americas Rally Association series outing came with a number of reliability niggles, but worse was to follow on the next event.

Within a handful of miles from the end of the first day, an intermittent gear selection issue caused a missed gear while Block was rotating the car into a left-hand corner. The Escort clipped a rock on the inside of the corner and rolled into a ditch on the outside of the road. Then it caught fire. It's believed that the fuel rail broke off the engine and despite Block and co-driver Alex Gelsomino's best efforts to save the 'Cossie', nothing could be done to stop it burning to the ground.

That took the American squad back to the drawing board. "We went through a whole discussion of do we keep that classic car like what we had before, or do we keep the essence of it but build something new, something modern. I was genuinely surprised with the reliability issues we dealt with, with the old car," says Gymkhana, rally and rallycross star Block. "There wasn't anything wrong with it, but race cars get old. If you're going to race a car a lot, you need it to be very reliable. So the idea we went with was if the Ford Escort RS Cossie came out today, what would the current World Rally team do with that car? That's the concept."

The man tasked with turning Block's concept to reality is vastly experienced rally team director Derek Dauncey. "We knew the pluses and the minuses with the old car. Even back in the day when I worked with [Tommi] Makinen, we'd always pick the stages to attack on, we'd never attack every single stage," says Dauncey. "Ken's philosophy you know, he's do or die and he attacked from the

Photos: Hoonigan Racing

“Ken’s philosophy is do or die. Every service was big and he really took the car to its limits”

ABOVE The demise of the last Cosworth, on the New England Forest Rally

word go on the first event. Every service was big and he really took the car to its limits. It was quite interesting to watch, but the reliability was on the edge. We had active front and rear differentials and the diff units were tripping out. In the end, the demise of the car was ultimately down to the gearbox sticking. In my mind we were looking at a minimum of changing the wiring harness and ECU before that, but obviously we then had the fire so it kind of put everything back to square one.”

A donor car, a 1994 Ford Escort World Rally chassis, was sourced and MDV Specialist Engineering, based in Essex, UK, was signed-up to build the new machine. Not only was it chosen because of the firm’s close proximity ▶

LEFT The 100 Acre Wood Rally in Missouri marked the start of the reborn car's world tour

to the Cosworth's original birthplace at Boreham, but because of Peter Bennett's company's reputation for whacky Fords.

"We bought the donor car in late August, then Ken went across to see MDV between the [WRC] Rally Spain test and recce," recalls Dauncey. "We had a design outline and bodywork sorted and I had a technical outline of the car. Ken had been in touch with Ash [Thorp], who designed all the bodywork, and within a couple of days he'd come up with this design of the car just before Rally Spain started.

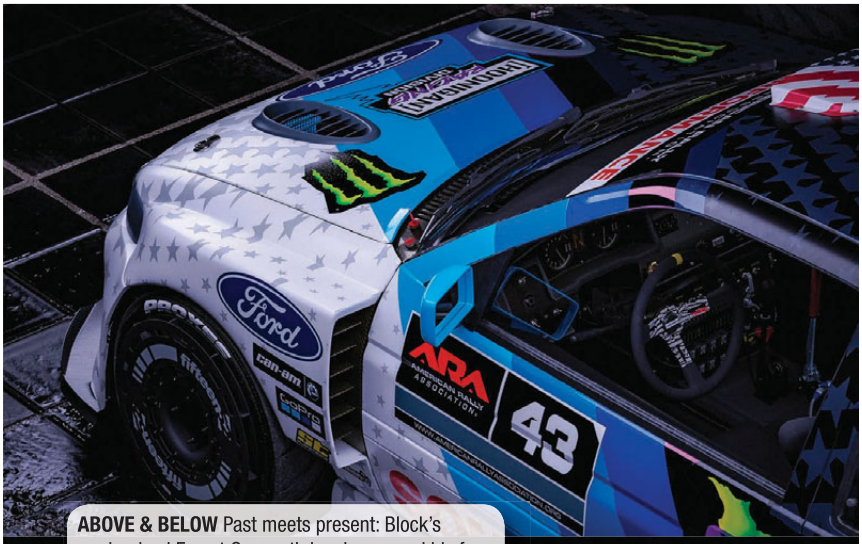
"I went back to MDV after Spain with an A3 print of what Ash had come up with and you just had to build it – it looked stunning. One thing that we've been struck by with a couple of projects is you come up with some concepts and drawings, but they're never really what the actual end product looks like. But with this, it was identical to what we've got now."

INSPIRATION

Taking inspiration from M-Sport's current WRC Fiesta, the Escort boasts wider arches and sills, a new front bumper and splitter, different rear bumper and diffuser, and a lip around the iconic duck-bill rear wing. The bottom part of that spoiler, incidentally, is moulded into the composite boot, to save weight and aid performance.

"Anything we've ever put on a car, we've wanted it to do something: we're not into just bolting things on to make them look good," explains Dauncey. "With the aero as it is, we are getting downforce at the back – a bit more than I expected. The diffuser is working and the lip we added on the spoiler is having quite a bit of effect. We've not put it in a wind tunnel, that would be quite interesting to do at some point, and there's some work to do around the front splitter still. It follows the trend of the WRC car but it won't nail itself to the floor like the WRC car does."

Under the wider arches, the Escort's track has been extended to the same width as current WRC rules at 1835 mm, attached to latest-specification MacPherson strut multi-way adjustable dampers from Reiger, to get away from the limited travel of the Group A units used on the previous car. To increase the width, the turrets were moved out at both the front and rear of the car. ▶



ABOVE & BELOW Past meets present: Block's modernised Escort Cosworth has impressed his fans

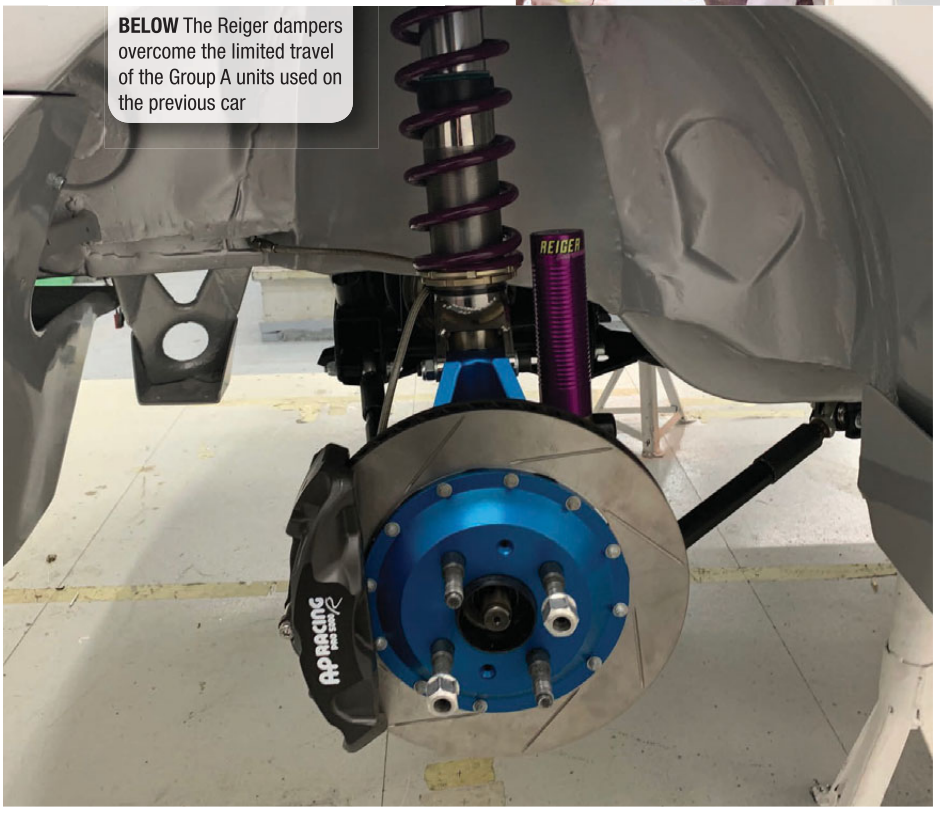
ABOVE Care has been taken to keep the 'office' clear of clutter

"There's a bit more to come as a step two," notes Dauncey. "We were a bit safe on this one. We are going to evolve the car, but we wanted to be safe with driveshaft angles, plunges and rebounds and everything." The car uses modified Escort WRC crossmembers to accept the Sadev SP03 differential (the same diff used front and rear), while the WRC rear suspension arms have also been revised to suit the widening of the track.

Housed within the 7x15" wheels on gravel and 8x18" wheels on Tarmac are AP Racing 5000R 4-pot brake callipers and 315 mm x 28 mm discs all round, using pads from Ferodo. Drive is delivered to the wheels by bespoke Sadev driveshafts from the very latest six-speed sequential SC917 transmission. The French firm has also provided the gearchange tower, bespoke propshafts, and bellhousing.

"We're going to need to run big horsepower through that transmission. The worry with the last Escort was that it had the original [FFD, seven-speed] 'box. It was like it was always waiting for that to just give up the ghost," says Dauncey.

The Cossie V2, as Block refers to it, has been created to compete in a range of events, as part of the 'Cossie World Tour'. Block debuted the car on the 100 Acre Wood Rally in Missouri, but will also compete with it at Rally Whangarei in New Zealand, the Donegal Rally in Ireland, the Goodwood Festival of Speed, Gymkhana Grid in Poland, Rally Legend in Italy and more – events he's always wanted to do.



BELOW The Reiger dampers overcome the limited travel of the Group A units used on the previous car

Within the bespoke bellhousing lives an AP Racing clutch, comprising of three carbon driven plates and four carbon pressure plates, attached to the iconic YB Cosworth engine.

The longitudinally-mounted engine is one of the few components on the car that is directly-relatable to that used in the previous version, built by Julian Godfrey Engineering [JGE]. It does however feature a raft of upgrades in its latest iteration.

"This is a rethinking of the original Escort WRC engine produced for rallying in-period," explains Dauncey. "The key differences between our V1 and V2 engines are that this uses a new ▶

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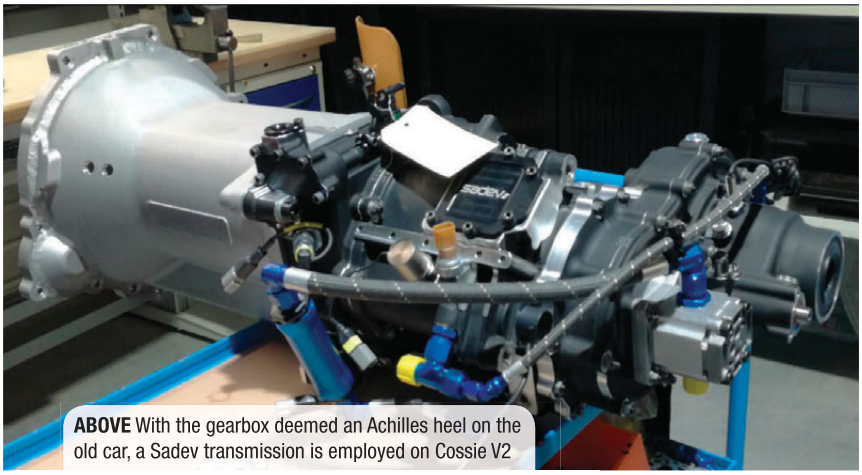

ABOVE With the gearbox deemed an Achilles heel on the old car, a Sadev transmission is employed on Cossie V2

lightweight aluminium block with through studs that secure the main steel caps to the cylinder head, rather than relying on the cast iron block structure. The original 90.8 mm bore and 77 mm stroke have been retained but with components made by Arrow Precision. Omega forged pistons have been retained, as these were an upgrade from the original Cosworth design and well proven to be the best choice. The cylinder head is an evolution from the original Coscast head and features a redesigned chamber shape which allows a higher compression ratio without skimming the head face, which makes for a more stable chamber. It's got JGE custom profile camshafts, produced from original blanks for both inlet and exhaust and developed specifically to work with restricted turbo engines."

Externally a new billet cam cover has provision for a coil for each spark plug, to allow use of a surface discharge spark plug from NGK. The inlet manifold has also been upgraded to a new design by JGE, straightened with lengthened constant taper inlet tracts compared to the previous version. A 60 mm fly-by-wire throttle body has also been used, with eight modern fuel injectors. The inlet plenum has been designed to direct air away from the inlets to make for a more even distribution to the cylinders. "Making the most of the available air has been the key element in the 2019 engine," says Dauncey.

For the engine control, the period Cosworth T6 ECU has been ditched for a state-of-the-art Cosworth MQ12Di unit, as used in the latest World Rally and World Rallycross cars.

"The change to the new ECU means we have mass-based fuelling rather than time-based, resulting in a significant step forwards measuring fuel consumption and potentially more power," he says. "We have more advanced strategies ▶

ABOVE This is a 'rethinking' of the original YB Cosworth engine

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Whacky racers

Boreham influence and a reputation for building outlandish machines is behind birth of 'Cossie V2'

MDV Specialist Engineering owner Peter Bennett began working at Ford's motorsport base, Boreham in Essex, in 1988 as a design engineer. He was involved first on the Sierra Cosworth programme, then the Sapphire and later the road and rally versions of the Escort Cosworth, until Malcolm Wilson's M-Sport concern took on Ford's World Rally Championship programme from 1997.

Bennett remained at Boreham until the firm closed in 2004, latterly being involved in the development of the Puma and Fiesta Super1600 kit cars.

Since creating MDV, where Bennett works together with two sons, Block's Escort is just the latest in a list of various motorsport projects that the firm has executed. That roster includes building a rallycross Supercar for Pat Doran in 2005, the unique McRae Enduro, designed from a clean sheet of paper for the Dakar rally, and famously the Ford RS200 that Mark Rennison drove to a sub-10 minute time on the Pikes Peak International Hill Climb.

> **"A ridiculous amount of work in a very short amount of time!"**

"It was very exciting to be involved with this project and we felt quite privileged that we actually got this job," says Bennett of the Hoonigan Escort. "We've known Derek Dauncey for many years and he always said he'd bring a project to us. When the project kicked off it was a fairly straightforward Escort Cosworth rebuild really. Then the designer came on board and that changed things dramatically, then Sadev and Cosworth came on board too and that changed things even more dramatically. It was a huge shift in the remit but the timescale stayed the same essentially. It was a ridiculous amount of work in a very short amount of time but we're very pleased with how the project went from our side and how the car left." HRT

ABOVE & BELOW MDV won the British Rallycross Championship with Pat Doran back in 2005 (above), but is perhaps best recognised for its work on Mark Rennison's spectacular RS200 Pikes Peak challenger (below)

for items such as anti-lag, gear control and launch control, and a built-in data logger, logging not only the engine data but also all of the chassis data." The new package has allowed for an increased number of sensors to assist with optimising the engine, while also being able to monitor for potential problems.

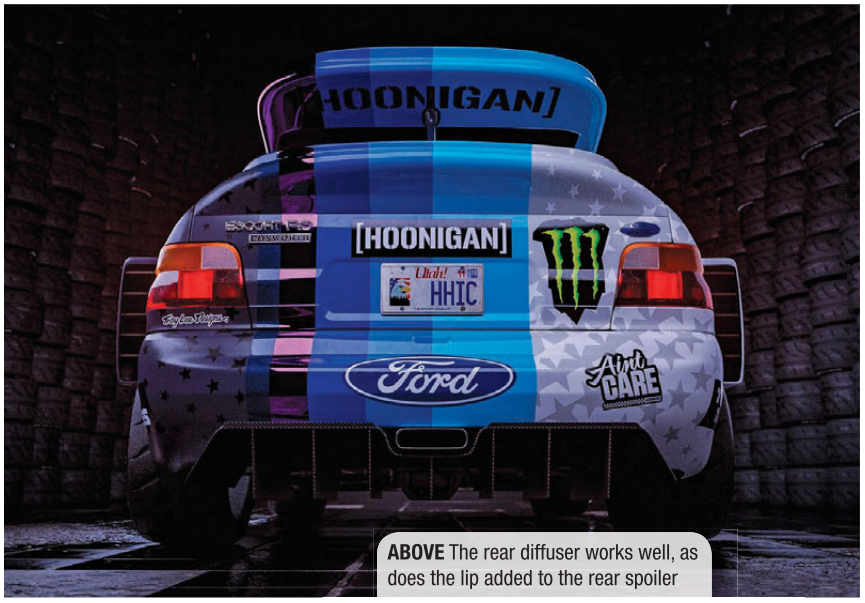
The Escort's turbocharger is courtesy of IHI, and for the first event, the 100 Acre Wood Rally, a 34 mm restrictor was used, resulting in 378 horsepower. In New Zealand that will be swapped for a 36 mm version (and an increase of 30 horsepower), while for events such as Gymkhana Grid, the restrictor will be dumped all together and a larger turbo fitted to deliver around 700 horsepower. "We're only using a small area of what we can do on the engine at the moment," notes Dauncey.

The MDV-made exhaust also features

> **"The idea we went with was if the Ford Escort RS Cossie came out today, what would the current World Rally team do with that car?"**

options for the different events, with both side and rear exit pipes. For rallies where a catalytic converter has to be run, the exhaust exits the rear.

A WRC specification fuel rail and Aeroquip fittings have been used, with fuel delivered to the rail from the cell in the rear of the car, where the interior paintwork is also a point of interest for Block. "We wanted to bring the original Cossie somehow forward into this car, so we ended up sending DeathSpray [an artist] part of the turbo, part of a wheel and part of a fender. He took those parts and ground them up so that we could add them to the paint," explains the car's driver. "So we added some of the flakes from the original Cossie's ground up parts to the roll cage in the rear, just so part of the original



ABOVE The rear diffuser works well, as does the lip added to the rear spoiler

Cossie can come with us as we race on."

The crew's cockpit, which features a steering wheel from Sabelt, is far less cluttered than in a period Cosworth, thanks in no small part to Cosworth's IPS48 Mk2 power unit. The use of the 'intelligent power management system' means there's no need for traditional breakers and fuse boxes, while also increasing the safety and reliability. The system also enables the Hoonigan team to implement custom strategies, processed directly on the unit for 'smart' button features, for things like lights and other driver functions. That is accompanied by Cosworth's Omega ICD driver display, with various options for displays, alarms and shift lights, the same as is currently used in World RX Supercars. Controls are operated by Cosworth's RSP10 switch panel.

Recaro seats are accompanied by a Stilo intercom and Lifeline Zero 2000 fire extinguisher system. The pedal box is a modified Escort MkII unit that allows the brake reservoir to be moved inside the engine bay, while a bespoke competition wiring harness has also been manufactured for both chassis and engine bay.

"The biggest challenge was the timescale. Honestly, we've done some tight projects – you always use the time you've got and you work to that period – but when we set the lead date with MDV it was for the old design, which was much easier than this," says Dauncey. "When we decided to go with this bodywork it meant extra work for them and put a lot of pressure on them, but they delivered. Looking back at the original design to this, we were so pleased that we followed this trend. It looks good in photos but in real life it looks *really* good.

COMMON GOAL

"I would say we should have had another eight or 10 weeks on this car but they [MDV] did a fantastic job and our partners delivered too. This is a full prototype really, so everything was a knock-on effect from everything else. In the last week we did four all-nighters, but everybody had the common goal to go forward. I can't thank them enough for what they've done."

Having worked alongside the iconic Ford as it competed at rallying's highest level in-period, Dauncey is well placed to make comparisons between new and old. "For me it's two bites of the apple," he concludes. "Originally those were fantastic cars but there wasn't as much technology, or grip, back then. We're lucky we get to do some fantastic projects with Ken but this is a special one for me, especially with how everything that nobody really sees in the background came together, so it was really rewarding." HRT

ABOVE Beneath the wider arches, the Escort's track has been extended to the same width as current WRC rules

DRESSED TO KILL

For many racers form follows function, while others lack the go to match the show, but as **Alan Stoddart** finds out, there could be one car that really does do it all

IN many racing cars it is possible to find rough edges. The areas where its makers sacrificed neatness or elegance for speed, places where, in a pit garage in the early hours of the morning, or even at the side of a Sicilian road perhaps, work was carried out hastily and no mind was given to fit and finish, only to function.

There are other cars however, often those that are reborn today, where the minute details are of paramount importance, where the car's appearance makes as much difference as what's providing the power. There are cars like Tux.

Tux is a completely rebuilt 1969 Chevrolet Camaro that has been lovingly put together by Detroit Speed, a custom builder specialising in American Muscle cars. Detroit Speed has been designing and building '69 Camaros, as well as bespoke chassis and suspension components, for customers for many years, so much so that the model has become something of a speciality for the workshop. Even so, remembers managing director Kyle Tucker, the phone call that got the ball rolling on the glossy black beauty was a special one.

"I'll never forget, we had not long delivered car number three to him [long-time customer Stuart Adams], and he'd had it a while. But then he called me one night when I was late leaving the shop, you know it was one of those nights, but he calls me and he says, 'Hey, I want to build another Camaro'.

"'I want it to be black, and I want you to build what you've always wanted to build'."

That invitation was more than enough to capture the interest of Tucker, who set about thinking what the greatest



ABOVE & BELOW Tux is a car that dresses performance up in an immaculate suit

> **"I want it to be black, and I want you to build what you've always wanted to build"**

expression of a Camaro would be. It had to be black, and Tucker wanted the car to be sophisticated and elegant, as in the car's dinner jacket namesake, but of equal importance was function. Growing up a racer, Tucker abhors anything fake, and insists that anything coming out of Detroit Speed doesn't just look the part; it has to do the business when required to.

With this brief the team set to work. It started with parts the company has refined over several years including a hydroformed front subframe, with hydroformed frame rails and cross members stamped in Detroit. This assembly was put together, before being tweaked to facilitate Tucker's vision for the car. In this case it was narrowed slightly, to enable the car to ride lower to give it a more purposeful stance as well as more composed handling and improved drivability, a trait also aided by the inclusion of high performance Baer brakes.

This tweaking process proved to be far less simple than it might sound, with one change causing a ripple effect which meant additional modifications elsewhere. In this case it started with the inclusion of JRI coilover shocks, which meant the subframe needed to be narrowed to be able to achieve the required steering angle. Next a custom full floor was built which acted as the car's subframe connectors, and the team fitted its Quadralink rear suspension kit and swivel links to properly get the body down over the suspension.

All this went under an almost entirely custom body that was built from a green on green column-shift Camaro with a 307 ▶

cu in small block engine from Louisville. Despite being kitted out with the "ugliest options", Tucker says it was a "pretty solid car" which ran well. This, however, didn't stop Detroit Speed gutting it as needed, until in the end, the roof, the firewall and the tailpans were all that was left of the original donor car.

The reason for this extensive transformation was simple: getting the details right, while maintaining that '69 Camaro look.

ABOVE A custom floor was necessary to ensure its performance was up to scratch

GETTING THE DETAILS RIGHT

"So the window trims on the front windshield and the back glass look like that of a '69 Camaro," Tucker notes, "but it's all one piece of aluminium rather than several pieces of stainless trim. That sounds simple, but it's a pain to do.

"We started with aluminium bar stock, put it in the mill and actually slit the back side of it. We then cross grooved it so that we could shape it, almost like when you mould wood by wetting it and bending it to shape.

"So after it's been bent, the corners have been welded and it has been fabricated. Bearing in mind this is after the car has been carefully painted with materials from PPG because you have the gaps on the car consistently within thousandths of an inch. At this point we took the car to Nashville, and Advanced Plating."

"Equipped with technology that wasn't available to Chevrolet in the sixties, but is still desirable to any driver today"

At Advanced Plating the focus was the same: ensuring that all fitments looked immaculate. There, the company would repeatedly coat the aluminium trim pieces in copper, which forms the base for the final chrome plating. After each dip they would remove the pieces and once again file them to shape and affix them to the car to make sure there was a perfect fit, and then, and only then after carefully ensuring that the pieces were perfect, were they given the final chrome plating.

During the build, Tucker's focus on performance was also key, pushing the team and guiding the choices that were made regarding the parts used.

It needed to be powerful, as any custom Camaro should be, but it also needed to offer reliability and durability to make sure it could be used every day if needed. To make this happen a custom LS3 engine was brought in from Kurt Urban, using ▶

BELOW Even without paint, the shape of the custom panels gives the car a distinctive style

ABOVE The hugger orange engine offers eye-catching contrast to the elegant black exterior

very high-quality components, or "all the things you would expect to find in a high-end race engine" as Tucker puts it.

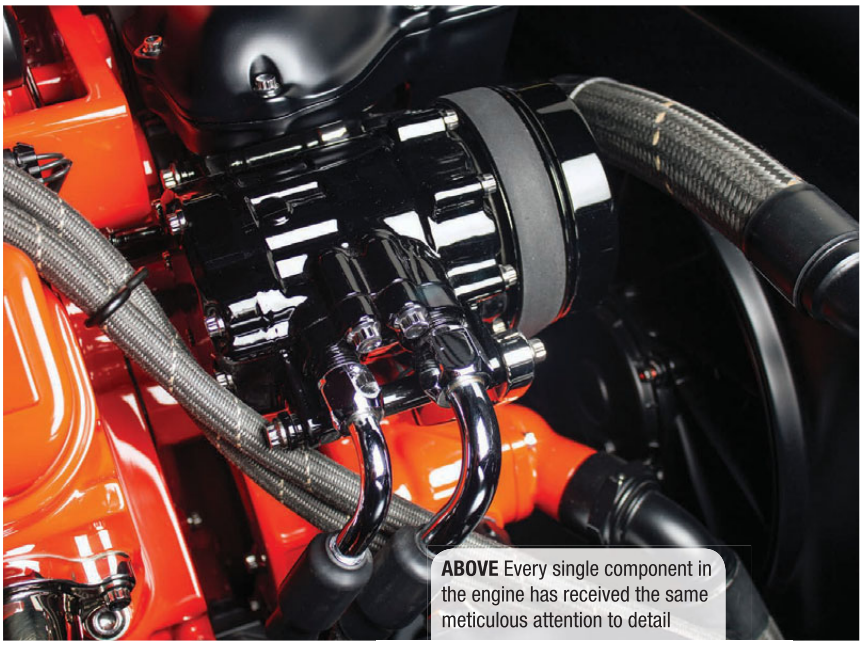
This meant that inside the long block things like Carrillo connecting rods and Diamond Pistons were installed and used in combination with a Harrop supercharger, a brand new GM ECU, and a Bowler Performance six-speed transmission to get a stress-free 650 hp down on the asphalt.

As well as choosing the right components, the engine also benefited from Detroit Speed's obsessive attention to detail. Continuing the theme of giving every aspect of the build a full Camaro feel, the company designed and machined custom valve covers from nothing in the style of an old-school small-block Chevy valve cover as the car would have had originally. In addition to this Detroit Speed then hand-made all the cold air induction work coming from the cold airbox in order to perfectly match the plenum of the Harrop supercharger, giving an incredibly clean look under the hood.

Finishing off the immaculate package, the whole engine was polished and base coated in the evocative hugger orange, before being clear coated, sanded and hand polished until it gleamed. This level of attention even stretched as far as the accessory drive, and the pulleys, which received the same incredible treatment.

To hold the package together in a manner in keeping with his performance-driven agenda, Tucker again did what any builder would do.

"Every single part has been held together with ARP fasteners, because that's just what you do when you build race cars, right?" he shrugs. "We used all off-the-shelf ARP fasteners where we could, but when they didn't have a fastener for what we needed, we actually worked alongside them to design fasteners for the car. This freedom means that every fastener we have on the car is an ARP stainless steel 12-point fastener, some of which they built bespoke for us, ▶



ABOVE Every single component in the engine has received the same meticulous attention to detail

which, by the way, is something they will do for any racer.

"It made a massive difference for us though, so for instance, a lot of times in the suspension we would need something like a nine-sixteenths fastener, and ARP would work with us to get what we required.

"They did more than that though. If you look under the car, there are no exposed threads, so it looks like a bolt head on one side and a bolt head on the other. ARP helped us do some clever things to make it look like we didn't have any nuts on the car."

Finally, in the name of perfection and to truly make the fasteners Tux's jewellery, as Tucker thinks of them, Detroit Speed took each individual 12-point ARP fastener, put it in the lathe and ball-milled the end of the head of the fastener before turning down the bolt flange to make custom washers. Going to such extraordinary lengths, custom making each individual fastener made sure that all the lines on the car were tidy and consistent throughout.

Considering Tux, and other similar builds, Tucker reveals that he believes the most important attribute is having a vision right at the start of what the finished car should be. Often other factors come into play during a build, which can place restrictions on what is actually attainable. Constraints such as time and budget can mean that a builder can lose focus or be forced to compromise on some aspects of a project. This was a trap that Tucker was keen to avoid. "It had to have the same incredible amount of attention to detail throughout the car; it all had to be consistent," he insists. ▶

ABOVE & BELOW Sophistication and elegance were the name of the game when it came to the bespoke interior

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However, while the level of care and attention to detail remained the same throughout the process, with the purity of the original vision being paramount, Tucker also acknowledges that the build inevitably took on its own personality as the work continued. “When we put it on the ground for the first time on its beautiful custom Forgeline wheels and tyres, you really got the sense it was coming to life,” he recalls.

“And then, a lot of times you can spawn ideas off of that new personality, with the guys in the shop being very open with the fabricators, which meant that lots of their great ideas were also brought into reality.”

Bearing in mind the levels that the team went to in order to ensure that the original vision for the car wasn’t sullied, it is no wonder the interior of the car is as precisely crafted as the rest of the build. Detroit Speed wanted to break away from classic Camaro for the interior, and, inspired by Porsches that blend performance with sophistication, instead sought to give Tux a far more elegant European feel.

An element of this was again down to the very particular components that were used. The gauge cluster, which was built with the help of Classic Instruments, for example, started life as an actual Porsche component. This Porsche piece was then modified and stripped out to leave it ready to receive the custom analogue gauges that Classic Instruments had handmade. To get the best view of the gauges you sit low in the custom-made Recaro seats, which were reupholstered with new leather and detailed with silver-based ball stitching by M&M Hotrod Interiors; all the while a Vintage Air air conditioning system makes sure you can use the car as comfortably in a December night as you can racing on an August afternoon.

NEW TECHNOLOGIES

The other element of the interior however was the inclusion of new technologies. Given that Detroit Speed wanted its customer to be able to comfortably drive to events, compete and then comfortably drive home, the team thought it was important that it was equipped with technology that wasn’t available to Chevrolet in the sixties, but still desirable to any driver today. As such a touch screen became the central element of the dash. From here the driver has control

BELOW The roll cage is superbly discreet so as not to spoil the clean appearance

ABOVE Stylish from all angles, Tux is dressed to impress

over every element of the car, be it the key items like the air conditioning and heater system, or the high-tech luxuries like the Wi-Fi hotspot, back up cameras, and iPhone integration.

Then there are the essentials. A roll cage is a necessity on any car with racing pretensions, so of course Detroit Speed knew it would need to install one, however, the cage is one of the elements of a racer that can often be untidy; roughly fitted into a chassis to stiffen things up and protect the driver if he gets a little over-enthusiastic while racing. It can often be a purely functional piece. Avoiding this brutal look was critical to the builder, and testament to its success is the fact that at first glance, it's easy to miss that there is a cage installed at all. It simply blends in to the headlining, matching the lines of the pillars exactly and precisely following the edges of the roofline to almost disappear, and maintain the clean, sophisticated ideal that Detroit Speed has adhered to throughout the build.

Of course, all this immaculate detailing and careful design means nothing if the car can't fulfil the original concept. "We wanted to prove that a car can sit like this, and look as good as this and still perform," Tucker says, "... and this car does.

"Driving it is nerve racking because in most race cars, if you need to clip a car, or put it back together you can, but in Tux every single part, every body panel, and every fastener is so detailed that you just don't want to touch anything.

"But, at the same time, it's been autocrossed and I can tell you, as soon as you put a helmet on, it gets to be like any other car, and it just pushes you to go harder. Then, as you get into it you start to think 'what can I do to tune it and to go faster', that's the mindset it gives you.

"I have autocrossed it and it does feel a little different to the cars we race weekly because the track was narrowed slightly, to be able to give the tyre and the wheel room for turning and to get the steering angles we needed," Tucker continues. "But overall, mechanically the car felt great the first time we took it out, and I think if we ran it all season it would be pretty quick."

Tux is an unusual car, in that it had to make all the promises a show car makes, but whereas most show cars don't need the trousers to match the dinner jacket, Detroit Speed has been insistent from the beginning that Tux had to be able to do it all.

Tucker realises that working on such a build has been special.

"In terms of the level of detail and sophistication, this has probably been our biggest build and it's definitely been the longest build we've done, but it's still a car that we want to go out and shout about how it can drive to the track, but then still do everything it needs to as a real car.

"You see the glamour shots of the car and it sits in the studio like a model.

"But," Tucker concludes, "we've raced it on the track. It *is* the full package. It really can do it all." HRT

SAVING THE BIG CATS

The Silk Cut-liveried Group C Jaguars remain, for many, the poster boys for one of racing's most evocative eras. **Chris Pickering** meets the men tasked with keeping many of them running

Do racing cars get any more iconic than this? The Silk Cut-liveried Group C Jaguars of the eighties and early nineties are among the best-looking and most successful machines of this hugely evocative era. To see any one of these cars in the flesh is a treat, but peer inside the immaculate workshops of Moto Historics in Surrey and you're likely to spot three or four of them lined up in a row.

The company's managing director Nigel Medcalf already had extensive experience of running Group C Jaguars before he founded the firm in 2012. Since then, the Chessington-based outfit has established itself as the go-to partner for those looking to race these iconic cars. Currently, it looks after the three 7-litre V12 team cars from 1987 (287 and 387 in XJR-8 spec and 187, which began as an XJR-8 and returned in XJR-9 spec for 1988), not to mention one of the mammoth 7.4-litre XJR-12s from 1990 (190) and the last of the twin-turbo V6-powered XJR-11s (490).

Inspired by an independent project run by Group 44 Racing in North America, the Jaguar works programme kicked off in 1985 with the XJR-6, designed by Tony Southgate and built by Tom Walkinshaw Racing (TWR). Up to the XJR-12, the cars followed very much an evolutionary path (the most notable change being a brief switch to twin-turbo V6 power in 1989 before the return of the V12 in 1990). The later XJR-14 is a rather different beast, designed by Ross

ABOVE Thanks to meticulous restoration and preparation, a whole new generation of fans gets to witness the sensational Group C cars

Brawn to the later C3 regulations and powered by a 3.5-litre Cosworth V8, but it's the earlier V12-powered cars that we're here to focus on.

Mechanically, the XJR-8 and the XJR-9 are virtually identical. It's only a few details, such as the position of the transmission oil cooler, which distinguish them under the skin. The team at Moto Historics takes originality very seriously and try to run the cars in exactly the same spec as the works team would have done back in 1987.

"We only run original racecars here – we don't work with replicas – and we try to keep those cars as authentic as possible, even down to original gauges in the cockpit and kitting the team out in Silk Cut shirts," explains Medcalf. "We want the driver to get in and know that they're sitting in exactly the same environment that Martin Brundle or Raul Boesel drove in."

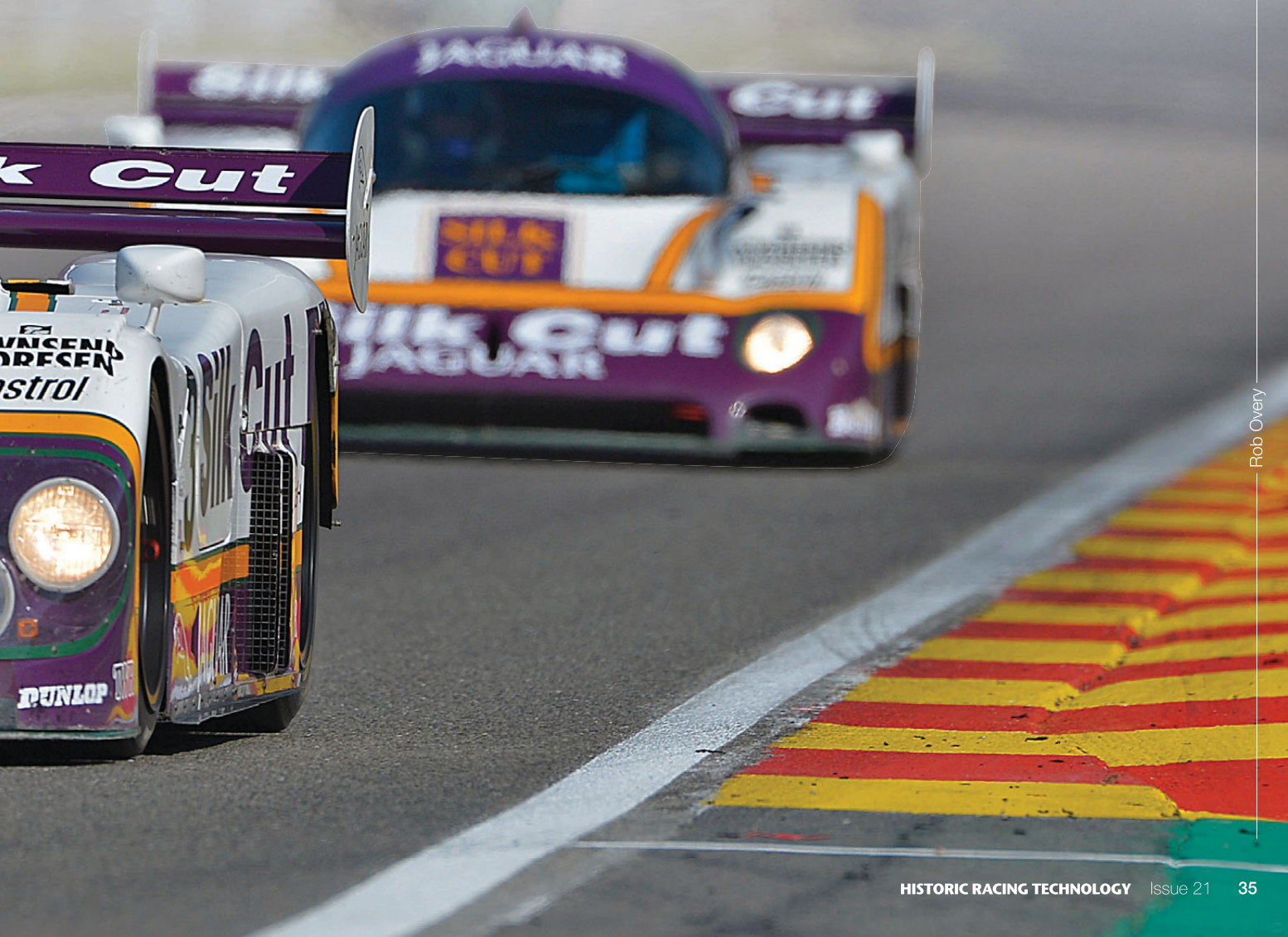
Under the skin, there's a carbon-Kevlar tub. This was cutting edge technology for sportscar racing in the mid-eighties and it remains a relatively new thing for a lot of historic racers, but looking after composite chassis needn't be too daunting. The key thing, he explains, is to keep a close eye on their condition: "Nobody really has any data on how long carbon fibre tubs last. We have them all ultrasonically tested regularly at Remas Composites, who carry out all of our composites, and we sometimes find areas that haven't been repaired properly in the past."

It's a particular issue with Group C cars, he notes. A lot of them were converted to show cars for static display when the category was discontinued and the repairs that were carried out then were never intended to endure track use in the future.

A similar problem exists with the spare parts market, Medcalf explains: "By this sort of era, a lot of components in Group C were designed with a relatively short operational life. The teams often held on to out-of-life components for various reasons, and over the years some of those have made their way back onto the market. As a result, we get all of our wishbones x-rayed, crack tested and ultrasonically tested. That's all carried out by an aerospace-certified supplier, with written records and photographs. If there's any doubt whatsoever, we get the parts remade."

One of the biggest re-manufacturing projects that Moto Historics has undertaken with the Group C cars was a batch of 16 sets of magnesium wheels, produced in conjunction with Creasey Castings. All the moulds had to be made specifically for the project and the machining was carried out by Crossthwaite & Gardner – one of the few specialists in the country with a lathe big enough to accommodate them.

While the carbon tubs were quite ▶



Rob Overy

Rob Overy

ABOVE In period, against fierce opposition, the XJR-9 had a relatively short competitive life. Its appeal, however, is enduring

radical, the layout of the suspension was relatively conventional, with double wishbones on both ends. At the front, the spring and damper units are hidden inside the nose section of the tub and activated by pushrods. Meanwhile, at the rear, the springs and dampers are placed outboard on a beam that runs across the top of the gearbox and they pick up directly onto the uprights; this layout means that the spring and damper units sit almost vertically, keeping them out the way of the Venturi tunnels and providing a 1:1 suspension ratio. Both ends use the same Koni dampers that the cars campaigned in-period.

V12 HEART

If the composite chassis makes up the bones of one of these cars, then the vast V12 engine surely constitutes its heart. Loosely based on Jaguar's V12 road car engine, they produce more than 750 bhp in 7-litre spec with more than 600 lb/ft of torque from 4,500 to 6,800 rpm, yet they remain relatively low-stressed by the standards of a top-flight competition unit.

The company charged with looking after these engines for Moto Historics is Init Racing, run by Chris Gilbert, formerly a powertrain engineer at Ilmor and Mercedes-Benz HPE.

"It's a relatively straightforward engine, there's just a lot of it," he jokes. "It's actually very similar to the Jaguar V12 road car engine in most respects. The internal parts are all unique to the race engine and you've got a complicated airbox layout with the fuel injection system integrated within, but the basic layout is very similar to that of the road car unit."

The early Group C V12s used a modified version of the production engine block, while the later XJR-12s featured a bespoke casting that's rumoured to use a superior quality material (the stock items being LM25 aluminium alloy).

"For the earlier [XJR-8 and XJR-9] engine you could re-machine a production block," Gilbert explains. "All of the main bearing caps would need to be changed to a four-bolt design, the outside of the block would need to be machined so the starter motor could be repositioned [in order to free up space for the Venturi tunnels] and it would need to be adapted for the dry sump arrangement."

Init Racing has had to reverse engineer all of the major internal components. This process often starts with digitising the designs, and the company now has 3D models of most of the major components, including the engine block and the reciprocating assembly, captured using a 3D scanner. Over the years, Gilbert and his colleagues have worked with Arrow Precision to produce new connecting rods and crankshafts, as well as collaborating with Kent Cams

ABOVE Silk Cut Jaguars wherever you look: what's not to like? Moto Historics has become a go-to specialist in this area

on re-manufactured camshafts and Kauffmann for valve springs.

As with the rest of the car, the emphasis is very much on retaining originality, but there are a few concessions to modernity for the sake of engine life. Diamond-like carbon (DLC) coatings are now used on the cam followers, applied by Wallwork (formerly Tecvac) in Cambridge. Meanwhile, the camshafts are superfinished to reduce wear. This helps to improve durability on what was already a fundamentally tough engine, Gilbert explains: "These cars were designed for endurance racing, so there's a much longer service life than you'd find on a single-seater engine of the same era. We're monitoring the longevity at the moment, but we're expecting to see 30 to 40 hours out of each rebuild."

To a certain extent, this longevity relies on mechanical sympathy on the part of the drivers and the race engineers. It's thought that the engines would have revved to around 8,000 rpm in-period, but that has been reduced for modern historic racing.

"You have to bear in mind that these engines have a huge amount of torque low-down – particularly in 7.4-litre form – so we don't think they generally used anything like the full rev range that was on offer," comments Gilbert. "With Group C being a fuel-based formula, they were also keen to get as much distance out of a tankful as they could."

In fact, this is still very much a consideration in historic racing, as Medcalf points out: "You need to be careful as you're still only allowed 100 litres of fuel. At Spa, for instance, we will use over 90 litres in a 45-minute race if it's clear flag-to-flag, so it's pretty tight. Had it been a completely clear race at the Le Mans Classic last year I think some of the Group C teams would have run out of fuel."

Despite a fundamentally robust design, the Jaguar engines do have a few quirks. The oil system was known to be something of an Achilles heel in-period and it's still something that the engineers have to watch carefully, Gilbert explains: "The oil pump isn't especially well-matched to the engine. When the engine's cold it results in very high oil pressure, but when it's hot you get very low pressure. We're looking into ways to improve that currently, but at the moment it's just a question of managing it; making sure that the engines are warmed up properly before the cars go out."

The warm-up process is relatively straightforward. The oil and water are heated separately (with dedicated heaters for each car to prevent cross-contamination) until they reach 50 degrees. Good quality fluids are also important, with a Castrol blend used for the engine oil and distilled water used for the cooling system, with an additive that raises the boiling point slightly and acts as a corrosion inhibitor. The anti-corrosion properties are particularly important when you bear in mind the engine contains substantial amounts of aluminium and magnesium.

One of the common concerns about recent historics, such as Group C cars, is how to deal with the engine management systems. The cars at Moto Historics will still run on their original Zytek systems, but for normal use these are substituted for a modern competition ▶

ABOVE The V12 might not be a complex engine, but it is a big one!

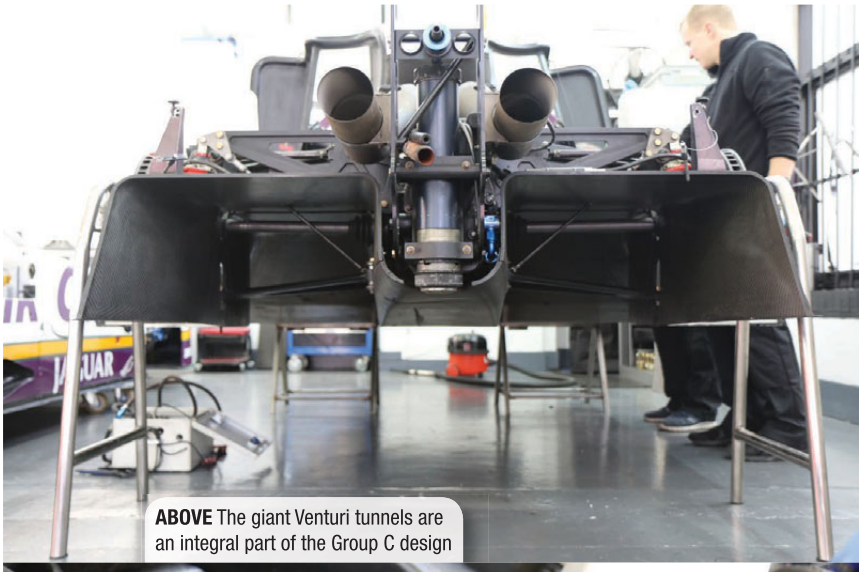
ECU. These operate on exactly the same channels as the original and they still work alongside the period Stack gauges.

"It was a relatively straightforward job to fit the new ECUs," comments Medcalf. "We're only going back to the late 1980s, so the technology is not completely removed from today. They still had 12 injectors, one ignition driver and all the basic sensors, like air temperature and water temperature. Every single sensor on the cars is original. The only real difference is the processors used within the control unit, because we can't get the modern laptops to connect to the old ECUs."

In-period the cars would have run multiple maps, whereas each now runs a single calibration, designed to work with standard 98-octane fuel. "Mapping these engines is tricky," notes Gilbert. "You could expend the entire rebuild life of an engine mapping it on the dyno. Instead, what we tend to do is create a basic map on the dyno and then carry out all the trimming on the circuit."

There are a handful of additional changes, relative to the cars' period spec, but you'd be hard pushed to spot them. The headrests have been changed slightly to give the drivers more room with their HANS devices, but the cockpits are essentially unchanged. Even the Lifeline fire suppression systems are plumbed in exactly the same way as their period counterparts.

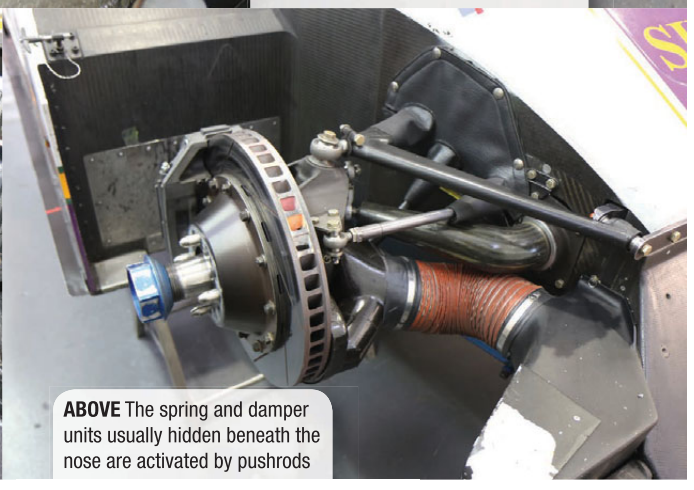
"The nice thing about a Group C car – as opposed to something like an AC Cobra – is that you're talking about a proper, purpose-built racing car, which means there isn't really anything you ▶



ABOVE The giant Venturi tunnels are an integral part of the Group C design

ABOVE The rear damper layout, straight onto an upright, keeps the Venturi clear

ABOVE The gearshift linkage is about 10 ft long, with five different universal joints



ABOVE The spring and damper units usually hidden beneath the nose are activated by pushrods

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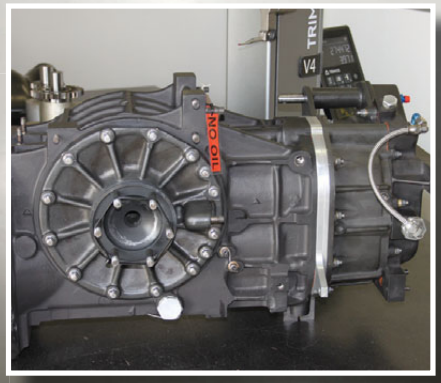

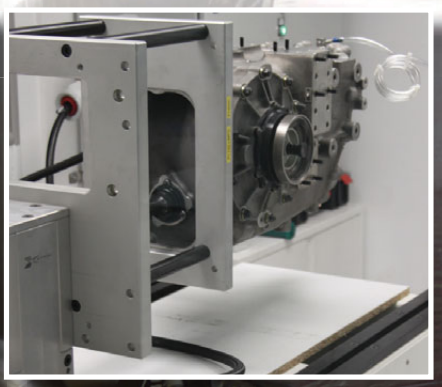

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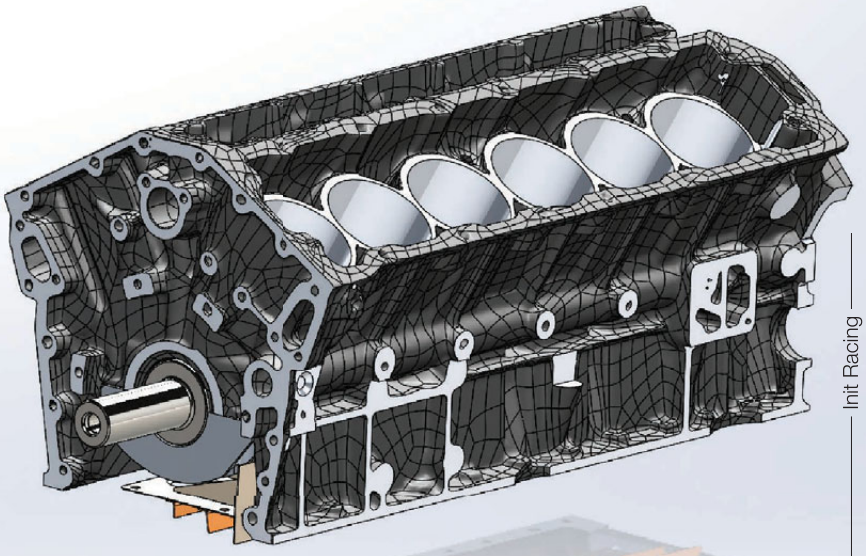
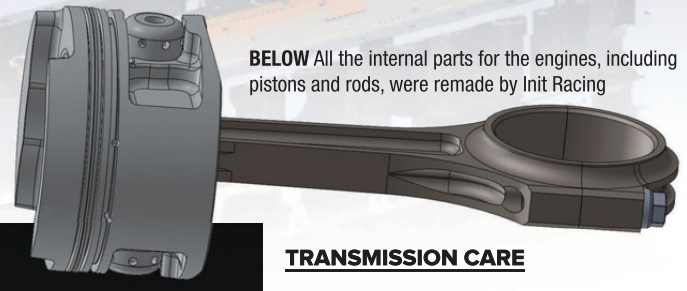


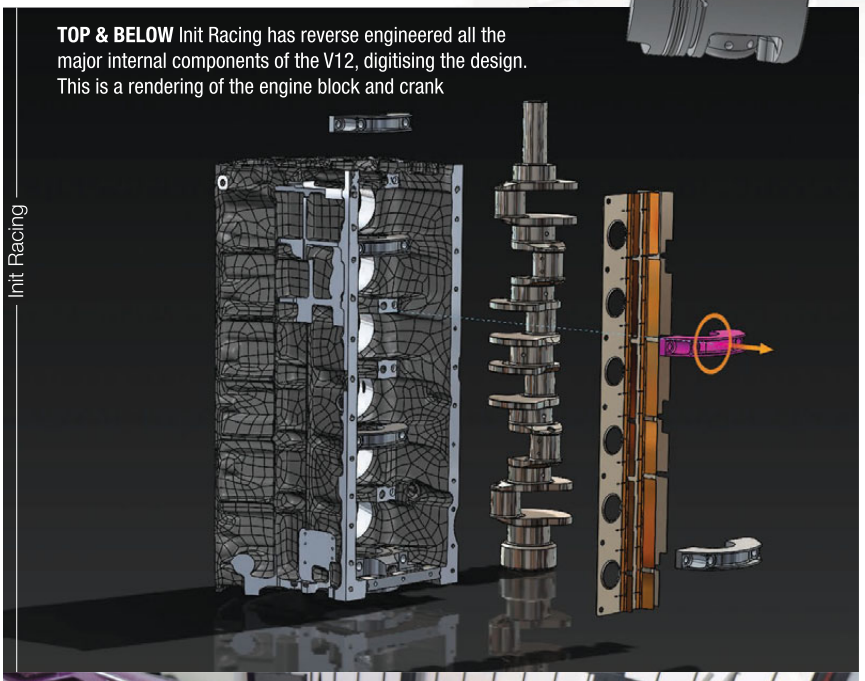
Init Racing



BELOW All the internal parts for the engines, including pistons and rods, were remade by Init Racing

have to change," comments Medcalf. "Also, cars of this era are quite well documented and a lot of the original engineers are still out there. When it comes to things like nuts and bolts, you can still get aerospace-quality parts that are built to exactly the same specifications. Likewise, the AP Racing clutches and the Brembo brake callipers can still go back to their original manufacturers to be tested or serviced to the original tolerances."

The fuel tank comes from Advanced Fuel Systems, which digitised one of the original tanks and created a perfect replica. Again, being a proper racing design, they already featured collectors and lift pumps.



Init Racing

TOP & BELOW Init Racing has reverse engineered all the major internal components of the V12, digitising the design. This is a rendering of the engine block and crank

ABOVE The complex air tray and injection setup is one of the more fundamental changes relative to the road car engine

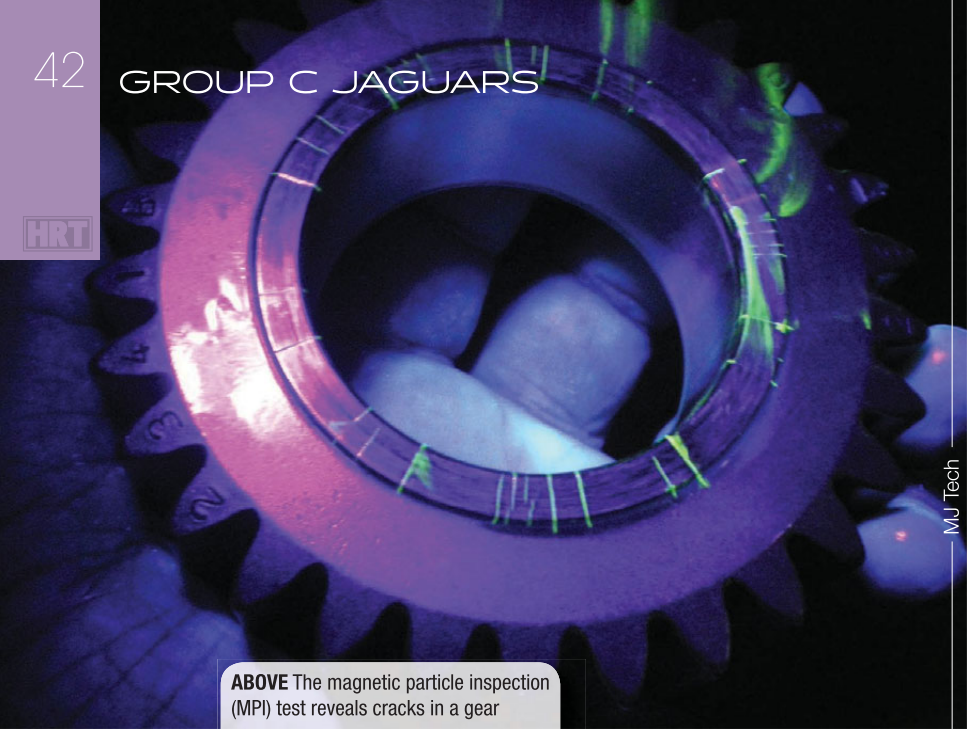
TRANSMISSION CARE

The V12 cars use a 5-speed H-pattern gearbox designed by TWR, fitted with Hewland-derived internals and a Salisbury differential. Again, they are relatively straightforward in design, but none of the parts are available off the shelf anymore, meaning that the value of these hand-built gearboxes is comparable to that of the engines.

Like all of the mechanical parts, period spares can be a bit of a minefield. For instance, it turned out that the main shaft in one of the cars had no oil drillings when it arrived. The only explanation the engineers could think of was that it must have been a part that had failed an inspection in-period and hence never progressed to the final stages of the manufacturing process. One suggestion was that it was retained so the mechanics would have a representative part to use for gear inspections.

Moto Historics' partner for transmission work is MJ Tech, run by ex-F1 gearbox technician Michael Jakeman, who once looked after Michael Schumacher's cars at Benetton. He's worked on a significant number of the Group C Jaguar gearboxes in circulation, but there are still some unrestored examples around.

"Sometimes these transmissions have spent a long time in storage before they come to us," he explains. "So we start by stripping them right down and vapour blasting the casing. They're then re- ▶



MJ Tech

ABOVE The magnetic particle inspection (MPI) test reveals cracks in a gear

chromated so they look virtually new."

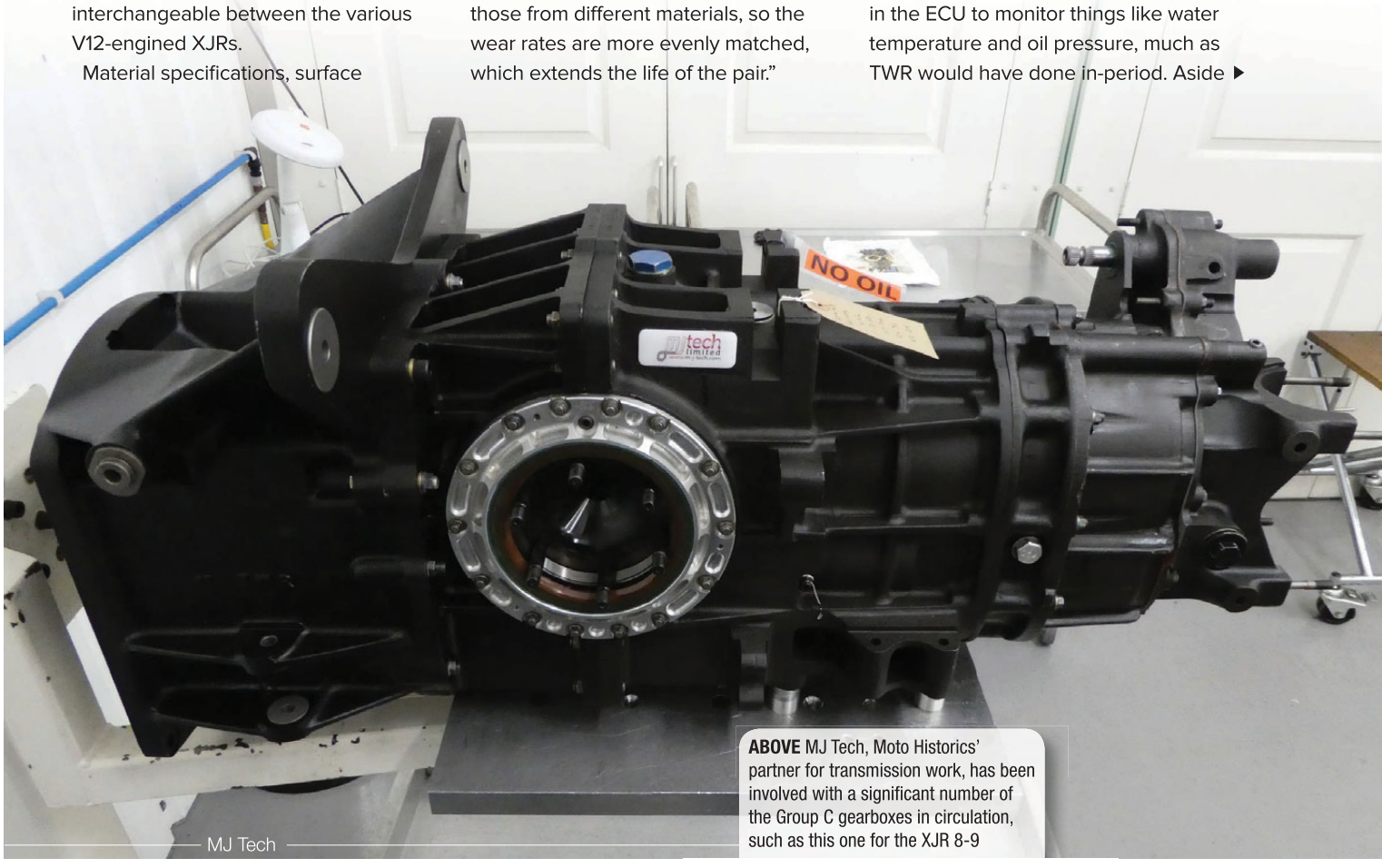
MJ Tech now remanufactures all of the transmission internals for Moto Historics, including dog rings, diff ramps, gears and bearings. One of the benefits of this is that it gives Jakeman and his team control of the tolerancing between the parts, whereas previously the gearboxes often featured an assortment of bits from different suppliers. The parts have also been standardised when it comes to things like gear widths, making them interchangeable between the various V12-engined XJRs.

Material specifications, surface treatments and machining techniques have all moved on since the 1980s, Jakeman points out, so the new parts should also offer improved longevity. "These days we shot peen the parts and then superfinish them," he explains. "Material choice is also important. In the past, the crown wheel and the pinion would typically have been made from the same material, but the pinion would inevitably wear faster, leading to both parts being replaced. We now make those from different materials, so the wear rates are more evenly matched, which extends the life of the pair."

The gearbox internals are sent to MJ Tech after each event for a check up, which includes magnetic particle inspection (MPI) crack testing. However, the rebuild life of these gearboxes – designed to race for 24 hours without breaking a sweat – equates to well over a season of historic racing. For full gearbox rebuilds, MJ Tech also has a transmission dyno, which allows a unit to be run through the gears, while monitoring things like oil pressure and flow. Another benefit of doing this is that it enables the team running the car to check back against the laboratory data if they're concerned about any of these parameters on track.

SETUP IS CRUCIAL

For race days there are typically two mechanics on each car, plus a dedicated engine technician from Init Racing. Moto Historics is also in contact with a number of race engineers and tyre technicians who can consult on setup. A limited amount of onboard datalogging is run in the ECU to monitor things like water temperature and oil pressure, much as TWR would have done in-period. Aside ▶



MJ Tech

ABOVE MJ Tech, Moto Historics' partner for transmission work, has been involved with a significant number of the Group C gearboxes in circulation, such as this one for the XJR 8-9

from that, the only data logging comes from a Video VBOX, with an in-built g-sensor and GPS receiver.

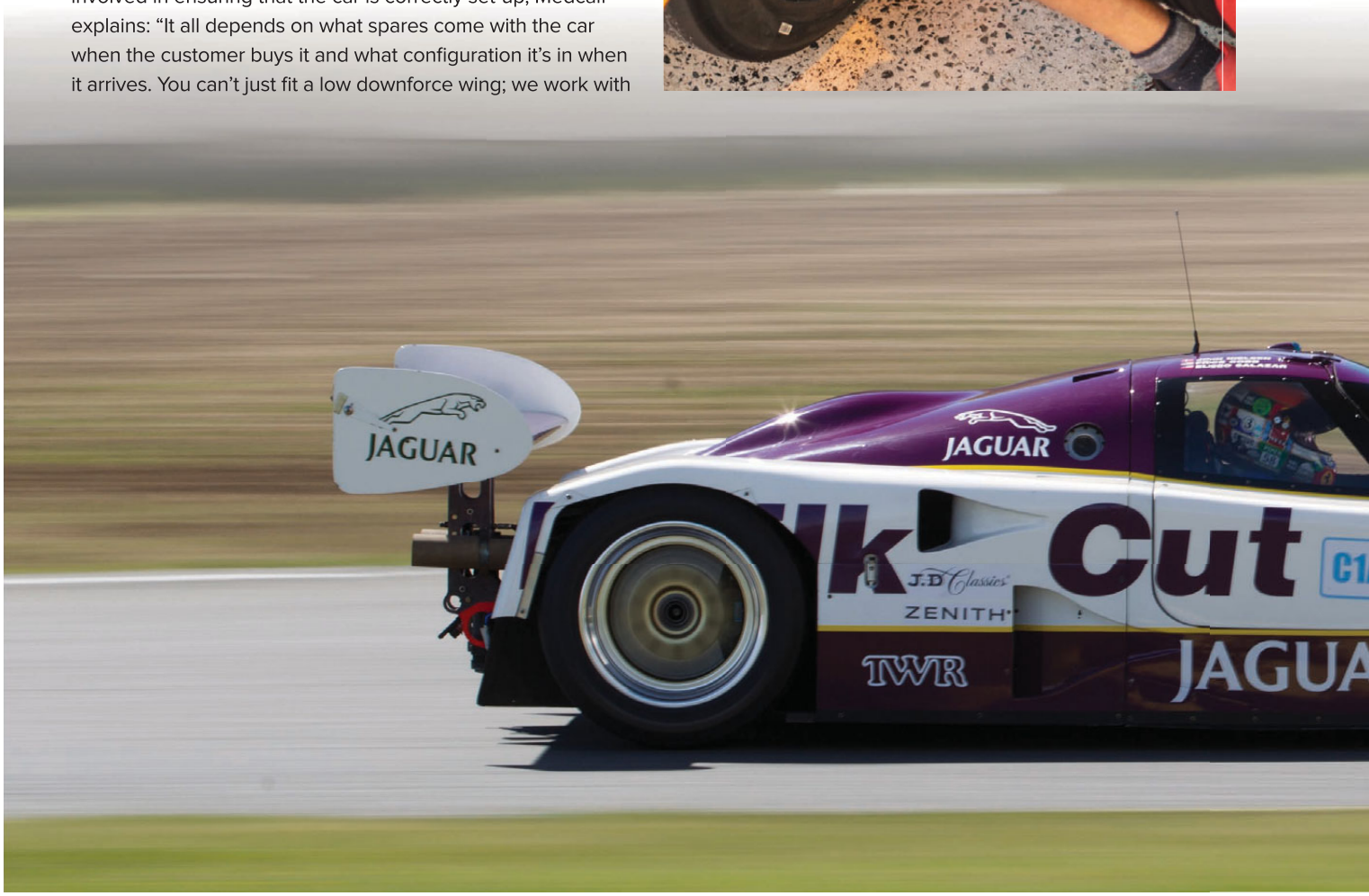
There's a reasonable degree of adjustability in the geometry, but things like tyre pressures are also extremely important, Medcalf points out: "At the moment we're running a control tyre from Avon. We have to be careful with tyre pressures, particularly at Le Mans. The later C3 cars that are designed to run very high downforce struggle to maintain the sidewall shape if you run too little pressure, but if you run too much pressure then they are prone to overheating. The driver also plays a part here – if you go off like a scalded cat at the beginning you can cook the tyres, whereas you have to be mindful of the risk of a puncture if you've lowered the temperature to prevent that."

Unlike earlier historics, aerodynamic setup also plays a key role with a Group C car. The Jaguars were essentially homologated with two different aero packages. There was a high downforce package with giant Venturi tunnels, a more prominent splitter at the front and a twin element rear wing. For the long straights and fast sweeping bends of Le Mans, however, the cars would run a low downforce package, with significantly smaller tunnels, a much smaller splitter and a single element wing.

The idea of swapping between the two might sound straightforward, but in fact there can be quite a lot of work involved in ensuring that the car is correctly set-up, Medcalf explains: "It all depends on what spares come with the car when the customer buys it and what configuration it's in when it arrives. You can't just fit a low downforce wing; we work with

BELOW Tyre pressures are critical to the setup

Rob Overy



> **“In low downforce configuration the fastest Group C machines can still hit the best part of 215 mph – slightly more than a modern LMP1 car”**

some engineers who can advise on the setup and come testing with us, looking at things like spring and damper settings to go with the revised aero package.”

Even that’s not easy, he points out. In the case of the XJR-8 and XJR-9, there are three different sections to the rear floor, revised front bodywork with different wheel arches, new wing stays and a host of other changes. Beyond those two basic configurations there are also a number of detail tweaks that can be carried out, such as adjusting the rear wing angle or swapping the Gurney flaps.

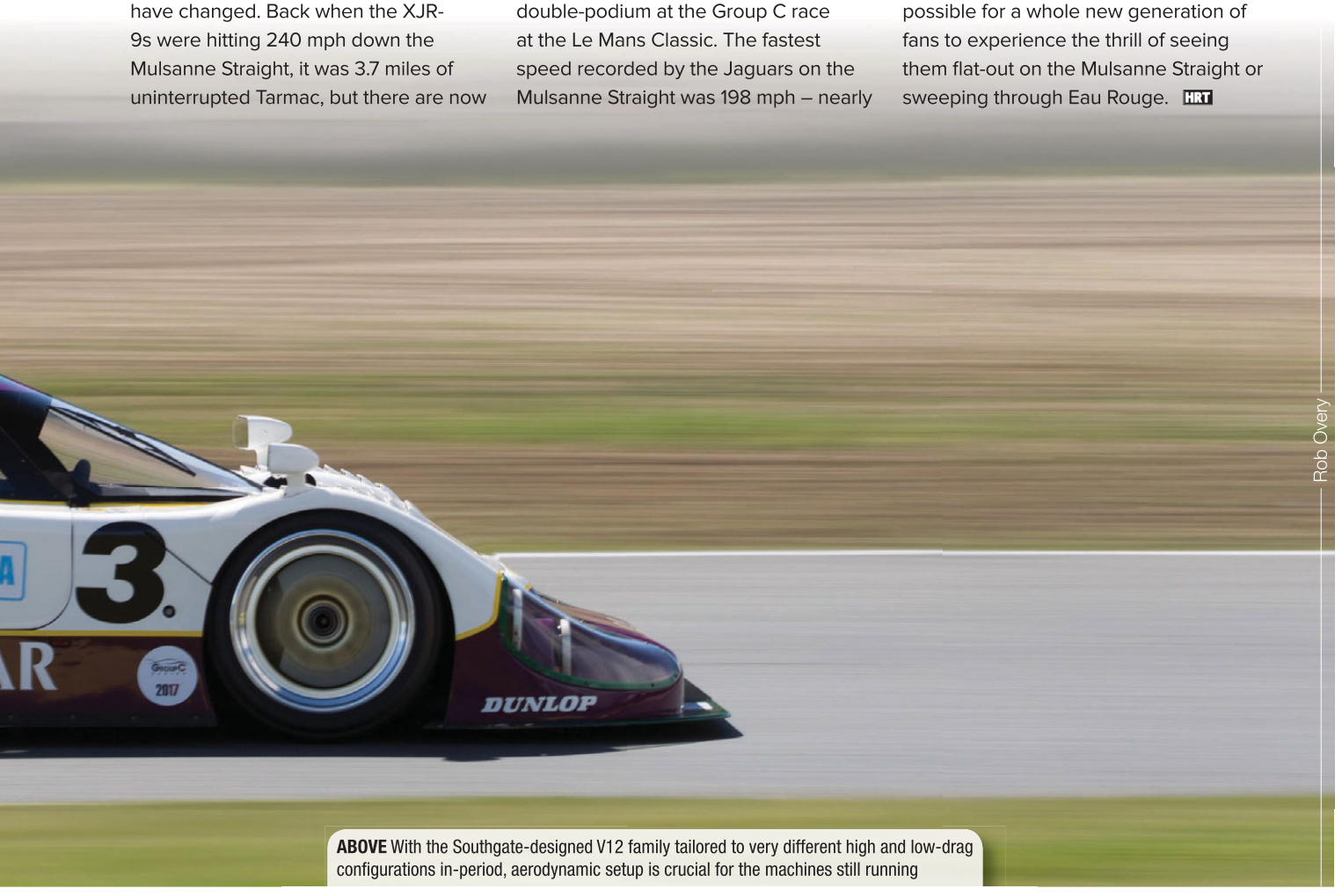
These days it’s common for the cars to stick with a high downforce configuration on all circuits. Part of this is due to the way that the circuits themselves have changed. Back when the XJR-9s were hitting 240 mph down the Mulsanne Straight, it was 3.7 miles of uninterrupted Tarmac, but there are now two chicanes that limit the top speed potential. Nonetheless, in low downforce configuration the fastest Group C machines can still hit the best part of 215 mph – slightly more than a modern LMP1 car – and even with those great big Venturi tunnels sucking the cars onto the ground, things can apparently get quite lively at such speeds. Opting for a high downforce package gives the driver a far greater margin for error through fast sections like the Porsche curves, yet the Jaguars are still among the most competitive on the C1 grid.

CHASING MORE LE MANS GLORY

Last year, Moto Historics picked up a double-podium at the Group C race at the Le Mans Classic. The fastest speed recorded by the Jaguars on the Mulsanne Straight was 198 mph – nearly 20 mph down on the Nissan R90 CK at the same event – yet they were several seconds a lap quicker overall.

“The Jaguars were doing 187 mph at Barcelona in testing recently – quicker than the LMP2 cars that were there, even in the high downforce trim,” comments Medcalf. “The highest speeds that we see are about 205 mph at Monza, but we’re not necessarily the quickest thing on the circuit. You’ve got to remember that these are C1 cars from the 1980s; the C3 cars introduced in 1990, like the Jaguar XJR-14, the Mercedes C11 and the Peugeot 905, are very different machines. The pace of development and the level of manufacturer involvement really ratcheted up in those last few years of Group C and they effectively became sprint cars.”

It’s testament to the huge performance of these historic Group C machines that they can still reach higher top speeds than contemporary LMP cars. And thanks to companies like Moto Historics, it’s now possible for a whole new generation of fans to experience the thrill of seeing them flat-out on the Mulsanne Straight or sweeping through Eau Rouge. HRT



Rob Overy

ABOVE With the Southgate-designed V12 family tailored to very different high and low-drag configurations in-period, aerodynamic setup is crucial for the machines still running

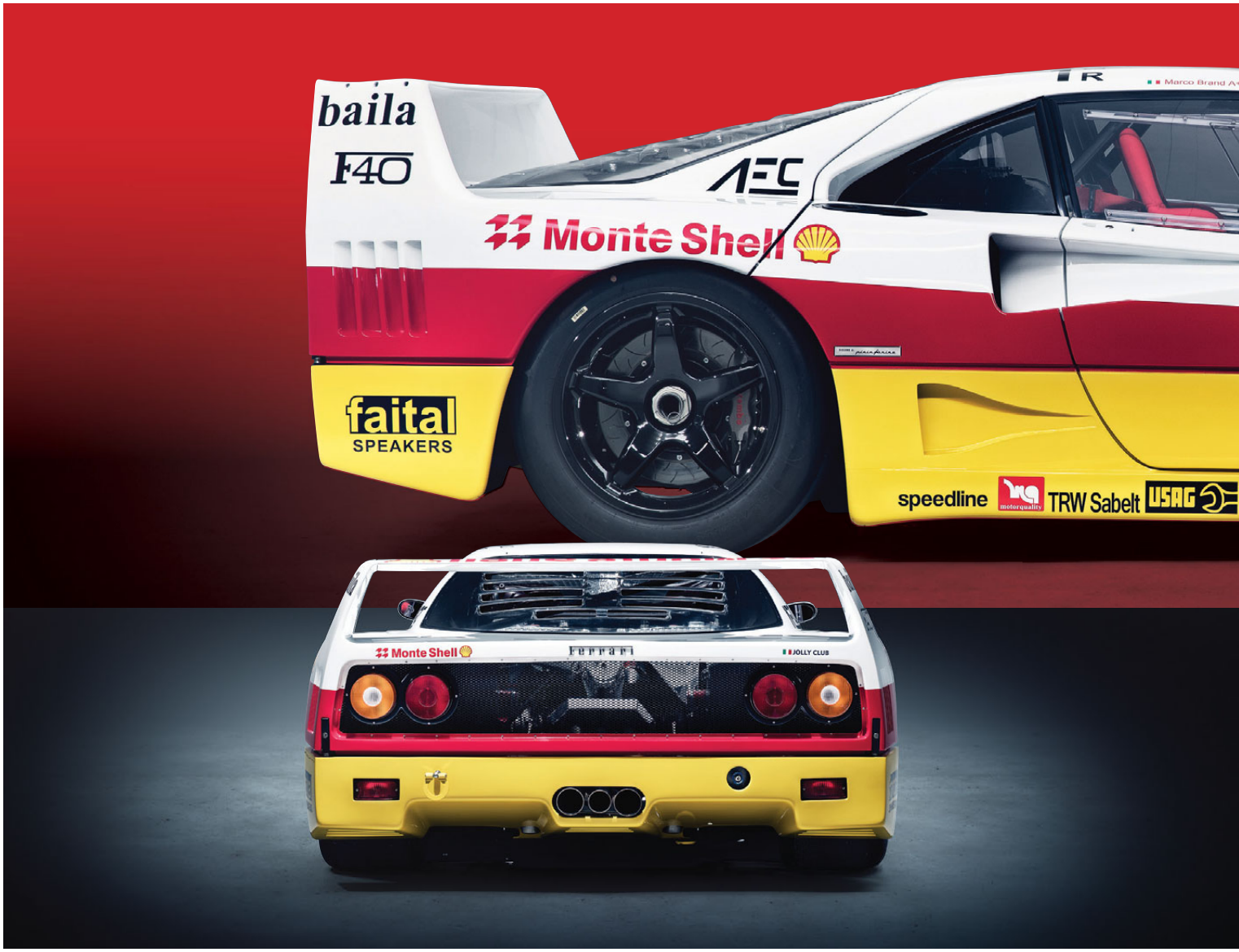
PUTTING THE 'SUPER' BACK INTO SUPERCAR

Alan Stoddart traces the restoration of one of the most revered supercars ever built

THE Ferrari F40 is one of those cars which was so focused, so magnificently purposeful that many of its particular attributes are known by all who still get a kick out of the smell of petrol. From the green glue that holds the sparse bodywork together, to the lightweight paintwork that was so thin you could see the weave of carbon fibre through it, the F40, from its inception, was all about function.

This makes sense. It was (as is well known) the last car that Enzo Ferrari signed-off before his passing in 1988. It harked back to the race cars of the past which were much more closely linked to road cars than the racers prevalent in the late '80s. The F40, named to celebrate Ferrari's 40th year, was different though: it was built like a racing car. Hard, unforgiving and uncompromised, it was, according to Giovanni Perfetti of Ferrari's marketing department, designed to be "sporting in the extreme and Spartan... [it] is for the most enthusiastic of our owners who want nothing but complete performance."

According to legend, Enzo Ferrari himself was even more direct in conveying his intentions in building a



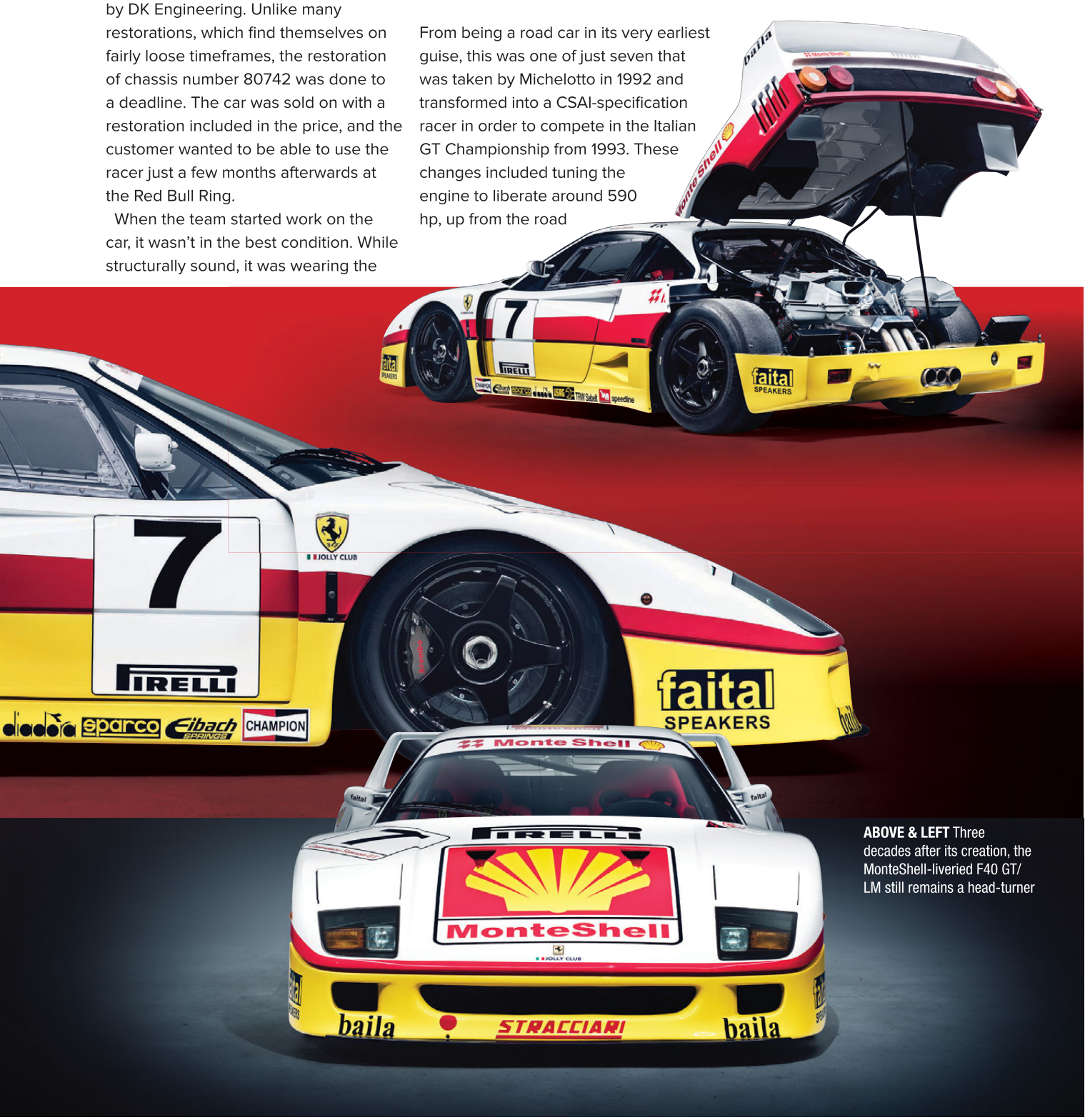
sports car, and is apocryphally quoted as saying, “I don’t care if the door gaps are straight. When the driver steps on the gas, I want him to shit his pants.”

This uncompromising motorsport pedigree also shone through during a recent rebuild of one of the Michelotto Le Mans-spec conversions, undertaken by DK Engineering. Unlike many restorations, which find themselves on fairly loose timeframes, the restoration of chassis number 80742 was done to a deadline. The car was sold on with a restoration included in the price, and the customer wanted to be able to use the racer just a few months afterwards at the Red Bull Ring.

When the team started work on the car, it wasn’t in the best condition. While structurally sound, it was wearing the battle scars of many a race. What’s more, the refurbishment meant that the customer was able to return the car to his preferred of all the many specifications the machine ran in throughout its racing life.

MAGNIFICENT SEVEN

From being a road car in its very earliest guise, this was one of just seven that was taken by Michelotto in 1992 and transformed into a CSAI-specification racer in order to compete in the Italian GT Championship from 1993. These changes included tuning the engine to liberate around 590 hp, up from the road car’s 480 hp, lowering the car slightly, adding bigger racing Speedline wheels and making upgrades to the fuelling and Brembo braking system. The suspension was also improved, with anti-roll bars of a different design replacing the original system which utilised bushings, with a solidly mounted rose-jointed system. ▶



ABOVE & LEFT Three decades after its creation, the MonteShell-liveried F40 GT/LM still remains a head-turner

Further changes were also allowed for the ’94 season, including the cars being chipped, and freer-flowing exhausts being admissible, but it was still essentially a lightly modified road car; by all accounts one of the draws of the Italian Championship. In this series the car also wore its most distinctive livery, the MonteShell scheme, and won nine out of the year’s 10 races in the hands of Marco Brand in ’93.

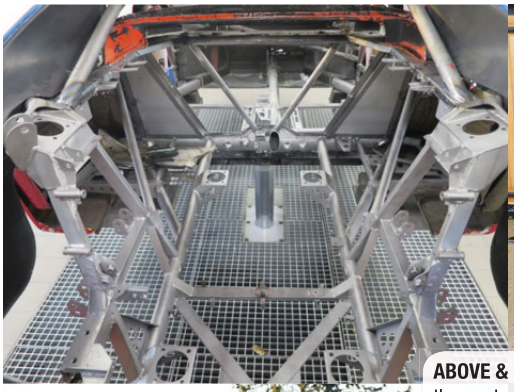
At the end of ‘94, after another season of being the most winning car, it was sold to a customer who wanted to race it in the Japanese GT championship. For this series, the rules were more relaxed and that meant the car could go back to Michelotto and benefit from an upgrade to the full-fat LM package, including a racing engine and a proper Le Mans-spec dogbox.

In addition, in Japan the car was also fitted with uprated HKS intercoolers, as well as HKS crossover recirculation valves, which help to keep the turbos spinning while off-throttle, such as in a gear change, and help to prevent lag.

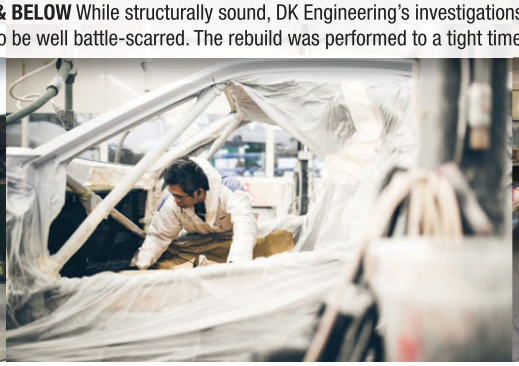
Despite these improvements, and the fact that the Japanese series wasn’t restricted on power, the car wasn’t actually that successful. This, explains James Cottingham, DK Engineering’s Ferrari specialist, was down to a surprisingly humdrum reason.

“Looking back at it, we’ve realised from people that have run these engines over the years that the problem with them, and why they have a cap of around 700 to 750 horsepower, is that you can’t get enough air into the engine,” he says.

“You haven’t got the air intakes, so you are restricted by how much air you can get in there. They physically can’t get enough air in for the intercoolers and the intakes to produce more power.”








ABOVE & BELOW While structurally sound, DK Engineering’s investigations revealed the car to be well battle-scarred. The rebuild was performed to a tight timescale

This was the start of the F40’s transition from top-level motorsport to being raced for pleasure. All of which was why when DK Engineering bought the car it was in a fairly tired state, and that the company’s customer was able to get it restored to its ultimate Italian-spec as it was in 1994, only with the more powerful engine and racier dogbox. It was also put back into the MonteShell livery, even though the Taisan scheme run in Japan would have actually been more accurate, and given the LM, open-headlight front end, which it never actually ran with in period.

Although of course, DK also restored the original front clam which the owner can choose to use should he want to change back to the Taisan livery and run it exactly as it looked in period.

BEST OF BOTH WORLDS

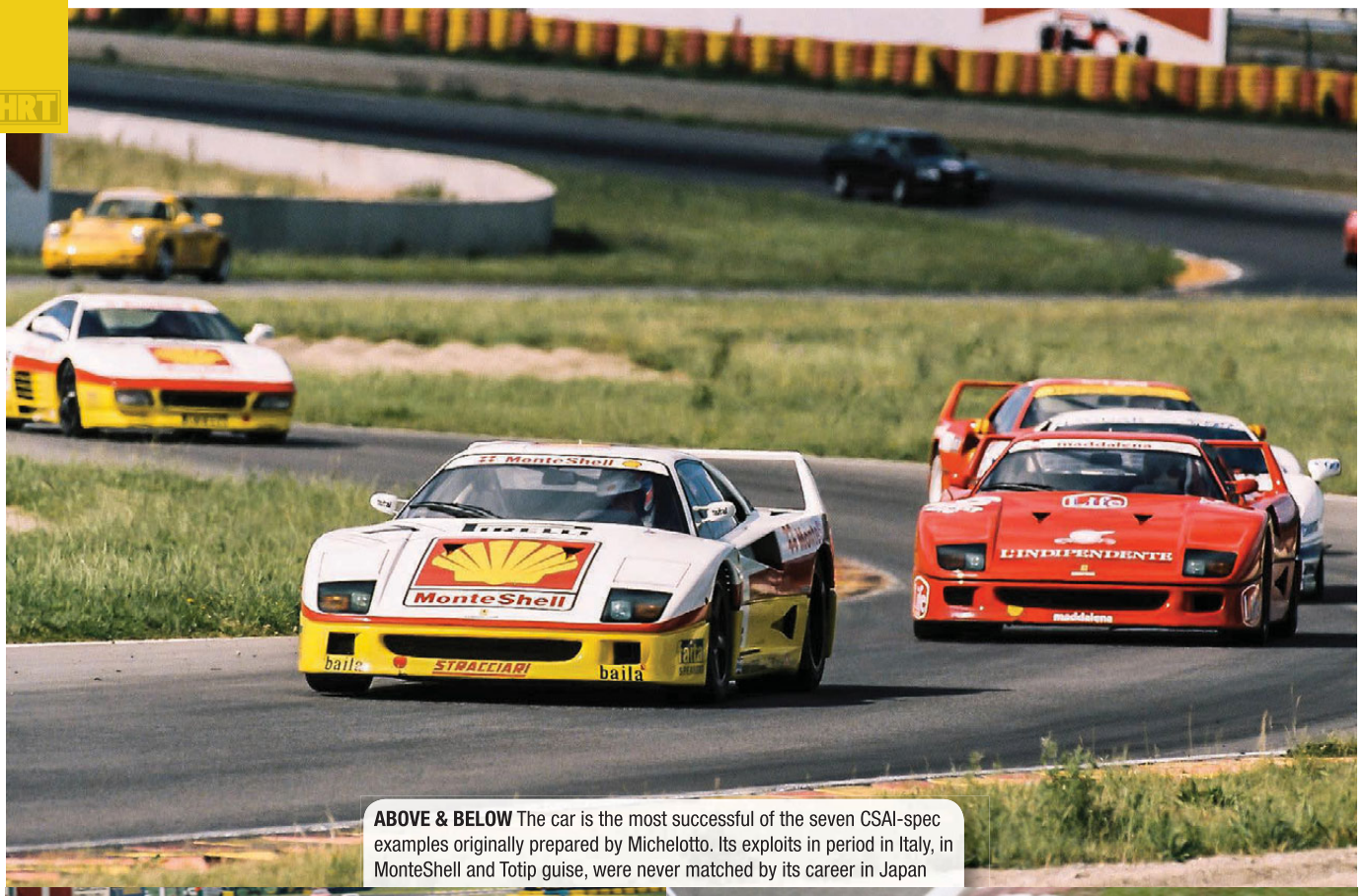
“We restored it to look as it did when it was new, but technically the car is as it was when it raced ultimately in Italy,” Cottingham says. “So brakes and suspension are as it was when it was first a race car, but it’s got a more complicated rollcage and it’s got a LM engine and gearbox. So at the moment, it’s the best of all worlds.”

The timeframe was another aspect of the car that the company had to consider. However, this pressure was eased by the wealth of specialist subcontractors on which DK Engineering could rely to expedite the work. While DK could have done everything in-house, it made sense to use smaller specialists to ease the build. For example, to strip back the ▶

> **“I don’t care if the door gaps are straight. When the driver steps on the gas, I want him to **** his pants!”**

Jeff Bloxham

ABOVE Now restored to 'LM' spec, the car returned to competition at last year's Silverstone Classic Masters Historic Legends event



ABOVE & BELOW The car is the most successful of the seven CSAI-spec examples originally prepared by Michelotto. Its exploits in period in Italy, in MonteShell and Totip guise, were never matched by its career in Japan

carbon Kevlar body panels and chassis, DK turned to Normandale, a specialist whose expertise is utilised in everything from the marine industry to Formula 1. Stripping everything back meant that DK was then able to remove the floor, which needed repair work where it had been dented during its racing life.

DISCOVERIES

There was also some work needed doing to the sills. The construction of an F40 is a steel monocoque chassis which is wrapped in carbon Kevlar. During its career in Japan however, the then-owner decided to fit a beefier roll cage. To install it in the car though the sills had been removed, and then after welding the new roll cage onto the monocoque, the sills were just placed back on top, instead of being properly bonded as they should have been. All of this kind of details, and the findings made, were why it was essential to strip it all back.

Another of the main subcontractors used was Xtec, which completely rebuilt the engine for DK Engineering. Crucial to the rapid speed at which DK Engineering needed the car was the fact that Xtec had parts on the shelf, ready to go. It was an extensive list of parts too, with everything in the engine, including pistons, conrods, bearings, valves and cam followers, being replaced and rebuilt. A bigger issue was, as is the case with many historics, the ECU and the engine management system.

"If we try and go down the original route, A: it's not data trackable, and B: it's not necessarily going to be reliable and easy to set up. So we decided to go down the MoTeC route and put MoTeC ECUs inside the original ECU housings," Cottingham explains.

Replacing the original Magnetti Marelli ECU, which is obviously very simple by today's standards, brings all the advantages of reliability and in terms of functionality, but outwardly appears identical to the original.

The new ECU also means that a modern MoTeC display can be used, to give the driver far more information, and

a much wider range of configurability. That aside, retaining the F40's original look was paramount.

"We wanted it to work and function, but also to look OK at the same time," Cottingham recalls. "So, we 3D printed this plastic fascia, so that the MoTeC unit fitted to the back of it looked like an F40 LM dash. So I worked with Xtec because they could rebuild the engine quickly and efficiently, and they had the bits on the shelf, and they were able to help us set the MoTeC ECU up, which we did with a day on our in-house rolling-road.

"There are some people that would say that converting the car to a MoTeC system is not the right thing to do, but it's safe and reliable and that's why we decided to go that route," he continues.

"It is also manageable, and renewable as well. Contrast that to the original ECU setup, where there is no way of getting into it and there is no setup as such, it really is suck-it-and-see, and in this day and age, that isn't really appropriate."

This rebuilt engine was mated to a new AP Racing clutch and the gearbox, which had also been sent out of house for a complete overhaul. In its case, it returned home to Michelotto.

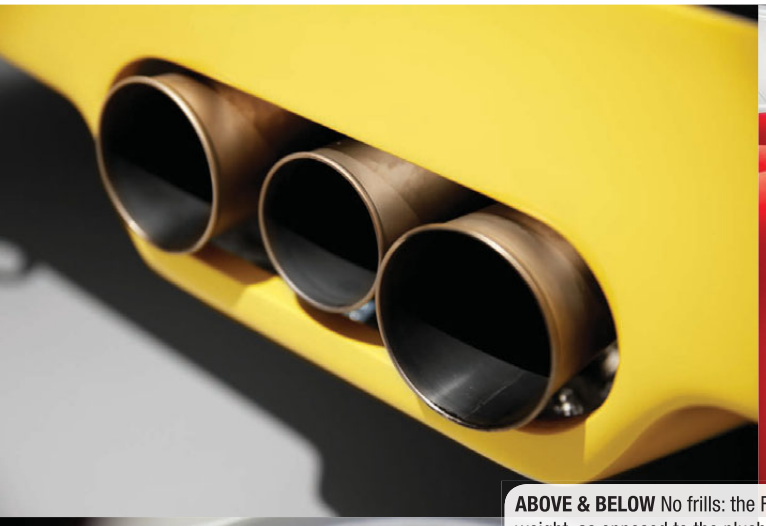
Another of the functional changes made involved the wheels. Those that came with the car were the ones used in Japan, which wouldn't have matched the CSAI-spec car, so they were shelved. Another hurdle was that the wheels run in period were 17-inch, but getting the correct-sized slicks to run on that size wheel today is impossible. Fortunately the car was also homologated with 18-inch wheels, for which tyres are readily available, so this was decided to be the best course of action to ensure the F40 could be used as much as possible. Even more fortunate was the fact that DK Engineering already had a set of 18-inch OZ wheels in its new old stock, which were ready to be stripped, crack tested and then painted and finished in the right colour to be fitted to the car.

> **"Built to impress equally on track and in the paddock"**

Much of the rest of the work was done in-house, with DK Engineering jigging the chassis itself. It wasn't in bad shape, but it did require some repairs on various areas such as on the wishbone pickups and the roll cage mountings.

Rather than simply being a chore, for Cottingham, this part of the process was actually a pleasant way of connecting with the car, and learning first-hand about its life. "We didn't find much that we weren't expecting," he says, "but it was really nice to find lots of hints to its originality.

"So for example in one race in 1993, the car had a bit of a bang in the side. ▶



ABOVE & BELOW No frills: the F40 always traded on its light weight, as opposed to the plush finish of some supercar rivals

ABOVE Upgraded throughout its racing life, the car was ultimately taken to 'LM' specification, utilising Michelotto's LM engine and gearbox

Then, when we stripped it down, in the sill you could see the entire original repair, it was in the door sill still, so we saw lots of things like that."

The suspension was also restored: each component was stripped back to its constituent parts where minor repairs could be carried out. To ensure the car's safety, all of the parts were also crack tested, which revealed some flaws on the rear uprights. To counteract these imperfections DK turned to Peter Jaye Engineering, which was able to help the company redesign a 'top hat' to sleeve the cracked area and make sure it was strong again.

SAFETY FIRST

This, and other similar repairs were important because DK Engineering didn't have the option of replacing the suspension components. They were instead modified, strengthened and brought up to scratch, enabling the new owner to be able to rely on them while racing on track.

The F40 was completed to the deadline, and made it to the Red Bull Ring as scheduled. Its track time here was used as a shakedown for the iconic prancing horse. During the running, the change to the MoTeC ECU gave a slight hiccough to the proceedings, as it caused an alternator failure. This was because the existing alternator was struggling with the demands of the new ECU, so it was upgraded and given some additional cooling.

Aside from that the car was "as good as gold". This, reasons Cottingham, was in no small part due to the fact that DK Engineering had been able to set up the car on its in-house rolling road.

"Importantly, we did this with the MoTeC unit in the car," he notes, "as often people overlook that and they set an engine up on the dyno, but it then needs to be done once again when it is in its 'natural environment' with the loom that it is running, and the exhaust system that it is running and all of that stuff. Otherwise you have got to set it up and check it again."

Aside from the alternator though, Cottingham says there weren't any issues with the build. This is down to careful planning as much as anything, he reckons, as the short timeframe was mitigated by everyone involved on the project being on the same page and everyone delivering on time.

This was especially crucial given DK Engineering's use of other companies to do some of the work. "I think with many of these projects, one of the key parts is the management side of things," he


Jeff Bloxham

ABOVE Given a choice of configurations from the car's history, the LM rear wing was always going to win out

suggests. "Making sure that everything is being dealt with and it is accounted for and that there is a plan and a procedure in place. It was definitely the right thing to do.

"There are obviously people in the UK that specialise in certain things, and there is no point in trying to do something as well as someone who can do it better than you for less money in a shorter timeframe.

"That's why we don't paint our bodywork here, for example, because it's very hard to differentiate between painting an F355 bumper and painting that of a 250 LM. The person that is painting the F355 isn't going to be the same as someone painting the 250 because they require very different things.

"The biggest strain was actually on our guys, who had to work really long hours for months on end to get the car back together."

The results speak for themselves, however, with the gorgeous MonteShell-liveried F40 GT/LM drawing the admiring glances of all and sundry at its first proper race outing at the Silverstone Classic in 2018. The car, which was born out of Maranello's racing development of the 288 GTO to be hard-edged, uncompromising and purposeful to the point of almost being utilitarian, was still able to impress equally on track and in the paddock. Now, more than 30 years after its introduction, the car still justifies its billing for those who truly want nothing but "absolute performance". HRT

Michael Jurtin

BELOW The car hit the racetrack again for the first time in testing at the Red Bull Ring

THE GREATEST RACING CAR EVER?

Porsche's museum mechanics, plus former technicians and engineers, have laboured for more than a year to restore the first 917 ever built. **William Kimberley** reports on the 50th anniversary of one of motorsport's most legendary machines

THIS is the year of anniversaries: the Bentley centenary, the Mini's 60th and the 50th anniversary of the Ford Capri, still held in affection by many. However, March 12th 1969 is a very special date for many as it saw the reveal of the Porsche 917 at the Geneva Show.

To many, this is the ultimate race car that was brought to life in the Steve McQueen *Le Mans* film. Had the 917 been racing against itself in the 1970 and '71 seasons, it wouldn't have been so epic, but Ferrari responded with the 512, which made that era of Le Mans and sportscar racing just so special.

While the 917's success story is legendary, the car securing its maiden overall victory in the World Sportscar Championship 1,000 km race at Zeltweg, Austria in 1969, its first appearance at Le Mans that same year, while making a big impression, was inauspicious. On the positive side was its outright performance, but on the downside, it was such a handful to handle that it could only be tamed by a few drivers. As British driver Vic Elford wrote: "The Mulsanne Straight wasn't wide enough to get the car to run straight!"

Part of the problem was that with the engine producing in excess of 600 bhp, it was 66% more than any Porsche had achieved in the past. At the same time, the design team had to develop an aerodynamic shape that kept the car glued to the road at speeds in excess of 220 mph. Both were steep learning curves.

The 917 chassis was adapted from the 908 but with the driver moved further forward to allow for the longer engine, the bare chassis weighing just 47 kg (104 lb) without the 120-litre fuel tank. The fibreglass panels weighed 83 kg (183 lb), meaning that the combined weight of the engine, body and chassis was 370 kg, or 46% of the finished weight without fuel.

EXTENSIVE MODIFICATIONS

The remaining 54% was accounted for by the transmission, driveshafts, suspension units, titanium anti-roll bars, magnesium wheels and spare wheel, plastic side glass, battery, lights and lubricants. That left just a small margin added to ensure it met the 800 kg minimum weight for scrutineering. Over a two-year period, though, there were extensive modifications carried out in all areas of the car, including the engine.

The starting point for Ing Helmuth Flegl, one of Porsche's bright young engineers who was given the responsibility of developing the 917's chassis, was the 908. That had been powered by an eight-cylinder 3.0-litre engine producing round 360 bhp. Initially utilising the 908's bore and stroke, along with a number of other design features such as the same pistons, connecting rods, valves, fuel injection settings and other components, the 917's flat 12-cylinder 4.4-litre, air-cooled engine produced 580 bhp at 8,400 rpm when bench tested for the first time in March 1969. However, it was not a direct development of the 908 8-cylinder as the 917, which was given the type number 912 to increase the secrecy, was a pair of 6-cylinder engines siamesed together and so 50% greater than the 908's swept volume.

As Michael Cotton wrote in the *Kimberley's Racing Sportscar Guide No 1*, on the Porsche

917 published in 1987, by joining a pair of 'sixes', the engineers were able to revive an old concept. It took the power from the *centre* of the crankshaft, with a gear wheel at halfway in mesh with another gear on the output shaft running parallel to, and beneath, the crank. This design fully eliminated the torsional vibration and for the same reason the timing and accessory drive gears were also driven from the same source, along with the four camshafts, the ignition distributors and cooling fan.

Later, in 1971, the capacity would be raised to 4,998 cc by increasing ▶

ABOVE Under high pressure: under scrutiny from the governing body, Porsche had to demonstrate that it had constructed 25 racing cars to meet homologation requirements

"The Mulsanne Straight wasn't wide enough to get the car to run straight!"

ABOVE Porsche 917 chassis 001 is now enjoying celebrity status after a painstaking restoration

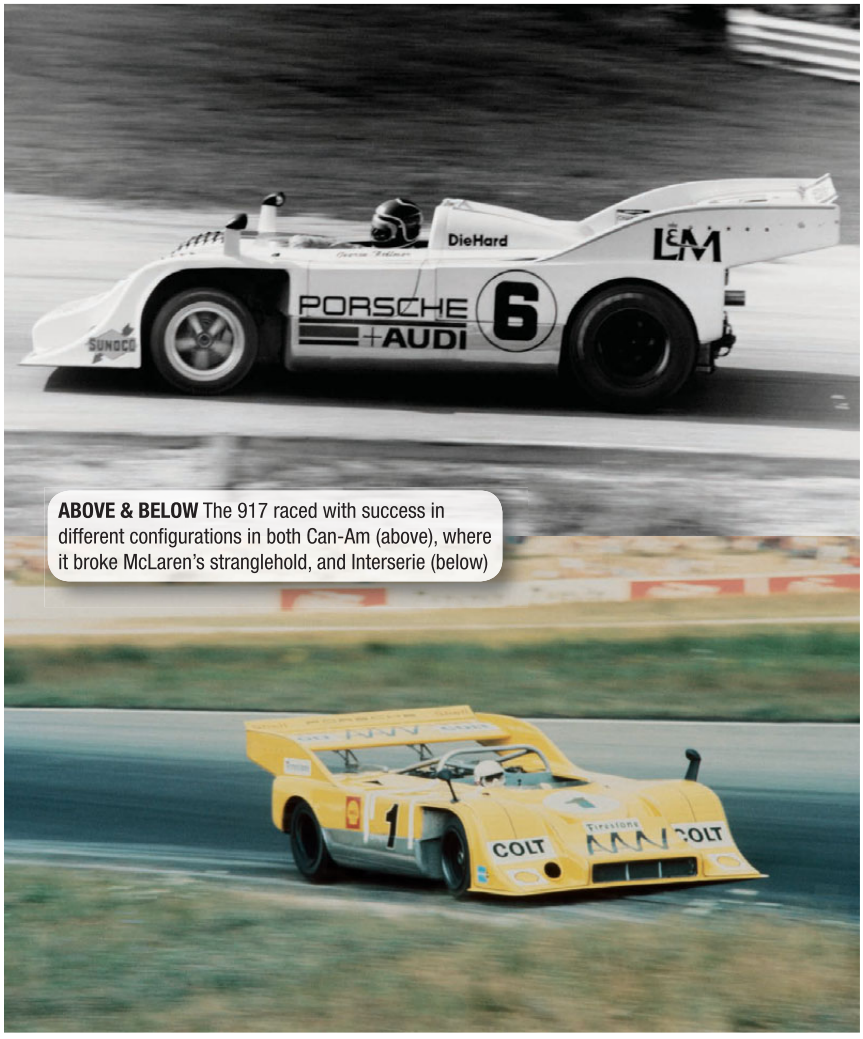
Photos: Porsche AG

> **“Porsche engineers thought this was a disaster in the making: the car was going to loop the loop as soon as it reached any speed”**

the bore dimension from 86 mm to 86.8 mm, while the bore material was changed from Cromal to Nikasil. The result was a hike in power to 630 bhp at 8,300 rpm.

The 917’s disappointing results in its first season, allied to the cost of developing and running the cars against a background of falling road car sales, persuaded Porsche that drastic action had to be taken. In mid-1969 it appointed the Slough, UK-based John Wyer Automotive, which had successfully been campaigning the now-aged Ford GT40 in the World Sportscar Championship, to run the works cars with backing from the Gulf Oil company. Porsche would continue with the development work while JWA was the operational arm of its research and development centre at Weissach. At the same time, the German company also came to an arrangement with Porsche Salzburg to run other customer cars – much to John Wyer’s annoyance, for it was merely a ‘customer’ itself.

Much to Porsche’s horror, when handed the programme, JWA immediately modified the car, cutting away the sloping back window and building the tail panel up to a wedge shape. As far as the Porsche engineers were concerned, this was a disaster in the making as their design had been compromised and the car was going to loop the loop as soon as it reached any speed. The opposite was the case. Wyer and his engineer John Horsman were right and the car was faster and more stable.

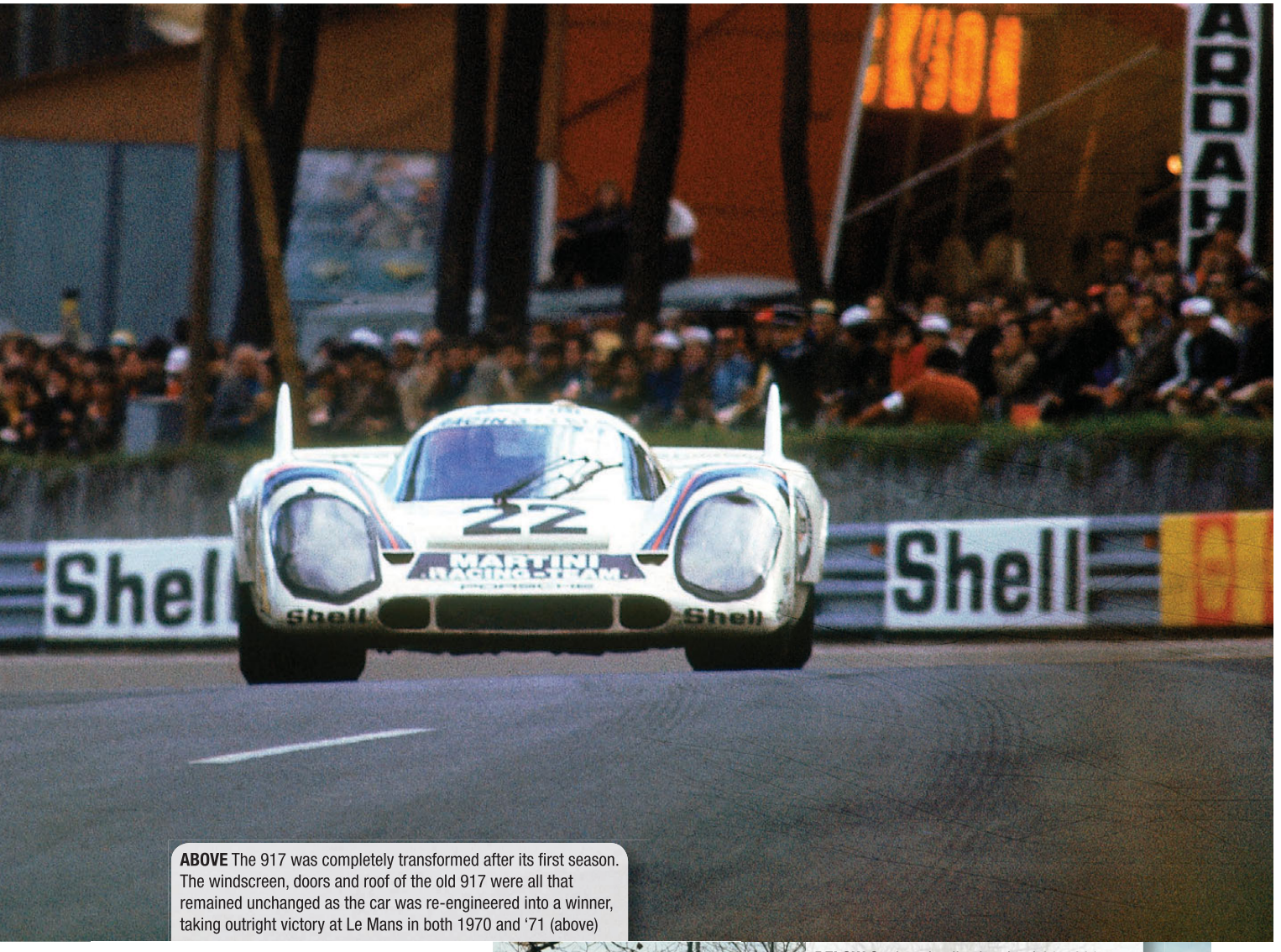


ABOVE & BELOW The 917 raced with success in different configurations in both Can-Am (above), where it broke McLaren’s stranglehold, and Interserie (below)

While the Gulf-sponsored cars did not win the Le Mans 24 Hours in either 1970 or 1971 – although the race was won by 917s in both years – it dominated the championship in both seasons. However, such were the battles being fought out between the 917s and the 5.0-litre Ferrari 512s that the World Sportscar Championship was stealing some of Formula 1’s limelight.

During 1971, the CSI (Commission Sportive Internationale, predecessor to the current Fédération Internationale de l’Automobile) therefore came under pressure to discard the Sport class, in which the 917 and 512 competed, for prototypes limited to three litres.

However, the 917 was not just developed for the World Sportscar Championship. In early 1970 Porsche had decided to develop it for



ABOVE The 917 was completely transformed after its first season. The windscreen, doors and roof of the old 917 were all that remained unchanged as the car was re-engineered into a winner, taking outright victory at Le Mans in both 1970 and '71 (above)

campaigning in the Can-Am race series in North America. The series was a true *Formula Libre* with unlimited engine size, no minimum weights and no fuel limits. In Europe, these same FIA Group 7 cars could be raced in the German-based Interserie Challenge.

McLAREN-BEATER

Roger Penske, a successful private entrant in the US, was contracted to run the car in 1972. Driving for him at this time was ace tester Mark Donohue, who consequently spent much of his time in Germany at the Weissach test track sorting the chassis out.

Initially the 917/10, as it was designated, ran with the same 4,998 cc engine as the cars had run in the now banned 5.0-litre category of the World Sportscar Championship. However, the Porsche engineers had re-developed the engine so that it was now a turbocharged 4.5-litre unit, initially developing 850 ▶

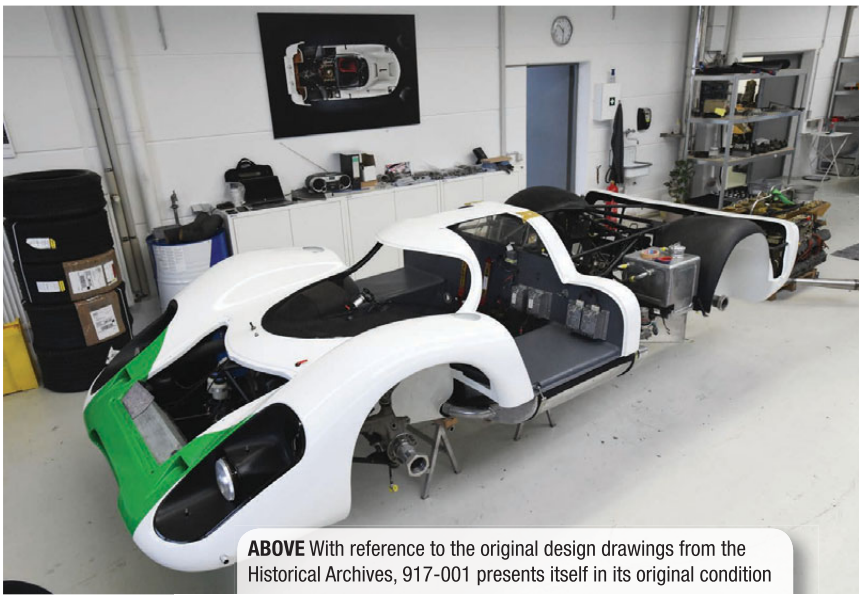
BELOW So they do all exist, then! 917-001 was the first of 25 vehicles that had to be made to meet the requirement for type approval

bhp. The combination of the world's most powerful racing engine with the magnesium frame, long wheelbase chassis and very high downforce bodywork, backed by extensive testing in Weissach and at Paul Ricard, proved a winner. It enabled George Follmer to dominate the championship, scoring twice as many points as Denis 'Denny' Hulme in the once-dominant Chevrolet-powered McLaren.

The screw was further turned the following year in 1973 with the new 1,110 bhp 917/30 that had been developed by Penske Porsche, with Donohue winning six of the eight races in the blue and yellow colours of the Sunoco oil company. These Porsche models also proved unbeatable in the Interserie Challenge right through until 1975.

RESTORATION OF 917-001

The Porsche Museum has celebrated the landmark 50th anniversary with the restoration of the first 917 ever made to its original condition, as it was when first unveiled in Geneva, with its bodywork in white with a green front section.



ABOVE With reference to the original design drawings from the Historical Archives, 917-001 presents itself in its original condition

"Our approach to the authentic handling of classic cars has changed considerably over the past 10 years," explains Achim Stejskal, director of the Porsche Museum. "When restoring vehicles from the company's historic collection, the museum places great importance on retaining original material and taking into account the relevant history of its exhibits."

For over a year, museum mechanics, former technicians and engineers from Zuffenhausen and Weissach, as well as the Historical Archives and partner companies, worked on the restoration of this original 917. The project was particularly challenging from the outset because of the multiple transformations the car had undergone during its time as a test and presentation vehicle.

Following its debut in March '69 at Geneva, chassis 917-001 then sported a new look for its appearance later that year at the International Motor Show in Frankfurt, for which it was repainted ▶

ABOVE For the first time ever, the Porsche Museum participated at Goodwood with no fewer than four 917s: (from left to right) 917-001, 917 KH, 917/30-001 and 917/30 Spyder

ABOVE Exactly 50 years on, the 917-001 was being presented at the Retro Classics in Stuttgart, restored to its original condition as in 1969

ABOVE For the first time the Porsche Museum is presenting a 917 concept study within its special exhibition as homage to the first Le Mans victory of 1970

in white and orange. When Porsche later announced the transfer of its racing activities to the JWA team, it was once again used as a presentation vehicle and refinished in the light blue and orange brand colours of US oil company Gulf.

Following the marque's first ever outright victory at the Le Mans 24 Hours in 1970, 917-001 was reworked into the short-tail version of Hans Herrmann and Richard Attwood in that September. When the car was handed over to Porsche Salzburg in October 1970, it was in the colours of the car that had won the Le Mans race and was emblazoned with starting number 23.

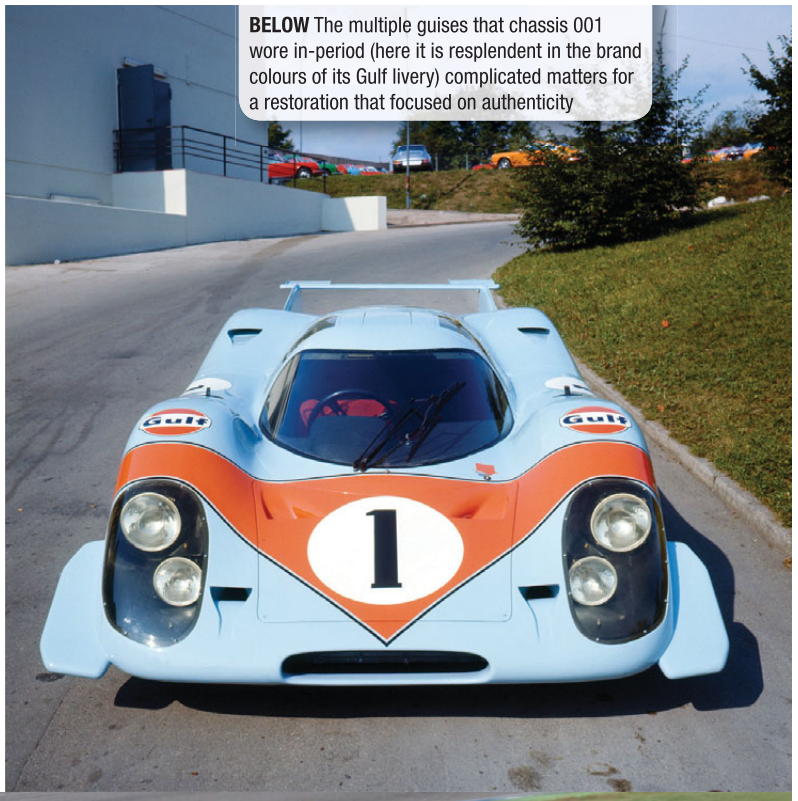
The top priority throughout the restoration was the conservation and re-use of the car's original materials wherever possible and technically practicable. The process was particularly guided by testing, which was able to determine which of the body materials were original and could be reused, using material analysis and comparison with historical design drawings and photographs. It was with this approach that the body parts for the front and rear sections were painstakingly reproduced using state-of-the-art 3D technology and

with reference to the original design drawings; the rear section of the aluminium spaceframe was also restored with the aid of original documents.

Exactly 50 years on, the 917-001 has been presented in the Porsche Museum, restored to its original condition as in 1969. It will be one of 10 models on display from 14 May to 15 September in one of its biggest-ever special exhibitions: “Colours of Speed – 50 Years of the 917”.

The Porsche Museum will also present a 917 concept study, bearing number 23, to the public for the first time as homage to Porsche’s first win at Le Mans in 1970 in car number 23 driven by Richard Attwood and Hans Herrmann. The red-and-white show car was designed by a small team of designers and engineers, though with the entry of Porsche into the LMP1 category of the FIA World Endurance Championship (WEC), this model remained as purely a concept study.

To mark the anniversary, the museum shop will also offer a selection of 917 products for sale, including a pink barbecue apron inspired by the unique 1971 917/20, nicknamed the “Pink Pig”. Edition Porsche Museum, the in-house publisher, will also release a book to mark the anniversary of the 917. HRT



BELOW The multiple guises that chassis 001 wore in-period (here it is resplendent in the brand colours of its Gulf livery) complicated matters for a restoration that focused on authenticity

ABOVE The 917 KH was the first in what would become a long line of Le Mans winners

PERFORMANCE ON A PLATE

It's easy to get obsessive over a classic racer's engine, but, as **Alan Stoddart** finds out, that means nothing if you can't control its power

HOURS can be spent working on the engine of a classic racer. From a gentle fettle, to an entire rebuild, engine experts and amateurs alike hunt down ever more miniscule improvements and tweak the feel of old cars until they have powerplants that run far more sweetly and reliably than they ever did when new. This is only part of the story, however, because regardless of how sweetly the engine runs it doesn't matter if its power can't be delivered reliably, and in a controlled way, further down the drivetrain. It is, in essence, necessary to have a good clutch.

This is where Helix Autosport comes in to play. One of the Banbury-based firm's key offerings is for cars which were originally fitted with coil-spring clutches. A lot of these old cars struggle for parts given that the coil-spring clutches, and even their constituent parts are no longer available. As such, Helix started taking the old clutches and modifying their designs so that they could instead utilise a modern diaphragm spring, and then manufacturing those new clutches in house. This switch to a more modern diaphragm spring not only makes for a better clutch, it also means that a historic vehicle can continue to be used and enjoyed by owners, drivers, and spectators alike.

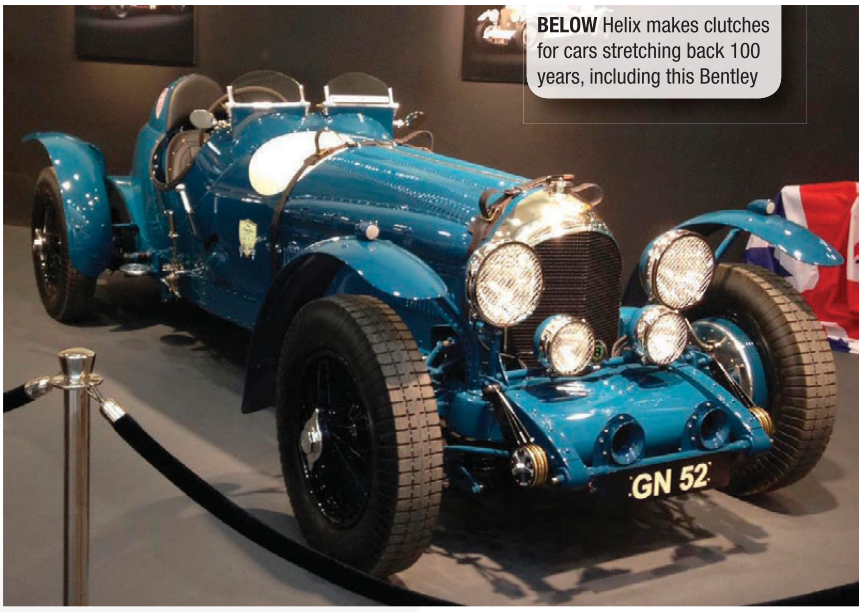
It isn't just a few marques or type of cars that Helix is able to offer this service to either. "We go back as far as Bentleys from 1919," says Terry Ormerod, who founded Helix Autosport in the late '80s. "We have done basically anything that is of a historic nature, and even if we don't do it, we can do it."

This is how the range has come to be

BELOW Almost everything that goes into one of Helix's clutches is made on-site

so massive today, people have come with classics that need replacement clutches, and they are either able to have one off the shelf, or the company can manufacture one bespoke for the customer, but then add that clutch into its standard range. This approach means that Helix's range is always growing.

"It's relatively straightforward to design a new clutch though," adds Olly Prentice, Helix's general manager. "We see what the flywheel is like, and then if the client has the old clutch we can measure it, put it on the test rig and test its load and release plate pressure. We will take it apart so we can replicate it, and take more accurate dimensions. We also look inside the clutch to identify anything unusual or abnormal, then the designers will come up with something on SolidWorks.



BELOW Helix makes clutches for cars stretching back 100 years, including this Bentley

"If the customer doesn't have the old clutch we have to work out what space is there for it and find out what torque it has to handle, then we can get something to fit and work.

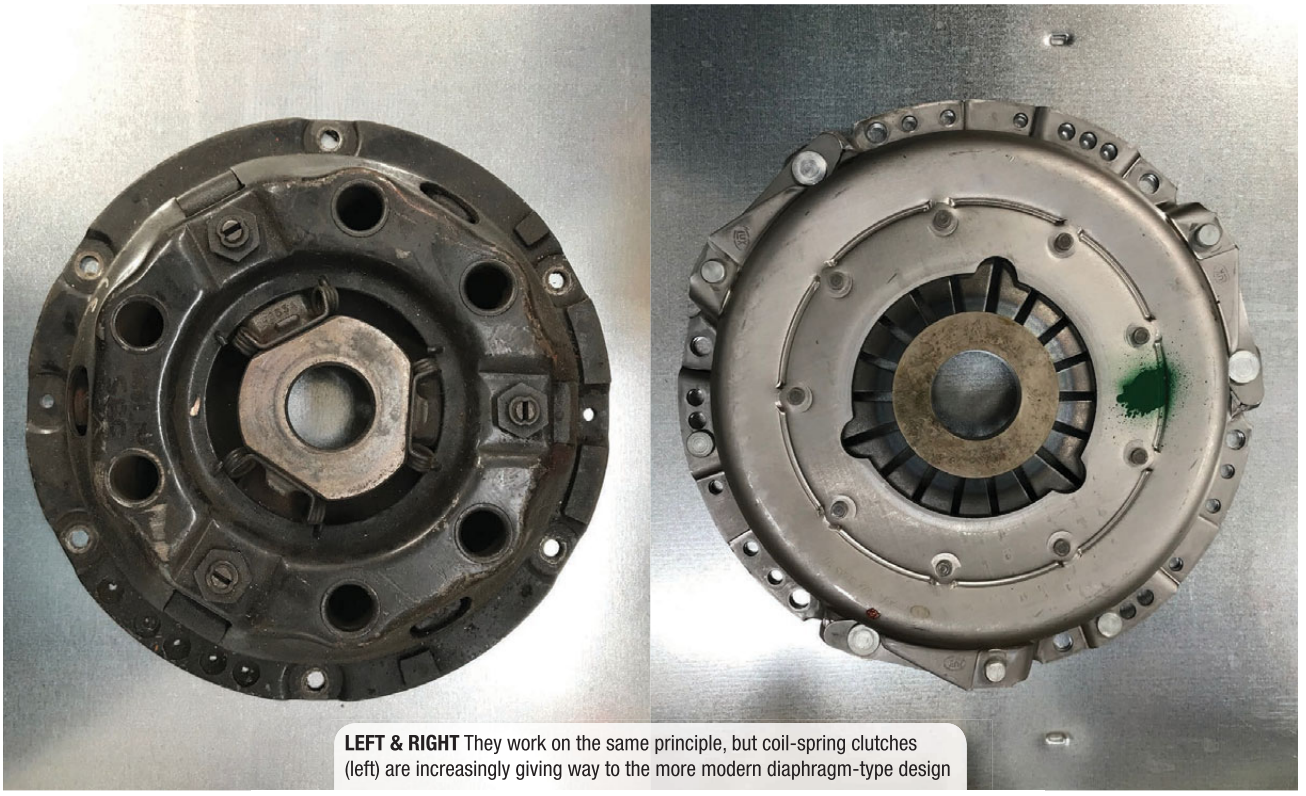
"Additionally, we've also got 53 different broaches, so we can make 53 of the different manufacturers' splines. So, for instance if someone, for whatever reason, had an old clutch where they needed the Ferrari spline in a Honda cover, then we can make the driveplate to suit the input shaft that it needs to go on.

PRESTIGIOUS CLIENTS

"Even if it's not in our range of 53, then we can still get it wire eroded elsewhere as a bespoke item. We are the only company in the whole of Europe that can do that."

These capabilities have led to some very big names in the motorsport world coming knocking on Helix's door, with even one of Germany's best-loved marques turning to the manufacturer to supply a race bearing for one of its older cars because there was no one else that was able to offer what the firm needed.

Aside from replacing irreplaceable parts, Helix's clutches also offer a few other advantages. Longevity is one of the benefits, with Ormerod mentioning ▶



LEFT & RIGHT They work on the same principle, but coil-spring clutches (left) are increasingly giving way to the more modern diaphragm-type design

that one of his customers only needed to replace the clutch in his racing car once every eight years. He does however admit that this is also down to the mechanical sympathy of the driver, pointing to a 6R4 rally driver who needed a clutch after every rally!

"We make ours better than the originals to a certain extent," Ormerod continues. "For the pressure plate we use a spheroidal graphite iron, which bends but doesn't break. OE clutches use a grey cast iron that, if it gets too abused, just snaps in half and sends bits flying everywhere."

ROBUST

Prentice adds: "We've seen it in the past where someone has sent in an original one, after telling us it's snapped, and you can see that it is cracked or the pressure plate has literally snapped in half, where as with ours, you might get some heat marks on it, and it might warp, but I've never seen one fail.

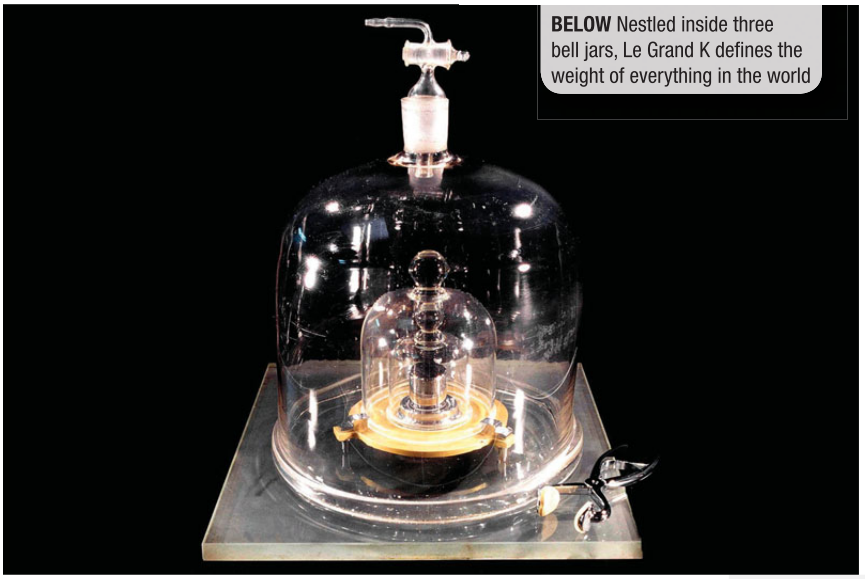
"It also helps that we test every single clutch that goes out. All of our clutches are individually handmade, tested and balanced."

Despite these changes and the stringency of the FIA when it comes to changing historic racers from original homologation specification in any way, making the switch to clutches of a more modern diaphragm-type design is admissible, because, as Ormerod says, "the point is coil springs are no longer available".

"If they said it has got to be the coil-type springs, nobody could race because they can't get them, so the FIA has to be pragmatic," he adds.

This is the key to what Helix enables: cars that are one hundred years old being thrashed on track as when they were new. The additional technology and expertise that goes into the clutches, well that is just a bonus. HRT

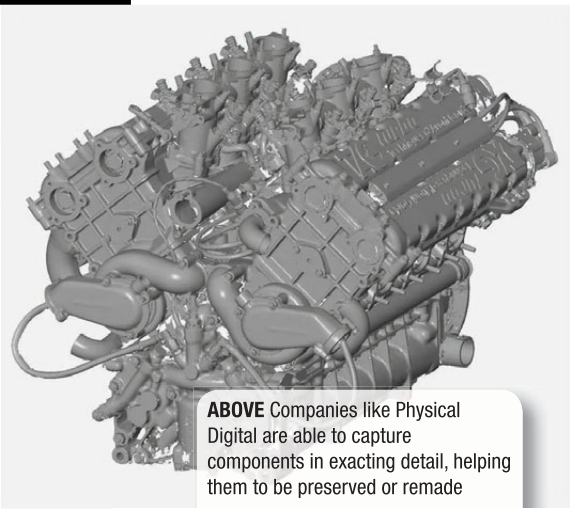
ABOVE Every clutch is carefully tested before being delivered to customers



BELOW Nestled inside three bell jars, Le Grand K defines the weight of everything in the world

AN ISSUE OF MASSIVE CONCERN

Alan Stoddart considers the perils of preservation and reflects on the issues facing metrologists and mechanics alike



ABOVE Companies like Physical Digital are able to capture components in exacting detail, helping them to be preserved or remade

AN immensely exciting day for those interested in engineering is coming up. It is a day of meteoric importance, when the very way in which we interact with the world will be formally changed forever. For, on the 20th of May, 2019, a change agreed on by the General Conference of Weights and Measures will officially come in to force, marking "one of the most significant revisions to the International System of Units since its inception".

Yes, on World Metrology Day 2019, science will formally renounce the International Prototype Kilogram, a platinum-iridium lump housed securely underground in a Parisian suburb, in favour of a daunting amount of quantum physics. The IPK, or Le Grand K, as it is known to friends, represents the last measurement for which a physical object is the ultimate reference, and its replacement by one based on universal constants will complete a process that has been ongoing since at least revolutionary France.

The real significance of this shift though, is how it affects people in laboratories and workshops all over the world. Every machine and tool is calibrated against a reference, which will itself have been calibrated by another reference, and so on in a chain that, for weight at least, will ultimately lead to Le Grand K. Unfortunately, as the kilogram is defined as being "equal to the mass of the international prototype of the kilogram", any change to the IPK affects all the measurements downstream.

Problematically, despite the best efforts of the International Bureau of Weights and Measures (the BIPM) which looks after the reference kilo, this is exactly what's happened; it has been getting lighter thanks to reasons metrology is yet to fully explain.

Headaches stemming from deviations in the physical world do not just affect those at the International Bureau of Weights and Measures, however, with changes affecting, among many others, those involved in recreating and restoring classic cars.

In the same way as the degree of distance from Le Grand K impacts the accuracy of measurements, degrees away from original parts can affect the accuracy of replacements. What's more, if a car achieved recognition in a hard campaign involving a few knocks and trackside repairs, it is likely to have already deviated from its 'straight out the factory' form. What to do then during a restoration? Return it to a virgin state, or restore it in a way that leaves its scars and history intact?

These considerations will become weightier in future as original components stop being available, processes used to make them are deemed too environmentally harmful to be permitted, and old masters hang up their tools and take with them tricks of the trade. Deviation from the original designs crafted by Ettore Bugatti, Walter Owen Bentley or Colin Chapman will surely grow, as the cars themselves become more distanced from their creators and original crafters.

Mercifully though, as is often the case, technology can provide some help. The abundance of accurate, efficient and affordable 3D scanning, optical metrology and photogrammetry services mean than digital models of unparalleled accuracy can readily be made of a racer exactly as it stands today. This can serve as a permanent reference the next time parts are remade or a restoration is commissioned, helping future fans and owners enjoy icons from the past in a form as close to original as possible.

Whether measurement or motorsport is your thing, we can all appreciate some much needed stability. HRT

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