140-PAGE BUMPER ISSUE

AUTOCAR

MALAYSIA SINGAPORE

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OFFICIAL

NEW ASTON DBX

REVEALED The car to save the company

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FIRST PICS

Hottest ever Mini

Stunning new Ferrari

New Mustang SUV

VW's radical estate

BRITAIN'S BEST DRIVER'S CAR 2019

30TH ANNIVERSARY SPECIAL 11 brilliant cars, 1 amazing winner

PLUS Our greatest ever champ named

KIA XCEED ROAD TEST • ALFA GIULIA VELOCE • LIVING WITH HYDROGEN

AUTOCAR
December 2019

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AUTOCAR

The original car magazine, published since 1895 'in the interests of the mechanically propelled road carriage'

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COMMENT

HAS THE FUTURE GONE 'VOOSH' OVER OUR HEADS?

Who actually reads this message from the Editor every month, I wonder? No one, I suspect. To test my theory, the header has no relation whatsoever to this message.

If you did read this, drop me an email at my email address below and share any thoughts you might have about our content, what you'd like to see more - or less - of or what you think will be the future of motoring in Malaysia. Will the flying car take off (pun intended) or will it be a dead duck?

Enjoy the December issue of Autocar Malaysia Singapore and until the next edition, have a good month and stay safe on the roads.

Merry Christmas, Season's Greetings and Happy Holidays to everyone.

Lisa Kuok Managing Editor
lisa@blackdogmedia.asia

EDITOR'S PICKS

BEST OF TOKYO
Our coverage of the world's most creative motor show starts on p34

ARE WE THERE YET?
As the M1 turns 60, we celebrate in a Shelby Cobra, p110

JUST THE ONCE...
That's how many times you need to try these automotive icons, p130

NEWS

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New DBX charged with reviving Aston's fortunes

New 542bhp SUV, priced at £158k, is expected to boost Aston's sales by two-thirds

OFFICIAL PICTURES

Perforated leather seats and panoramic glass roof feature

> “The five-seat 4x4, powered by a 542bhp 4.0 turbo V8, goes on sale today for deliveries next spring”

Aston Martin has officially unveiled its all-important SUV, dubbed the DBX – a model designed to open a vital, perhaps life-saving, new tranche of its global business. The five-seat 4x4, powered by a 542bhp version of the 4.0-litre turbocharged AMG-sourced V8, will cost £158,000 before options and goes on sale today for deliveries next spring.

The DBX's striking fastback looks are revealed here for the first time, although the company has been teasing market watchers for many months by displaying disguised prototypes in public.

The Aston Martin SUV's arrival represents a unique case of a hard-pressed car company fighting fire with fire. Aston Martin, floated on the stock exchange just over a year ago, has had one of the toughest debuts ever for a listed company, shedding around three-quarters of its share capitalisation. But now that they're seeing hard evidence of the DBX – a model from the brand-new St Athan factory designed for sales in the still-thriving luxury SUV market – some analysts have begun recommending Aston Martin stock for growth, a development the company's hard-pressed CEO Andy Palmer always said would happen.

Aston has been working on the DBX project, including its new production hub in St Athan, Wales, since 2015 and driving its prototypes around in public for nearly two years. It aims to sell more than 4000 units a year, initially boosting total Aston volume by two-thirds to more than 10,000, by far the greatest output in its 106-year history. Aided by the DBX's sporty-looking fastback shape – with its traditional 'DB' grille, its elegantly sculpted haunches and its powerful, aerodynamic rear – market forecasts for demand are said to be strong.

The DBX is a late-comer to the sporting premium SUV market: Porsche has been in it for the best part of two decades. Lamborghini and Bentley are more recent arrivals and even Ferrari has fast-maturing plans.

But Aston Martin believes its combination of an all-new bonded aluminium platform (using techniques perfected in two generations of sports cars) plus the fact that the DBX's structure is shared at the outset with no other model – Porsche and Lamborghini share structures, for instance – gives the new SUV considerable advantages. One is weight saving: the DBX's 2245kg kerb weight does not make it light by any means, but it undercuts some rivals by as much as 400kg.

For now, the DBX's engine is the AMG-sourced 4.0-litre V8 but a high compression ratio plus upgrades to the intercoolers and turbochargers lift power to 542bhp at 6500rpm and peak torque to 516lb ft, delivered between 2200rpm and 5000rpm, with 0-60mph in 4.3sec and a top speed of 181mph.

There are new efficiency refinements and a cylinder cut-off system for part-load running. The upshot is a combined WLTP fuel economy figure of 19.7mpg and a CO_2 output of 269g/km.

New powertrains are coming for the DBX, and although Aston won't give many details, it seems likely they will include a plug-in hybrid (doubtless →

Aston-branded ski rack, as well as boot warmers, will be available

using know-how from technology partner Daimler). Meanwhile, the company has also been gathering experience of electric vehicles – at St Athan – with its limited-edition RapidE saloon.

With an overall length of just over 5.04m, the DBX fits almost exactly into a gap between Bentley's Bentayga (5.14m) and Porsche's Cayenne (4.92m). It is low and sporty in SUV terms – 74mm lower than the Bentley, 20mm lower than the Porsche – yet its 3.06m wheelbase is longer than both, allowing packaging that makes it unusually spacious for both people and luggage.

Palmer said the DBX's specification has been guided by "external counsel", including from a female advisory board set up soon after his arrival at Aston Martin five years ago. Palmer especially values female customers and has been successful at attracting them to the company's other vehicles, especially in Asia and the US.

As you might expect of a company that brought in Lotus's top chassis man – Matt Becker – to develop its cars' dynamics, Aston has equipped the DBX with all of the suspension hardware a serious SUV needs to perform its wide spectrum of duties well. It has triple-chamber air suspension to vary spring rates, adaptive damping from Bilstein and a 48V anti-roll system that incorporates what Aston claims is an extremely quick-acting electric motor into its anti-roll bars to counteract body roll according to instructions from sensors all over the car.

There's a smart all-wheel-drive system that features electronically controlled centre and rear differentials to distribute torque away from slipping wheels. In normal use, the car is 100% rear driven – for high-speed handling reasons – but when necessary, just under 50% of torque is directed to the front wheels.

"The lateral grip numbers we've seen in testing on Tarmac have been incredible," said Becker. "We believe we've pushed the boundaries of what is possible for an SUV."

Choice of optional extras, such as bespoke leather luggage, emphasises the DBX's luxury aspirations

The DBX's all-independent suspension can raise the car 45mm or lower it 50mm from normal ride height and there are six adaptive driving modes (four on road, two off road). The steering is all electric and high geared, requiring 2.6 turns from lock to lock.

The car rides on 22in Pirelli-shod wheels available in two different styles and the brakes are steel discs, 410mm diameter with six-piston discs in front and 390mm diameter at the rear.

Inside, the DBX is extremely plush and almost infinitely configurable. All switches and controls have been designed specifically for this new model. Prominent features include a large pair of TFT screens, one central and one ahead of the driver, and a 'bridged' centre console that brings both elegance and space efficiency to the cabin.

The seats are derived from DB11 designs, to enhance sportiness, and among a plethora of imaginative options are a pet package (which carries a portable dog washer) and a snow package (which has boot warmers for keen skiers).

The first 500 DBX buyers get what Aston calls a '1913 Package', whose name celebrates the marque's 106 years of life by adding unique body and sill badges plus a commemorative plaque.

Each car will be inspected and endorsed by Andy Palmer and a special photographic build book will be signed by both Palmer and design boss Marek Reichman to underpin the fact that, after more than a century, Aston is now building a new kind of car.

"DBX will give many people their first experience of Aston Martin ownership," said Palmer. "It needs to be true to Aston Martin's core values."

STEVE CROPLEY

AUTOCARMALAYSIA.COM

Roomy cabin has two TFT screens and bespoke controls

Normal ride height can drop by 50mm or rise by 45mm

It's 74mm lower and 100mm shorter than a Bentley Bentayga

Q&A MAREK REICHMAN, DESIGN CHIEF

What's different about the DBX against other SUVs?
"DBX doesn't compromise beauty or performance for practicality or usability. We've designed it to deliver on the proportions that meet the beauty criteria we'd apply for any Aston Martin."

How did you derive the impressive interior dimensions. Did you do the cabin first?
"There's never been an Aston that has had so much research into its design, especially to ergonomics and interior space. That began with the decision to tailor the vehicle size and proportions to the specific needs of DBX. The length between the wheels allowed us to optimise cabin space while maintaining a low roofline."

Did you feel constrained by the practical nature of an SUV after all those sports cars?
"Not at all. An SUV has to be fun, too. Some others may not be, but ours certainly is. This was never going to be a breadvan. I think of it as a car with its own spirit, an adventurer."

Of which parts are you proudest?
"I'm pretty pleased with the way the fastback look of DBX positions the visual mass over the rear wheels, just as you see with our sports cars, without compromising the ingress and egress. That's not so easy to do."

Do you expect loyal Aston buyers to go for the DBX?
"Our research tells us 72% of our existing customers have a high-end SUV, but we don't believe success will come from depending on their loyalty. These days, success is about having the best product."

OFFICIAL PICTURES

Sharpened, high-tech Golf steps out of ID 3's shadow

Volkswagen's future-facing EV gives all-new Golf space to build on winning formula

Volkswagen has revealed the eighth-generation Golf, claiming that its evolutionary exterior styling hides the biggest technical leap in the history of the model.

The latest version of the long-running family car – which was first launched in 1974, with more than 35 million sold since – will go on sale next year in five-door form only with new mild-hybrid engine options and a raft of new digital technology.

The new Golf was launched at VW's Wolfsburg headquarters, with an initial reveal at this year's Frankfurt motor show postponed so the firm could focus attention on its new ID 3 electric hatch. But while the ID 3 represents the next generation of Volkswagen, in the medium term it is likely to be dwarfed in sales by the new Golf. That's why Klaus Bischoff, VW's design boss, has referred to the new Golf as "an indicator of the present" that represents "what's possible nowadays within the volume segment".

The Golf's engine line-up will include three new 48V mild hybrids and a revamped GTE-badged plug-in hybrid.

The entry-level 1.0-litre three-cylinder TSI petrol will be offered with 89bhp and 109bhp, while a 1.5-litre four-cylinder TFSI will come in 129bhp and 148bhp guises, all driven through a manual gearbox. The sole diesel on sale in the UK will be a 114bhp 2.0-litre TDI, available with manual or automatic transmission.

The eTSI-badged mild-hybrid engines use a 48V belt starter/generator linked to a 48V battery and mounted directly to a seven-speed direct-shift gearbox (DSG). VW says that the eTSI units, offered with 109bhp, 129bhp and 148bhp outputs, reduce fuel consumption by around 10% by allowing for engine-off coasting, and increase acceleration due to electric boosting.

The most powerful Golf shown at the launch was the

IT REMAINS A CAR FOR TODAY

JAMES ATTWOOD

The Volkswagen ID 3's name points to its position as the heir to the Beetle and Golf as the firm's most important car. Just one problem with that: the Golf is still here.

In 1974, the Golf essentially replaced the Beetle on Wolfsburg's main line, consigning the original people's car to limited production. But VW will make and sell more Golfs than ID 3s – for the next few years at least.

That will change at some point, raising questions about what happens to the Golf – surely VW won't abandon the heritage of that nameplate? But, conversely, the ID 3's arrival benefits the Golf today: it means this Mk8 doesn't have to be a car for the future, or move VW into new sectors. It just has to be the ideal family car for today – a better version of what came before.

In an industry obsessed with the future, the new Golf is a rare thing: a car for the present. And all the better for it.

> "It will go on sale next year with new mild-hybrid engine options and a raft of digital technology"

Launch Golfs range from 89bhp 1.0 to 241bhp GTE PHEV

241bhp GTE plug-in hybrid, which combines a 1.4-litre TSI petrol engine with an electric motor. Energy is stored in a 13kWh battery, providing 50% more capacity than the outgoing GTE.

VW will offer a less powerful 201bhp eHybrid PHEV model in some markets, although it won't be available in the UK. Neither will a TGI natural gas-powered machine that will be sold in Europe. With the arrival of the ID 3, the e-Golf will no longer continue with the new generation.

The Mk8 Golf uses the latest version of the VW Group's MQB platform, with dimensions largely unchanged from its predecessor: the car is 4284mm long, 1789mm wide and 1456mm high, with a wheelbase of 2636mm. It retains the MacPherson strut front and multi-link rear suspension, which work with VW's adaptive damping control system and steering that has been reworked with a more direct ratio for extra feedback.

The latest Golf's styling is distinctly familiar, with the front end revamped with new-look lights and, reflecting a similar feature on the ID 3, a new strip running from them to the VW roundel. The side profile has been tweaked with a focus on the more contoured C-pillar, intended to give it more presence at the rear, while the back gets a new raised rear bumper, and the Golf name written out beneath the VW logo.

While the exterior design is evolutionary, the new Golf's interior has been comprehensively reworked, with a focus on digital instruments and controls. The dashboard is dominated by the infotainment touchscreen – 10in as standard in the UK – which is paired with a standard 10.25in digital cockpit display and an optional windscreen head-up display.

The climate and infotainment volume can now be adjusted by using a 'slider' located underneath the touchscreen, while a similar →

> A more contoured C-pillar is intended to give the car more presence at the rear

Three new 48V mild-hybrid Golfs will wear the eTSI badge

system is mounted into the roof console to operate the optional sunroof. The Golf also features the latest version of VW's MIB3 infotainment system, which supports both touch and voice control, including the ability to use Amazon Alexa. It is permanently connected to the internet via an eSIM, enabling online music streaming, traffic information and shopping.

The positioning of the remaining physical controls have been reworked. Many have been bundled together and positioned higher and closer to the steering wheel and instruments on the dashboard. To make the interior feel cleaner and more spacious, the upper portion of the dashboard has been designed to appear as if it sits on a 'table', with an indented line underneath now housing the air vents to minimise their appearance. That line also features integrated ambient lighting elements, to make the car feel bigger.

VW has focused heavily on upgrading the technology on the new Golf, aiming to take its digital systems to a higher level than other cars in the class. It is offered with Travel Assist, which uses a combination of adaptive cruise control and lane assist to enable 'assisted driving' at speeds of up to 130mph.

The new Golf is also the first VW to feature Car2X technology, based on the harmonised European Union standard. Car2X uses information from cars and various bits of infrastructure fitted with sensors to produce data based on local traffic and conditions that can be fed back to drivers in real time.

The Golf is offered with upgraded front assist, a system that can automatically brake for oncoming vehicles. There is also LED lighting as standard, with the option of VW's top-spec IQ Light system. Sections of the matrix LED headlights

Battery capacity of new plug-in hybrid GTE is up by 50%

A bank of digital displays dominates the new Golf's cockpit

Some controls now sit atop a dashboard 'table'

Bolder headlights bring verve to the front-end design

Eighth-generation Golf will be available in five-door form only

can be dipped for oncoming traffic or to reduce glare from traffic signs, and adjust for corners and poor weather. Dynamic turn indicators feature too.

The new Golf's eSIM also allows for over-the-air software updates to both the car and the infotainment system. UK buyers will receive a three-year subscription to VW's We Connect Plus, which offers a range of services including media streaming, online route calculations, vehicle status, driving data, online map updates and, for the GTE, charging information. It will also allow owners to download add-ons from an 'in-car shop'.

The firm has developed a mobile key system that will allow the Golf to be operated via smartphone. This won't initially be offered in the UK but could be introduced at a later date.

Exact trim levels and specs have yet to be confirmed, but the UK will retain S, SE, SEL and R-Line forms.

While entry-level cars will run on 16in wheels, higher levels will gain 17in rims, more ambient lighting options, chrome exhausts and leather trim options. R-Line models will get bespoke bumpers, trim elements and sport seats, with similar tweaks expected for the GTE version.

VW also claims the new Golf will be upgradeable, so features such as adaptive cruise control, light assist and wi-fi hotspot can be enabled after purchase.

The Golf is due on sale in the UK early next year. Pricing has yet to be finalised, although a slight increase on the equivalent versions of the outgoing car is likely.

The GTI and GTD models are scheduled to follow later in the year, with the GTI using an upgraded version of the 241bhp 2.0-litre turbocharged engine from the previous model. The hot R version is likely to arrive in 2021, along with a range-topping 400bhp R Plus.

HOT TOUAREG R PLUG-IN CONFIRMED

Volkswagen will expand its R performance line-up with a hot version of the Touareg SUV, powered by a plug-in hybrid powertrain, in 2021.

The new car, the first PHEV-powered R model, was confirmed by VW sales boss Jürgen Stackmann at the launch of the new Golf. He said the new machine represented the start of "an electric future for R", adding: "For the next five years as we are launching some Rs, we will couple these with a very strong message for low emissions."

A plug-in hybrid is offered in China, producing 363bhp from a 2.0-litre four-cylinder turbo petrol engine mated to an electric motor. That model is expected to go on sale in Europe in the coming months. Currently, the fastest Touareg available in the UK is the 335bhp V6 petrol model. It is unknown if VW could electrify this unit to take the output beyond 400bhp – the likely target for a Touareg R – or upgrade the existing four-cylinder plug-in.

Stackmann added a full-electric R model is still some way off, but said: "Obviously we need to worry about it as our emissions need to come down in 2020, [so] R needs to go in that direction."

Q&A JURGEN STACKMANN, VW SALES AND MARKETING BOARD MEMBER

The new car is a big technological leap. But how does it link to its predecessors?

"The car has been around for 45 years and we have sold 35 million, but we say this is a 45-year-old car because it has never lost its inner genetic code. It has always been the car where our engineering team are trying to protect what people love about Golf and try to bring in as much as possible from the future, but always in the form where people understand what's going on."

Is the new Golf your most advanced car?

"It is as digital as the ID 3, as ambitious in its connectivity, as advanced in its assistance systems. But that had to be delivered in a way that Golf owners understand and can use intuitively.

"The car is knob-free, it's all either touch, swipe, speak or wipe, so even the sunroof is a simple swoosh of the finger. But it's very easy to understand. You can talk to the car, say 'hello Volkswagen', it speaks back to you in a natural way. And when we make progress with new software and assistance systems, we can update it over the air."

We know the software has moved on, but what about the hardware?

"We have advanced our engine systems by at least 10% in many directions. The new eTSI mild-hybrid engines will improve the CO_2 footprint of petrol cars by 10%. It is also a huge gain in comfort and smoothness. Our diesels now have twin dosing that brings down CO_2 emissions by up to 17% and reduces NOx by up to 80%."

Do you think there will be Golf customers who migrate to the ID 3 instead?

"From the first indications for ID 3, our 36,000 pre-bookers, around 80% are new to the brand. It shows that the interest on the electric side is very far-reaching. It's much younger – the average age is around 35 while the average of a Golf owner is 53."

The Golf bodystyles have been simplified to the five-door and the estate. Will you expand that with something new?

"I would say for the start clearly that's the essence of Golf. But there is potential space for a crossover version, clearly, that could be explored. But you have to be careful not to over-proliferate – our salesmen cannot handle 15 cars at the same time, and most customers get lost if they

Audi's hot RS Q8 took 12sec off the previous lap record for SUVs

RS Q8 smashes 'Ring record

Audi's 592bhp RS Q8 has set a new record for SUVs at the 12.9-mile Nürburgring

The Audi RS Q8 hasn't been officially unveiled yet, but already it's a record breaker. Packing 592bhp, the high-riding, high-performance flagship has smashed the SUV lap record at Germany's fearsome Nürburgring with a time of 7min 42.253sec – 12 seconds quicker than the previous benchmark set by the Mercedes-AMG GLC 63 S.

In the build-up to the RS Q8's official launch later this month, Autocar was given exclusive behind-the-scenes access and granted a high-speed passenger ride around the 'Ring (above right).

Based on the SQ8, the RS model features the twin-turbocharged 4.0-litre V8 from the forthcoming RS6, which means it packs 592bhp and 590lb ft – good for 0-62mph in 3.8sec and a 190mph maximum top speed.

The SQ8's air suspension and 48V anti-roll bars are carried over, but software tweaks mean the spring rates are up to 10% stiffer and the adaptive dampers can be around 15% firmer. Also used is the four-wheel steering set-up, plus the torque-vectoring Sport rear differential.

> "The RS Q8 packs 592bhp and 590lb ft – good for 0-62mph in 3.8sec and a 190mph top speed"

However, extensive work has also been put into the bespoke Pirelli P Zero tyres, which run to 295/35 ZR 23 in their largest guise on the RS Q8.

"We wanted the RS Q8 to be able to deliver on the track, but also be usable every day," said Victor Underberg, Audi Sport's head of development. "We needed a tyre that's quiet, comfortable and can cope with all sorts of weather but has the performance to deliver a strong lap time. With this tyre, we have achieved our targets."

Structurally and externally, little has changed, with the engineers keen to stress that despite its performance and capability, the RS Q8 is a daily-usable series-production vehicle, and apart from those vast 23in wheel options, the only other noticeable updates are the carbonfibre trim around the revised front grille and lower bumper, plus the rear diffuser with its RS-trademark twin oval exhausts.

Inside, the most obvious tweak is the inclusion of RS-specific displays for the TFT instrument cluster, but with its roll-cage, race seats and discarded rear bench, the interior we saw was in all other ways unrepresentative.

JAMES DISDALE

BRISTOL LOOKS AT NEW NO-DIESEL ZONE

Bristol City Council is consulting on proposals to ban privately owned diesel vehicles from entering a part of the city centre between 7am and 3pm daily by 2021. A wider charging zone would be in operation for commercial vehicles.

FISKER NAMES ELECTRIC SUV THE OCEAN

The new electric SUV from US start-up Fisker will be called the Ocean. It's claimed to be the "world's most sustainable vehicle", with recycled vegan materials and other natural products used throughout. Order books open this month.

WE RIDE IN THE RECORD BREAKER

Audi factory ace Frank Stippler is not hanging about. We've got one hot lap of the Nürburgring and damp but drying conditions similar to those during his record-breaking run. (Had it been dry, Stippler reckons, there were another four or five seconds on the table.)

Obviously, we can't truly get a handle on what the car's doing when riding shotgun, but there's enough feel through the seat of the pants to suggest the RS Q8 is hugely capable.

The relentless acceleration is a given, and looking at the telemetry later reveals there's even enough grunt through the 180mph kink of Döttinger Höhe to spin a lightly unloaded inside rear wheel. The optional carbon-ceramic brakes work well, too, tirelessly hauling the car down from big speeds – although on a lap that's 80% full throttle, they're not worked as hard as they could be.

No, what's surprising is the Audi's agility. Where you'd expect plough-on understeer and extreme body roll, the RS Q8 takes a neutral and flat stance. If anything, the balance in these conditions is more towards oversteer. You can feel the rear-wheel steering pointing the nose into the apex in slower turns and the trick diff allows Stippler to get early on the throttle at the exit to get the rear rotating for a quicker exit.

Tellingly, we're in the Auto driving mode. "When it's a little slippy like this, then in Dynamic with stability disengaged, we'd have oversteer all the way from entrance to exit," says Stippler with a smile.

Rapid changes of direction are no problem for the RS Q8, yet despite the roll stiffness, the trick suspension can still deliver enough compliance to ride the big kerbs with real suppleness.

It's truly impressive, and while we'll have to wait for our turn behind the wheel (and in a car with rear seats) to deliver a proper verdict, we've learned enough to know that Porsche won't have it all its own way in the battle for high-performance SUV supremacy.

Stippler (left) gives our man a taste of what an RS Q8 can do

Trick suspension lets it ride the bumps with suppleness

PRICE RISES AND SHAKE-UP FOR FOCUS RANGE

Ford has revised its Focus line-up by axing entry-level Style trim and raising prices on certain models. The Focus now starts with the £20,645 Zetec. Active, Zetec and ST-Line prices rise by £250, estates by £100 and petrols by £500. A new flagship Vignale variant of the Active model is available from £27,045.

MOTORSPORT IMAGES

McLaren uncorks 804bhp Elva

Range-topping V8 roadster features clever aerodynamics – and no windscreen

McLaren has revealed the Elva, a 804bhp two-seat roadster with no windscreen, as its latest Ultimate Series model.

The new machine, which was first revealed by Autocar in the summer, joins the P1, Senna and Speedtail in the range-topping model line and is limited to 399 examples, priced from £1,425,000 (including UK VAT).

McLaren claims the rear-wheel-drive Elva is the lightest road car it has ever produced. Powered by the firm's 4.0-litre twin-turbocharged V8 engine, it is able to reach 62mph in "under three seconds" and has a claimed 0-124mph time of 6.7sec – faster than the track-focused Senna.

The Elva name is taken from the East Sussex constructor whose chassis was used as the basis for McLaren's M1A, M1B and M1C two-seat sports cars in the 1960s (see box, right), which serve as spiritual predecessors to the new road car. McLaren has acquired the rights to the Elva name.

McLaren boss Mike Flewitt says the Elva is "a uniquely modern car that delivers the ultimate connection between driver, car and the elements". It features a bespoke, lightweight carbonfibre chassis, with no roof, windscreen or side windows.

To shield occupants from the elements, McLaren has developed a patented Active Air Management System (AAMS). Automatically activated at speed, this guides air through a large inlet in the splitter at the front of the Elva's distinctive low nose and out of a clamshell ahead of the cabin. As a result, the air is channelled up and over the occupants to create a 'bubble' of calm. A small carbonfibre deflector rises from the front of the bonnet when the AAMS is active to direct the air, which is deflected through a number of carbonfibre vanes across the bonnet.

When not active at low speeds, the air flow is diverted into two low-temperature

Instrument display moves in conjunction with the steering wheel

OFFICIAL PICTURES

AUDI INTRODUCES REAR-DRIVE R8

Audi has added a rear-wheel-drive R8 as a full-time member of the range for the first time. Called the V10 RWD and available to order in January in both coupé and Spyder forms, it's powered by a 532bhp and 398lb ft version of the 5.2-litre V10.

BLOODHOUND BREAKS 500MPH BARRIER

The Bloodhound land speed record car topped 500mph during testing in South Africa. A fire warning caused pilot Andy Green to evacuate the cockpit, but it was a false alarm. The team is ultimately aiming to eclipse 1000mph.

radiators to boost their efficiency. McLaren claims the radiators boost the output of the engine by cooling the oil in the seven-speed transmission. The firm says the AAMS tech means helmets are not required but can be worn if preferred, while a fixed windscreen will be offered as a factory option.

As well as the open front, McLaren has made the cabin as open to the elements as possible with low sides and by minimising the size of the twin rear buttresses by the use of an automatically deploying roll-over protection system.

The car has a number of features designed to maximise aerodynamic efficiency, including air intakes on the rear buttresses and an active rear spoiler. The latter works in conjunction with an extreme rear diffuser, which features vertical fences designed to accelerate air out from under the Elva's flat floor.

McLaren's traditional V8 engine has been tweaked for improved power output with a revamped exhaust system, while the car's chassis has been optimised to "maximise agility and driver engagement and feedback", with electro-hydraulic steering and unique software settings and springs.

McLaren has yet to cite a weight for the car, but says that, as well as the open-top design, it has been minimised where possible through the extensive use of carbonfibre. The front clamshell is 1.2mm thick and is formed from a one-piece panel, while the large side panels are also single pieces. The small gullwing doors are carbonfibre too, mounted via a single hinge.

The sintered carbon-ceramic brakes measure 390mm, and McLaren claims they are the most advanced to be fitted to one of its road cars, with increased thermal conductivity that allows for reduced brake duct cooling.

McLaren has used a "blurred boundaries" design principle for the interior, with a carbonfibre element flowing from the rear buttresses into the cabin to serve as the central armrest between the driver and passenger.

The dashboard has been designed for a clean 'pebble-like' feel, with the only instrument cluster moving with the steering wheel to ensure optimum visibility.

The Active Dynamics controls are mounted on that instrument cluster for the first time in a McLaren. A central 8in touchscreen is used for many of the car's functions, including a track telemetry system.

The interior features lightweight carbonfibre seats and is offered without an audio system as standard. The floor is exposed carbonfibre, with lightweight non-slip mats as standard. With the cockpit open to the elements, the Elva is offered with a range of trims designed to cope with exposure to rain, sunlight and other intrusions.

A small storage compartment, designed to house helmets, is located beneath the rear tonneau.

The Elva is available to order now, with customer deliveries due to begin late next year after the production run of the Speedtail is completed.

JAMES ATTWOOD

Air management tech protects occupants from the elements

THE STORY BEHIND THE NAME

The tiny Bexhill-based Elva Equipe (the name comes from the French phrase 'ella va', meaning 'she goes') played a key role in McLaren's early sports racing cars, which the new Elva takes inspiration from.

Bruce McLaren established his eponymous team in 1963, developing the M1A sports car, powered by a mid-mounted 340bhp 4.5-litre V8, to race in both Europe and North America.

The car was quick, setting a number of lap records, and attracted much interest from potential customer teams. With his staff limited, McLaren teamed up with Elva to outsource production.

That led to the McLaren-Elva M1A, M1B and M1C, developed between 1964 and 1967. By that time, McLaren had developed the M6A, which the founder and team-mate Denny Hulme used to dominate the 1967 Can-Am Championship.

McLaren Elva's striking look was inspired by the marque's sports racing cars of the 1960s, including the M1A whose chassis maker gave the new model its name

C5 AIRCROSS HYBRID DETAILS REVEALED

Citroën has confirmed pricing and specs of its C5 Aircross Hybrid. The plug-in SUV costs from £35,340, with UK deliveries due in the middle of next year. It has a 222bhp petrol-electric powertrain promising a 31-mile electric range.

MERCEDES TO TURN G-WAGEN ELECTRIC

Mercedes boss Ola Källenius has confirmed the G-Class will eventually become electric. He said there will be a zero-emission version and claimed that, while the firm once considered axing it, "I'd say the last Mercedes to be built will be a G-Class".

Mustang reborn as Model Y rival

Ford unveils muscle car-inspired electric SUV; due here next year, priced from £40k

Ford has revealed the Mustang Mach-E, the firm's first bespoke electrically powered SUV, with styling and – its maker claims – performance inspired by the muscle car.

The Tesla Model Y rival is the first production car to emerge from Ford's Team Edison, a 70-strong Detroit group tasked with designing the firm's next-generation EVs. At launch the range-topping version will produce 332bhp, with a full GT model making around 459bhp due at a later date.

Murat Gueler, Ford's European design chief, said the aim was to create "something special that stands out from the crowd", describing the new machine as "an EV with soul".

The new electric car has taken the Mustang title as the first step in expanding the nameplate into a full model line. The Mach-E moniker is inspired by the Mach 1 variant of the first-gen Mustang.

The styling strongly links the EV to the regular Mustang, reflected in features such as the badge and front and rear lights, as well as several lines along the bodywork. Gueler said: "The approach was to put this car in a unique spot: only Ford can do Mustang. In the next few years there will be hundreds of EV nameplates, but with Mustang we can load up with emotion and drama."

The car lacks conventional door handles, instead featuring buttons that pop open the doors and small holds protruding from the front doors. Owners can use their smartphones as keys, or use a keypad built into the B-pillar.

The Mustang Mach-E sports a more radical interior, with a wide dashboard featuring a Mustang 'double cowl' and built-in soundbar. The dash is dominated by a Tesla-style vertically mounted 15.5in touchscreen with a rotary dial fixed onto it using special glue. Many of the car's systems are controlled through the screen, which uses a new Sync 4 operating system that can accept over-the-air updates. There is also a 10.2in digital cluster for the driver, while the steering wheel retains a number of physical controls.

The Mustang Mach-E sits on a new Ford EV platform called Global Electrified 2, or GE2 – an extensively reworked version of the C2 architecture used for the latest Focus and Kuga. Gueler said designers had input into setting the platform's dimensions, both to set the wheelbase and to enable the extended bonnet, which is long for an EV but which was considered an iconic Mustang design feature.

The model will initially be launched with two battery pack sizes and three power outputs. The entry-level version will feature a single motor driving the rear wheels, with either a 75kWh battery and 254bhp motor or a 99kWh battery and 285bhp motor. Both produce 307lb ft, with a claimed 0-62mph time of under eight seconds and WLTP range of around 280 and 370 miles respectively.

The twin-motor all-wheel-drive version is offered with a

> "At launch the range-topping version will produce 332bhp, with a 459bhp GT model due later"

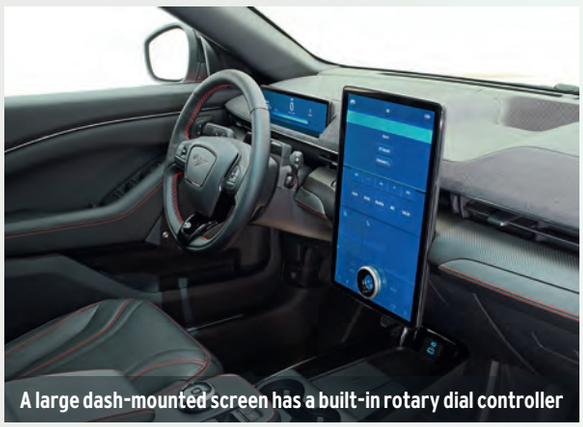
EXCLUSIVE PICTURES

HYUNDAI READIES BOLD PLUG-IN SUV

Hyundai has previewed a radically styled plug-in hybrid SUV concept, with a rakish roofline and active cooling flaps in its grille, ahead of its LA unveiling. The firm also confirmed the Santa Cruz pick-up concept will enter US production in 2021.

MORRIS COMMERCIAL IS BACK WITH EV

Historic British marque Morris Commercial has been revived for 2019 with a modern, all-electric interpretation of the J-Type van. The new model has a 200-mile range, a 1000kg payload and fast-charging capability. Prices start at £60,000.



A large dash-mounted screen has a built-in rotary dial controller

WILL THE MUSTANG MACH-E SUCCEED?

JAMES ATTWOOD

On a recent trip to the US I met a Mustang-owning Texan who didn't much like EVs, but "I hear there's an electric Mustang coming, so maybe I'll like that". I fear he may be disappointed: there's a big difference between an electric Mustang and a 'Mustang-inspired' electric SUV.

Still, the Mustang Mach-E shows promise. To my eyes it echoes the muscle car without resorting to pastiche and looks relatively sleek for a large SUV.

It's certainly more desirable than, say, a Kuga EV would be – which is what Ford is counting on. The huge success of the latest Mustang has shown the value of the nameplate, badge and heritage – arguably stronger than Ford's Blue Oval. A Ford-badged EV could never battle with a Tesla on badge appeal, but a Mustang-badged EV might succeed – assuming expectations are kept somewhat in check.

75kWh battery and 254bhp, or 99kWh and 332bhp. Both versions provide 429lb ft and a sub-seven-second 0-62mph time, with estimated ranges of 260 and 335 miles. Charging is available through an AC home charger or via DC fast chargers at up to 150kW.

The car is 4712mm long, 1881mm wide and 1597mm high, placing it between the Jaguar I-Pace and Mercedes-Benz EQC. Kerb weights range from 1993kg to more than 2218kg, while all models will have a limited top speed of 111mph.

Claimed boot volume is 402 litres, and there's a 100-litre waterproof front luggage bay.

Ford hasn't given a full range of performance figures yet, but Team Edison's Dorit Haas said it was "meant to be like a sports car". She added: "This is a performance EV. Not just in a straight line, but in terms of handling and agility – the ride is very important."

The rear-wheel-drive models will sit on 18in wheels, with 19in wheels for all-wheel-drive versions. Twin-motor machines gain adaptive LED headlights and red brake calipers, while limited-edition First Edition models also get a panoramic roof.

The Mustang Mach-E is being built in Mexico and is available to order now and will be sold exclusively online, with first deliveries expected around October next year. Prices are not yet confirmed but will start at around £40,000, rising to about £60,000 for the First Edition.

JAMES ATTWOOD

The Mustang Mach-E's styling echoes that of its muscle car namesake

The model will be offered in rear- and all-wheel-drive forms

Q&A MURAT GUELER, FORD OF EUROPE DESIGN CHIEF

How did you approach the design of a Mustang-inspired EV?

"It's not literal, just inspired by. It's about doing it in the right way so it's not too banal and people go 'oh, they just tried to copy a Mustang'. We wanted some of that cool design. You can look at this and see it's not a normal combustion-engined car, but it has some of that Mustang flavour."

Was the plan always to make your electric SUV a Mustang?

"This started as another project in around 2014, and about two years ago it switched to this. The design had a big influence: the whole structure changed, the technology inside changed. We rebooted the whole programme. The designers came up with this concept and everyone went 'oh, this is good'."

While it uses the Mustang logo, there isn't a single Blue Oval on the car. Why do that for such an important car for Ford?

"We did our research and customers are totally okay with this. It's the same on the Mustang itself, and it communicates how unique this car is. The latest Mustang has taken it to a new level of popularity in Europe. It's a big nameplate."

TESLA SHUNS UK FOR BERLIN FACTORY

Tesla has chosen Berlin as the future home of its European factory, dashing hopes that the EV maker could establish a presence in the UK. The facility will produce the firm's new Model Y seven-seater alongside batteries and powertrains.

MITSUBISHI SPRUCES UP THE MIRAGE

Mitsubishi has unveiled its revised Mirage city car. It has a fresh exterior design featuring the firm's Dynamic Shield grille and a revamped interior with optional 7in touchscreen. UK specs are being finalised, but the 1.2-litre engine will continue.

OFFICIAL PICTURES

Ferrari launches £175k coupé

Portofino-related Roma packs a 612bhp turbo V8 and goes on sale next summer

Ferrari has revealed the 612bhp V8 front-engined Roma as a new '2+' coupé with the aim of winning over new customers who "might be a bit afraid" of the firm's more hardcore machines.

The Roma is set to go on sale next summer priced from around £175,000 as a rival to the Aston Martin Vantage and Mercedes-AMG GT. It shares basic underpinnings with the Portofino drop-top but has a new retro-influenced design and upgraded powertrain. Ferrari says the car is about 70% new.

Ferrari commercial chief Enrico Galliera said the Roma represents "a new kind of gran turismo", mixing high-performance driving dynamics with a refined style. He said it would appeal to customers who would "love to drive a sports car or a Ferrari, but might be a bit afraid of one".

The Roma's design aims to reflect "the carefree lifestyle of 1950s and 1960s Rome" and follows the tradition of front-engined 1960s Ferraris such as the 250 GT Berlinetta and 2+2 – but with a contemporary twist.

That includes a bold new grille, inspired by a Formula 1 car, and a highly sculpted rear, which incorporates an automatically operating active rear-wing element.

The Roma is powered by a revamped version of the 3.9-litre turbocharged V8 employed in the Portofino and elsewhere in Ferrari's line-up, albeit using the eight-speed DCT gearbox that was introduced on the SF90 Stradale. It has been tuned to deliver 612bhp and 591lb ft, up from 592bhp and 561lb ft in the Portofino – despite the system incorporating particulate filter technology to meet the latest emissions requirements. Ferrari claims a 0-62mph time of 3.4sec and a top speed of more than 199mph.

The Roma has a dry weight of 1472kg with lightweight options fitted – around 80kg less than the Portofino – and Ferrari claims a best-in-class power-to-weight ratio.

The Roma features the latest version of Ferrari's Side Slip Control, five drive modes and a new Dynamic Enhancer function that controls the yaw angle of the car by hydraulically adjusting the brake pressure.

Inside, the '2+' layout incorporates separate 'cells' for driver and front passenger, with space for a small rear seat or storage behind each. The driver is separated from the front passenger by a central divider. The steering wheel is an all-new design and hosts all the main driver settings to ensure a constant focus on the road ahead.

Traditional analogue speed and rev dials have been replaced by a 16in curved screen behind the steering wheel, while a centrally mounted, vertically oriented 8.4in unit displays infotainment functions. There is also a separate touchscreen for the passenger.

A boot capacity of 345 litres is roughly equal to that of the AMG GT and Vantage.

> "Ferrari claims 0-62mph in 3.4sec and a top speed of over 199mph"

Galliera insisted the Roma is not simply a hard-top Portofino but "a completely new model". He said there was room in the Ferrari range for two front-engined V8 models, particularly as the Roma is intended to target new customers.

The platform used for the Roma can accept a hybrid powertrain, but technical boss Michael Leiters said "we will never do so on the same model" that features a petrol engine.

Earlier this year, Galliera told Autocar that Ferrari would become "less predictable" and said at least one car it would reveal this year would be "in a new segment". Ferrari's current focus is on increasing revenues rather than strictly increasing sales.

JAMES ATTWOOD

Roma is meant to hint at 1960s front-engined Ferraris

Q&A ENRICO GALLIERA, COMMERCIAL CHIEF, FERRARI

What is the thinking behind the Roma?
"We've introduced the concept of unpredictability. We've redesigned our product range, with some models creating new segments such as the SF90 Stradale and Roma. The SF90 is for pure Ferrarista. The Roma is designed to attract new Ferrari clients, from a segment that doesn't exist."

Why not develop a hard-top version of the Portofino?
"The market was expecting the coupé version of the Portofino. You will see: this is not the coupé version of the Portofino. This is a completely new model. We did that on purpose. We believe there is space for the two different models."

You've launched five new models this year. How many will come in 2020?
"We committed to introduce 15 new models in a five-year plan. We launched five in 2019, so certainly something will happen in the future. But 2020 for us is a year of consolidation. We just introduced five new cars. Some are new segments. Now we need to make sure that our network and clients can clearly understand the position of the new models."

Roma's cabin features separate 'pods' for driver and passenger

Heavily sculpted rear incorporates an active wing and four tailpipes that run from the 3.9-litre V8 sited up front

New bodywork signals GP's intent. Cabin has only two seats

OFFICIAL PICTURES

Hottest Mini yet unleashed

Hardcore John Cooper Works GP has 302bhp; 0-62mph in 5.2sec

Mini's fastest road-going model yet, the John Cooper Works GP, has been revealed at the Los Angeles motor show ahead of UK deliveries starting in March 2020.

With 302bhp and 332lb ft from a 2.0-litre turbo petrol motor – significantly exceeding the output of the same unit in the 228bhp John Cooper Works (JCW) model – the GP is capable of 0-62mph in 5.2sec and a top speed of 164mph.

The production run from Mini's Oxford plant is 3000 globally, with 575 destined for the UK, priced from £33,895.

Externally, the most notable additions are a giant roof spoiler with double-wing contours, a new front apron design and special wheel-arch extender panels that are made of lightweight carbonfibre-reinforced plastic and dubbed 'spats' by Mini engineers.

The material for the spats is recycled from the production process of the i3 and i8 of Mini parent company BMW. With an exposed matt finish, the front arch panels each feature the car's specific build number. The body itself is available exclusively in metallic grey, with silver and red details.

Most of the GP's extra power is achieved with a new turbocharger. The motor's compression ratio is reduced to cope with the extra boost pressure, and a new intake duct and new multi-hole injectors – with up to 350 bar of pressure – also feature, as does a GP-specific oil sump.

A new exhaust system is said to bring sound effects "inspired by motor racing". Also taken from the firm's racing expertise is a newly developed cooling system.

Power is put to the front wheels only through an eight-speed automatic gearbox with steering-wheel-mounted shift paddles. A mechanical differential lock helps to channel the healthy power output smoothly.

The GP's body structure is said to be "extremely rigid" (though no percentage increase is quoted), with new supports, members and strut braces. The suspension was developed from extensive Nürburgring testing. The track widths are increased and the body is lowered by 10mm over the standard JCW, while a host of new parts and extra front camber reduce roll and improve grip.

The dynamic stability control set-up has a GP-specific mode that relaxes the system's intervention. A new sports braking system (in conjunction with lightweight forged wheels) features four-piston front calipers for greater stability and braking power.

Inside, there are just two seats. Combined with less acoustic insulation, the shedding of its rear seats contributes to a reduced, 1255kg kerb weight – 85kg lighter than the normal JCW. New 3D-printed honeycomb metal shift paddles feature and 3D printing has also been used for the passenger dashboard panel, where the car's build number is displayed.

Despite the pared-back approach, the GP can still be specced with sat-nav, wireless charging and heated front seats. It also gets the digital instrument cluster from the Mini Electric as standard.

LAWRENCE ALLAN

Wing is said to boost downforce

PEUGEOT HYPERCAR TARGETS LE MANS

Peugeot will build a new hypercar to make a return to the Le Mans 24 Hours in 2022. The car maker is the third major brand, after Toyota and Aston Martin, to commit to the new racing category but has yet to reveal any details about its car (the image on the left is a PlayStation Gran Turismo concept). The new rulebook, due for use at Le Mans from 2021, allows for two approaches: either to build a prototype racing car as Toyota has done or adapt a homologated road car like Aston Martin's Valkyrie.

CONFIDENTIAL

VOLKSWAGEN'S BUDGET electric vehicle is on track for a 2023 launch and will cost under £18,000, VW CEO Herbert Diess has confirmed. "We have to do it and we have a combined team between China, Spain and Germany [working on it]," he said. "They're working hard but there's still some way to go. It's really tough to get a decent range for a car under £18,000."

JAGUAR LAND ROVER produced a specially designed sports car, likely based on the F-Type, that never made production, a Twitter conversation between two employees suggests. Commenting on Ferrari's new Roma (below), SVO special projects manager Adi Smith asked designer Cesar Pieri: "Did you sell our special little project? Looks REALLY familiar." Pieri replied: "Seems like someone found our files! At least it got somehow produced."

SPORTS CARS WILL feature in Mercedes line-ups for years to come, believes the firm's design director, Gorden Wagener, because more and more race tracks are being built. "I read that one race track a week is being opened in China," he said. "Many of them are private facilities, but this underlines that there is still a strong appetite for sporty cars for the future."

DESPITE A WANING CAR-maker attendance at motor shows, Mazda thinks they still have a place for its brand. Design boss Ikuo Maeda said: "Motor shows are a good opportunity for manufacturers to express their corporate vision, philosophy and brand style all on one stand."

ELECTRIFIED MX-5 POSSIBLE

Mazda bosses are deliberating on the next generation of its existing sports car, the MX-5, by considering how to improve the popular model while potentially using an electrified powertrain.

Given its relatively low volume, the MX-5 might be one of the few cars that could avoid being electrified for its fifth generation but, either way, maintaining its light weight is crucial.

R&D boss Ichiro Hirose said: "The lightweighting and compact size are essential elements of MX-5, so even if we apply electrification, we have to make sure it really helps to achieve the lightweighting of the vehicle."

Brand and design chief Ikuo Maeda flagged changing public opinions as a consideration on which powertrain to use. "The preference of people who enjoy driving sports cars might be changing, so we need to think about what direction society is going," he said. "We want to look at the best powertrain to keep the vehicle lightweight, but because of the diversifying requirements and preference, we need to explore various options.

"I don't have the answer now but we need to make a vehicle that people can own without worrying that they are not being eco-friendly."

The current MX-5 continues to enjoy healthy sales, with 4000 units sold in the UK this year. Mazda UK MD Jeremy Thomson describes the model "as an evergreen car that keeps one aspect of the brand alive", also saying it has "an incredibly passionate following".

He added: "It wasn't so long ago that MX-5 was as well known as Mazda overall. We've tried to infuse that MX-5-ness into all our cars."

Electrified MX-5 must adhere to the model's lightweight ethos

NEW VW ID CONCEPT COULD BE VIZZION SPIN-OFF

Volkswagen will unveil a new addition to its ID electric vehicle family at an event ahead of the Los Angeles motor show. Appearing in concept form, the car is expected to be another variant of the Vizzion electric luxury saloon revealed last year and pictured above. One possibility is an estate version of the electric model, which Autocar has previously reported Volkswagen is considering for launch in 2022, and it's thought likely that this will be the new ID model, sitting on the same extended MEB platform as the Vizzion.

UNDER THE SKIN
JESSE CROSSE

STOP PRESS: THE CONFLICTING DEMANDS PUT ON BRAKE MAKERS

Brakes have to convert huge amounts of kinetic energy into heat to stop a car from speed.

IT'S PROBABLY AN overlooked fact that massive braking performance can be just as exhilarating as huge acceleration, involving steering and a deliciously slick manual gearbox. But it's an elusive asset. While all brakes work on the same basic principle of converting the kinetic energy in the moving car into heat, the brakes on a performance car and those on a family runaround are like chalk and cheese.

Except for some drum parking brakes and rear brakes on small cars, disc brakes have been the norm for years. The principle remains simple enough: when the brake pedal is pressed, a hydraulic caliper straddling the disc (or rotor) squeezes it under massive pressure between two pads made of friction material backed by a steel plate. The heavier the car and the higher the speed, the greater the amount of energy the brakes need to shed and the higher the temperatures generated.

For road cars, the brake designers have to factor in other things, too, such as the wear rate on brake pad friction material and disc, noise and whether any nasty stuff is being blown into the air as the pads get hot and wear down. Asbestos was once a key component of brake pads; these days, production cars are fitted with non-asbestos organic brake pads (NAO).

The story of stopping involves a vicious circle, though. If a brake gets too hot, it can't do its job properly – or at all. Brake fluid can boil inside the caliper, generating compressible gas, at which point the brake pedal becomes spongy and sinks to the floor and braking force drops away. As friction surfaces rub together and heat up, the coefficient of friction drops and so does the brake pads' ability to stop the disc from rotating.

To cool the friction surfaces, conventional discs are made of cast iron, and in between the two braking surfaces there are vanes, curving back from the direction of rotation to draw cool air from the centre to the outside and into the atmosphere. For higher performance, discs are drilled or the surfaces grooved, helping get rid of water on the disc quickly when braking starts and increasing initial bite.

Brakes become more complex the faster a car is. High-performance pad material is formulated to work at high temperatures but doesn't necessarily work so well when cold. So making a pad work well from cold but which keeps working when getting hammered is a tough call. Calipers get more complicated and expensive, too. The simplest (cheapest) design used for production cars is the floating caliper, a two-part thing with just one piston. Once performance reaches a certain level, though, calipers need opposing pistons. To increase the pad area, calipers may have four or even six pistons (or 'pots') and can be made from forged aluminium alloy rather than cast iron, to conduct heat better and reduce weight.

The upgrades escalate through the brake system the higher the performance gets. In more extreme cases, such as racing or track use, then racing brake fluid is needed, with a boiling point in excess of 300deg C. It's all technology you can't see, but if it's right, it's worth its weight in gold.

IMPROVING THE BREED

This AP Racing Pro 5000 R four-pot competition caliper has an almost skeletal lightweight forged alloy construction to absorb less heat, conduct it away quickly and reduce unsprung weight. With matching disc and appropriate choice of pads, it gives formidable stopping power.

VW 'envizzions' new EV estate

Electric ID Space Vizzion concept previews 335bhp, 486lb ft ID 5 crossover estate

Volkswagen has previewed its plans for a new electric-powered crossover-style estate with the unveiling of the ID Space Vizzion at the Los Angeles motor show.

The new car, with a claimed range of up to 367 miles on the WLTP test cycle, is the eighth ID-branded concept revealed by the German firm, which has already laid out plans to produce up to one million EVs per year by the end of 2022.

The ID Space Vizzion is set to go into production alongside the ID Vizzion saloon at Volkswagen's Emden plant in Germany in 2021. Both models are due to wear the ID 5 model name, according to senior Volkswagen officials, who suggest the production version will hold true to the concept in terms of appearance and technical specification.

The latest ID concept updates the more conceptual lines revealed on last year's ID Vizzion saloon with various styling elements that help to link it visually with the latest Passat estate, including the shape of its headlights.

But whereas the design of the Passat is restricted by the space dedicated to mounting a combustion engine within its front end, the ID Space Vizzion takes advantage of the inherent packaging advantages of its electric driveline by having a relatively short bonnet and a lengthy cabin.

Drawing on the versatility of Volkswagen's MEB electric car platform, the ID Space Vizzion is of a similar size to the A6 Avant of sibling firm Audi, with a 4958mm length, 1897mm width and 1529mm height.

With short overhangs front and rear, and 22in wheels, it also receives a lengthy, 2965mm wheelbase, providing scope for either a four- or five-seat layout and up to 586 litres of luggage space behind the second row of seats.

OFFICIAL PICTURES

ID Space Vizzion has a range of 367 miles from an 82kWh pack

Audi's E-tron Sportback ramps up the efficiency gains

AUDI HAS REVEALED its second bespoke EV, the E-tron Sportback, which already has a raft of technical improvements over its E-tron sibling launched last year.

The new coupé is the same weight, length and height as the E-tron and is identical from the B-pillar forward. The lower part of the rear door, back bumper and rear lights are also the same, while the obvious difference – the rear roofline – was cut from the A7.

That roofline makes the car slightly more aerodynamic than the E-tron, with a 0.25 Cd compared with the E-tron's 0.27, giving the Sportback an extra 6.2 miles of range.

Changes from the E-tron include decoupling the front and rear axles so the model can be rear-wheel drive, which adds another 6.2 miles of range. Brake pads have been optimised with stronger springs so there's no friction when not required, boosting the range by a further 1.9 miles. Audi has also replaced two water pumps for battery cooling with one larger one, saving weight and cost and adding 1.2 miles of range. The usability of power from the battery has increased by 88% to 91%, creating more than six miles of range.

In all, the most powerful E-tron Sportback 55 at launch has a 278-mile WLTP range. A lesser-powered E-tron Sportback 50 offers 216 miles but won't be sold in the UK.

Although the E-tron Sportback will always have the advantage of a coupé roofline, all of the other efficiency tweaks will be launched in an updated E-tron next year.

The range-topping E-tron Sportback 55 delivers 355bhp and 414lb ft from two electric motors and a 95kWh battery, achieving 0-62mph in 6.6sec. In Sport mode, it generates 402bhp and 490lb ft for eight seconds, dispatching the benchmark sprint in 5.7sec.

Audi claims, when braking, the SUV can recuperate up to 30% of its total range through regeneration.

Inside, the E-tron Sportback is almost identical to the E-tron. The only differences are 20mm less rear head room because of the coupé roofline and 45 litres less luggage space, at 615 litres.

The model features digital matrix LED headlights, a first

Four-wheel-drive range-topper has 355bhp and 414lb ft

OFFICIAL PICTURES

Inside, the new Volkswagen concept sports a clean and uncluttered interior devoid of physical switches and buttons. All controls are concentrated within touchscreen panels and displays, including those of the steering wheel, whose design has been inspired by that used by past Volkswagen models.

Its maker says the ID Space Vizzion can support both rear- and four-wheel drive. In rear-wheel-drive guise, it uses a rear-mounted electric motor developing 275bhp and 405lb ft of torque. In four-wheel-drive form, it also has a front-mounted electric motor that provides an additional 101bhp and 111lb ft. The combined system output for the four-wheel-drive version is put at 335bhp and 486lb ft.

Volkswagen quotes a 0-62mph time of 5.4sec and a governed top speed of 109mph for the four-wheel-drive variant, which is expected to form the basis of an even more powerful ID 5 GTX performance estate that's due in 2022.

Energy for the electric motors is provided by a 82kWh lithium ion battery mounted within the floor. It can be charged to 80% of its capacity within 30 minutes using a 150kW system.

GREG KABLE

MEB platform enables short overhangs that boost interior space

Concept's clean-lined interior banishes all old-school switchgear

for a mass-production vehicle. It uses hardware found in video projectors, which is broken down into 1.2 million micro-mirrors. Each can be tilted up to 5000 times per second with the help of electrostatic fields. The lights adjust dynamically when the driver changes lane and it can draw attention to any pedestrians that it spots.

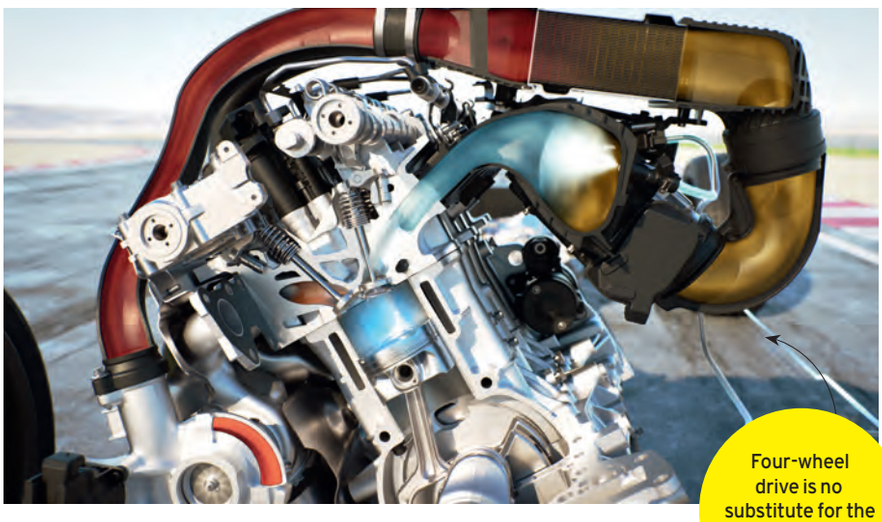
The technology allows for projections when the car is stationary. By mid-2020, it will offer five different animations to greet you, which are projected on either a wall or the floor. Audi light expert Stephan Berlitz said: "We are starting a new era for lighting. In future, [this technology] could allow for car-to-car communications."

UK pricing for the E-tron Sportback 55 is not yet confirmed but it costs €83,150 (£71,291) in Germany. First deliveries begin in spring 2020.

Roofline is the main visual change from the related E-tron

UNDER THE SKIN
JESSE CROSSE

A WINTER'S TALE: WHY SEASONAL TYRES WILL HELP YOU GET A GRIP



Four-wheel drive is no substitute for the science behind winter tyres.

IT'S FAIR TO SAY that the idea of switching to winter tyres hasn't caught on in the UK to the extent that tyre manufacturers had hoped. But increasing the grip at the tyre contact patch is the best way to maintain the best possible traction and steering on slippery or what engineers call a 'low-mu' surface. (The Greek letter μ, pronounced mu, represents the coefficient of friction.)

It might seem that four-wheel drive is a better idea, but it isn't necessarily. A 4x4 will make the most of the traction available from the four contact patches. It may also help prevent the balance of the car being upset by a clumsy driver stabbing at the throttle.

But if there's no grip available, the tyres still can't gain forward traction, stop the car sliding anywhere it wants, or stop it quickly enough under braking, if at all. Four-wheel drive alone can't prevent any of those things happening and the only thing that can is the grip of the tyres on the road.

In snow, there's something else to consider: the width of the rubber. Watch any rally video of cars competing in snow and they all have one thing in common: skinny tyres. In snow, whatever the type of tyre, it will get more grip if it can bite down into the surface. Wide tyres, while good for cornering grip in the dry, are likely to fare worse in the snow.

You can probably see where this is heading. A small, front-wheel-drive hatchback with 185-section winter tyres will be more effective in snow than a big 4x4 SUV on fat summer tyres. The winter tyres grip better in snow because they're designed to, the weight of the engine is directly over the driven wheels even if there are only two, and the tyres are skinny.

It's not just about snow. Winter tyres have a softer compound that keeps the tread soft and supple in low temperatures, giving more grip on cold, damp or wet Tarmac at anything below 7deg C. That's due to the chemistry of the compound and the fact that it contains more natural rubber than a summer tyre. Some high-end performance tyres don't contain any natural rubber at all and can deteriorate and crack over time in extreme low temperatures.

The solid centre band on a high-performance summer tyre designed to give sharp steering response is missing on a winter tyre and there are normally fewer grooves around the circumference than on a summer tyre – depending on the make. However, there are a lot more of those tiny slits in the tread, called sipes. They create more sharp edges to grip the surface as the blocks they define deform in use. In snowy conditions, they also trap the snow, which grips better than wet rubber.

The downside of a winter tyre is that wider fitments especially are likely to be noisier than a summer equivalent, the rolling resistance is higher and the steering response and handling of a performance car in the dry won't be as good. On a family car with modest performance, though, there's no reason not to leave them on all year round, dodging the cost and hassle of two sets of tyres and giving much more safety and convenience in the worst winter weather.

THE PRESSURE TO PERFORM

Why does fuel consumption rise if tyres are not inflated properly? Hysteresis. As the tyre rotates and meets the road surface, it deforms, consuming energy. As it turns away from the surface, elasticity returns it to its original shape, but not all of the energy is recovered and the rest is lost as heat.

VW's Wolfsburg facilities are reducing their carbon footprint

The planet in car firms' hands

After a history of chasing CO_2-based profits, can car makers really save the planet?

Climate change has become an overarching global issue and the need to reduce CO_2 emissions to halt global warming is now (largely) accepted as scientific fact. And there's no escaping that the car industry is a major contributor to CO_2 emissions. For example, the Volkswagen Group estimates that, through its operations and the cars it has made, it is responsible for around 1% of the world's total carbon emissions.

It might sound audacious, even somewhat hypocritical, to hear industry bosses say they want to take the lead in cutting CO_2 emissions. But that's exactly what Volvo boss Håkan Samuelsson did at the recent launch of the XC40 Recharge, the firm's first electric car.

"Despite decades of political climate summits and very bold emission targets, CO_2 levels are still increasing," said Samuelsson. "Something else is needed to turn this tide – and we believe the answer must be action from the business community."

Similarly, Hyundai's R&D chief, Albert Biermann, said recently: "The car industry needs to play a big role to find solutions to the issue of global warming. We want to be a big player on this planet, so we take it as our responsibility to come up with sustainable solutions."

Undoubtedly, the current move to mass electrification by the car industry has been sparked primarily by increasingly tough emissions targets from the EU and other regulators. Those targets are largely a product of the 2016 Paris Agreement – signed by 195 nations – which aims to limit global warming to 1.5deg C above pre-industrial levels.

The EU has mandated tough average fleet emissions targets for car manufacturers, starting with a 95g/km limit in 2021. For car manufacturers to meet those goals, they are essentially forced to produce – and sell – electrified cars.

But the CO_2 produced by a car's powertrain is only part of the story. Volvo says that such emissions account for only 59% of a car's total lifetime CO_2 footprint. Another 36% come from CO_2 produced in the manufacturing supply chain, with the remaining 5% due to operations such as distribution and servicing.

So, many car firms are aiming to go further, planning to cut CO_2 emissions across the entire production chain. For example, Volvo wants to become a climate-neutral company by 2040. It has set a series of goals to achieve this, including a 40% reduction in each car's life-cycle CO_2 footprint by 2025, at which time it is aiming for its global manufacturing network to be climate neutral.

For example, Volvo has said it will use blockchain data-sharing technology to trace the source of the cobalt that suppliers CATL and LG Chem use in its lithium ion batteries to ensure the raw materials are sourced responsibly. It will also show buyers an average lifetime carbon footprint for each future model.

Like Volvo, Volkswagen has set itself a CO_2-neutral target, but by 2050, and it has proudly advertised the ID 3 as its first carbon-neutral car, with the Zwickau factory, where it is produced, running entirely on renewable energy. Numerous other car firms have made changes so their plants run purely on renewable energy and are cutting emissions in other ways.

It's not hard to see the contradiction of companies built on producing carbon-emitting cars now pushing to be seen as leaders in the move to reduce those emissions – especially in the case of Volkswagen, given its actions unearthed in the Dieselgate scandal.

Volkswagen's argument is 'who else can?', a view rooted in that stat about it accounting for 1% of the world's carbon emissions. Ralf Brandstätter, the firm's chief operating officer, said recently: "Our big size means big responsibility." And he insists that the push towards emissions-free mobility will become the "guidepost" of Volkswagen's future action, adding: "It will be our compass in future. It's our mindset."

Samuelsson said Volvo is also making the reduction of emissions part of its core, comparing it with another driving force of the firm: "We made safety a part of our company and we should do the same with sustainability."

Samuelsson added that the increasing public drive towards sustainability meant the car industry could suffer if it doesn't respond.

He said: "Economic growth, new technology and competition is not necessarily bad. It should not be seen as part of the problem but as part of the solution for a really sustainable future.

"We believe the ability for people to move should not be seen as a negative. It should be seen as a positive. We should be careful about restricting freedom to move – but we should make it sustainable."

That's also key: although it will cost the car industry billions to achieve CO_2-neutral production and motoring, the cost of not doing so could ultimately be vastly more.

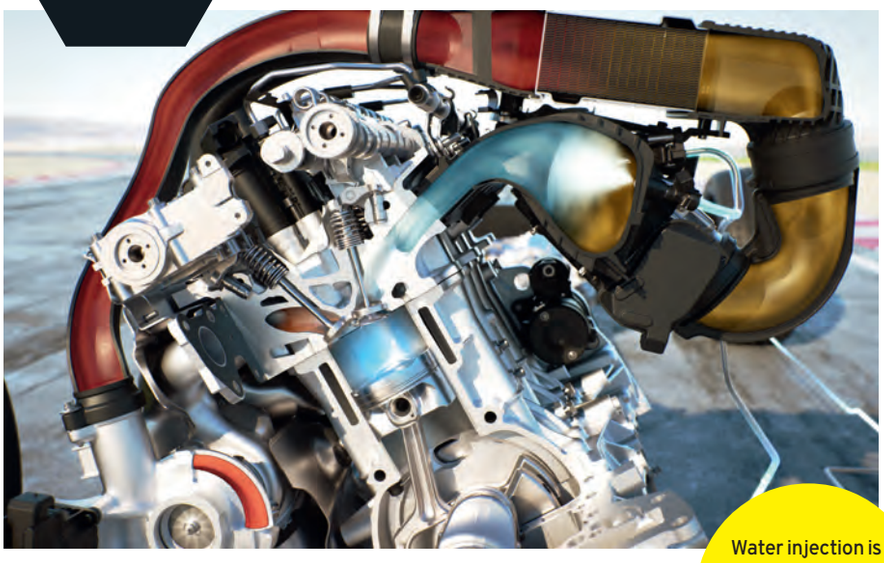
According to Biermann, that desire to appeal to eco-conscious customers could begin to drive electrification faster than the legislation that has kicked it off: "Eco-friendliness has become a big area of competition with battery-electric cars and plug-in hybrids. In areas such as Europe, this will be a very enjoyable fight – and it will be good for the customers who will go for an electrified car."

JAMES ATTWOOD

Volvo boss: sustainability is vital

UNDER THE SKIN
JESSE CROSSE

HOW WATER INJECTION IS SET TO MAKE A SPLASH IN PETROL ENGINES



Water injection is one way of reducing fuel consumption and increasing power in petrol engines.

ONE OF THE many technologies that's still on the back burner but could contribute to lower fuel consumption and emissions while squeezing a tad more power from petrol engines is water injection. It stirred up a lot of interest back in 2016 when BMW introduced it on the fabulously excessive M4 GTS, but its use in recent years has been confined mainly to more extreme motorsports such as drag racing.

Injecting water into the engine does a number of things. One is that it cools the combustion chamber as well as the incoming air, whereas an intercooler only does the latter. Reducing the temperature inside the combustion chamber reduces the threshold at which detonation (knock) occurs, so it's possible to run higher boost and more advanced ignition timing before knock threatens. That in turn means more power and increased combustion efficiency.

Another benefit is that cooling things down reduces the generation of the dreaded oxides of nitrogen (NOx), and this is what may drive the technology down the food chain and into more modest cars than the M4 GTS. NOx is created when the nitrogen in the air ingested into the engine is oxidised by the oxygen present in the high combustion temperatures. The same thing happens in both petrol and diesel engines, except the diesel produces more heat inside the combustion chamber because it runs lean (meaning more air) and at a higher compression ratio. Water injection doesn't work so well for diesels, though, because it generates more soot.

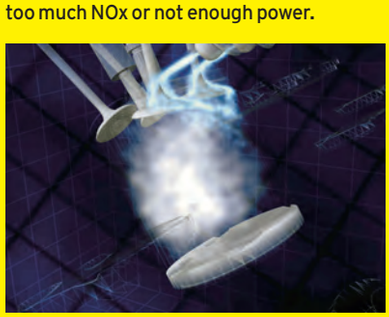
The M4 GTS system was developed by Bosch but is available to other manufacturers, and despite its use on the six-cylinder S55 M4 engine, Bosch says it's ideal for three and four-cylinder engine applications. As things stand, virtually all turbocharged petrol cars exploit the cooling effect of injected petrol to help lower combustion chamber temperatures. As the fuel evaporates, the temperature drops (it's called evaporative cooling).

Water is more effective as it has a 'high heat of vapourisation', which means vapourising it consumes a lot of heat. As a result, injecting small amounts of water into the engine moments before injecting the fuel does a good job of cooling the incoming air – better than an intercooler alone can do. And the amount of water is small: Bosch says a few hundred millilitres will last over 60 miles. It does mean that the distilled water must be stored in a tank and replenished periodically, though.

Bosch's original figures show a 4% fuel consumption saving under WLTC test protocols and 13% in real driving conditions. To keep it simple, the water is injected into the intake manifold's plenum chamber rather than directly into the combustion chamber, making it easier to adapt for a wide range of engines. When Bosch offered its system to the wider market in 2016, it didn't exactly have customers beating a path to the door, but as the screws tighten further on CO_2 and toxic emissions, water injection may have a wider role to play.

WHY NOT USE HYDROGEN?

Running existing piston engines on hydrogen instead of petrol has been tried by many manufacturers but none has adopted the idea. Running the ideal (stoichiometric) air/fuel ratio creates a lot of NOx; double the amount of air and the NOx falls to nearly zero, but power is significantly reduced, too. So it's a case of too much NOx or not enough power.



The end of the city car?

Ever-stricter CO_2 regulations look set to kill off the affordable city car as we know it. Andrew English investigates how the small car's existence has come under threat

Business case for city cars is getting ever harder to make

> “The lighter the car, the more demanding the CO_2 regulation”

Your first and last car might not be the most catchy of advertising slogans, but it's undoubtedly true of the species known as 'sub-B', 'A-segment', or 'city cars' as they are dubbed by the EU. Under four metres in length (often nearer 3.5m), these are tiny but up-to-the-minute cars that are economical and cheap to run, with the most modern safety and emissions equipment.

They're bought mostly by people at each end of the age spectrum: young and old, none of them particularly wealthy. An A-segment car represents a sizeable part of their disposable income, but it means freedom to work, to socialise with family and friends, and is individual mobility in a way most wealthier folk take for granted.

They're popular, too, with A-segment sales representing a steady 8% of the annual European new car market of about 15 million. In Italy, such cars account for about 15% of the market.

But they're also in danger of extinction and the EU is being blamed for this, accused of gross anomalies in emissions and safety standards for new cars, as well as undemocratic and unrealistic voting by the European Parliament.

Leaders in the A-segment include: Fiat's Panda and 500; Volkswagen's Up and its badge-engineered spin-offs, the Skoda Citigo and Seat Mii; Ford's Fiesta-based Ka+; Toyota's Aygo and its spin-offs, the Peugeot 108 and Citroën C1; Renault's Twingo; and Vauxhall's Adam. With the exception of Toyota, not one of these car makers has expressed a firm commitment to replace their A-segment cars. Vauxhall withdrew its Adam from sale this year and most of these small cars have a bleak future.

“An A [A-segment car] is often the first car young people buy,” said Olivier Murguet, Renault's sales and marketing head, “and they are still profitable from a global perspective. We sell 200,000 in Latin America and India, but we have to be very careful where we launch. Emerging markets are still profitable.”

But not Europe, it appears.

At the heart of this issue is the EU's new CO_2 emissions requirements, which are not only the world's toughest but also fall unevenly heavily on A-segment cars.

PSA boss Carlos Tavares was curt about the issue at the Geneva motor show in March: “The economics of small cars [is] simple,” he said. “You need to look at the way the CO_2 legislation structure is written: the lighter the car, the more demanding the CO_2 regulation. So small cars are very demanding on CO_2 and the only way is to get rid of the ICE [internal combustion engine] in them.”

At the same show, Jürgen Stackmann, VW's sales and marketing boss, told Autocar: “If Europe is pursuing this legal target, there is no single business case for cars the size of the Up. They are too small for the new technology and the engine can't meet the CO_2 targets. You'd need to sell an EV [like an ID] just to be able to sell a city car.”

The death blow to these small cars comes in the form of two stages of mandated CO_2 requirements coming down the pipeline. From next year, the EU will require average CO_2 emissions of 95g/km from car makers with a few exceptions for 12 months, whereupon the average emissions of all newly registered cars will have to be below 95g/km. Fines for not meeting these standards are exorbitant: €95 (roughly £82) for each 1g/km over the limit for each car produced. European research specialist Jato Dynamics estimates that, based on 2018 CO_2 emissions, industry fines could be as much as €34 billion (£29bn) in 2021, with VW, PSA, Renault, Fiat and Daimler predicted to be the worst affected.

Tavares said PSA will not incur fines “but there will be consequences and the EU might not like them”.

The second part of the CO_2 sledgehammer was voted in by the European Parliament last year and ratified in April. This mandates that, by 2030, there will be a 37.5% cut in corporate average CO_2 emissions from 2021's 95g/km limit, which effectively means an average CO_2 figure of about 60g/km.

The level of these cuts surprised observers because they were much larger than those recommended by the European Automobile Manufacturers' Association (ACEA), and even those advised by the parliament's own technocrats and law framers, the European Commission. The targets will also be almost impossible to meet without radical and widespread adoption of battery-electric vehicles.

Small cars, small profits

The economics of making small cars was summed up in the 1970s by Henry Ford II when he saw his engineers' plans for the Ford Fiesta. “Small car, small profits,” he is reported to have grumbled.

Nothing much has changed since then, as Seat boss Luca de Meo confirmed at Frankfurt. He said that even a large B-sector [supermini] car with a viable price is a tough call to develop and that electric versions of these cars are unlikely to make any money for their makers until battery packs have a cost parity with internal combustion engines, which is some way off.

“Zero CO_2 is a target worth fighting for,” he said, “but it's a huge stress for our company, and as for the €30,000 [£26,000] B-class cars at this show – pah!”

Battery-electric cars are the current darlings of a mass-media love affair with electric traction. Yet Tavares spelled out the problems. “On cars with such small price tags,” he said, “the battery can be up to 70% of the cost of the car. So you are going to see a segment of cars [A-sector] disappear, because if you →

Ford Ka+ is among the bigger and pricier city cars

> "If you only look at tailpipe emissions, you are never going to see the true environmental cost"

put a price on them to make them sustainable, that's a price that young people can't afford."

But how real are the fuel and CO_2 savings going to be as a result of getting rid of A-segment cars? Small cars have much lower annual mileages than bigger models – typically around 8000 miles for a B-sector supermini and even less for an A-segment car – so they simply don't get used as much or use as much fuel as larger cars, which makes them inherently cleaner. And although the nominal CO_2 contribution of an A-sector car might seem relatively high on paper, it's hard to believe that a 2.5-tonne plug-in hybrid SUV with its WLTP test emissions of less than 50g/km is half as polluting as a 900kg city car producing CO_2 emissions of around 100g/km. Moreover, do we know whether the owners of these monster plug-in SUVs are actually plugging them in?

It doesn't seem fair, either, that the cost of the crash-impact safety, which has to be built into an A-sector car to enable its passengers to survive an impact with a large, heavy SUV, is carried by the A-segment car's buyer alone. In 2001, Bernd Pischetsrieder, then head of VW, wistfully pointed out that if you took the safety and environmental equipment out of a standard VW small family car and laid it out on a workshop floor, you'd be looking at the cost of a complete VW small family car in Brazil. Since then, his example will have become more extreme.

What's more, no one has yet explained how 1.2 million new A-sector car buyers a year being forced into purchasing bigger and more thirsty cars, or used cars without the most modern safety and emissions equipment, will benefit European CO_2 emissions, air pollution or road safety.

The EU's new emissions legislation has put the economics of car making into a tumble dryer where profit is as much dependent on not paying fines as it is making profitable cars as efficiently as possible.

All the while, it seems car makers are free to carry any amount of penalty-free energy in a lithium ion battery car. Porsche's new Taycan, for example, like all battery-electric cars, has zero tailpipe emissions, but it isn't an environmental-free lunch and, using the latest UK energy consumption CO_2 figures, the Turbo model's best-case 'well-to-wheel' greenhouse-gas emissions are 92g/km*. You might wonder also how it is that the buyer of such expensive battery-electric cars are subsidised by the government to the tune of £3500 against the purchase price, with additional generous tax benefits in running the car.

True environmental cost

It's inconvenient truths like this that, Tavares thinks, are examples of the "superficiality of thinking" around the issue of CO_2 reduction at the level of European governments and the EU.

"The reality is," he said, "if you only look at tailpipe emissions and not the vehicle's life cycle, then you are never going to see the true cost to the environment. And there is no European agency at the moment which coordinates and counts these things."

What's more, Tavares has accused ministers of the European Parliament of environmental grandstanding.

"There have been extreme positions coming from countries which don't have an automobile industry," he said last year after the parliament's vote. "Where was the mandate?"

HOW TODAY'S CITY CARS COMPARE

	PRICE (FROM)	LAUNCHED	LENGTH	WEIGHT	CO_2 (FROM)	REPLACEMENT PLANNED
Citroën C1	£10,470	2014	3466mm	840kg	85g/km	No
Fiat Panda	£10,080	2011	3653mm	940kg	114g/km	tbc
Ford Ka+	£11,300	2016	3941mm	1063kg	117g/km	No
Peugeot 108	£9695	2014	3475mm	840kg	93g/km	No
Renault Twingo	£9995	2014	3595mm	864kg	112g/km	tbc
Seat Mii	£10,560	2011	3557mm	929kg	92g/km	No
Skoda Citigo	£8890	2011	3597mm	859kg	96g/km	No
Toyota Aygo	£9825	2014	3455mm	840kg	93g/km	Yes
Volkswagen Up	£9325	2011	3600mm	929kg	101g/km	No

ICE versions only

There were, however, equally split positions within member countries. Even in car-producing Germany, there was a desire for greater leniency on CO_2 from the transport and economy ministries, while the environment and finance took tougher stances.

There are, of course, other consequences of Europe's extreme position on road transport CO_2 emissions (which aren't matched by its requirements of the aviation, energy generation, building and manufacturing industries). These include the effects on Europe's 13 million car manufacturing jobs, as well as university funding, engineering training and research and development spending.

A recent ACEA report warned that effectively mandating battery-electric cars will lead to a 38% fall in parts sourced from European-based suppliers, with a knock-on effect on profitability, employment and high-skills training. There are also concerns about the advisability of passing production of a major part of the car's value to China and the Far East because there simply isn't the time to set up European battery-cell champions within the compulsory timetable.

But A-sector cars will be the first casualties...

"The adoption of the legislation setting new CO_2 emission standards for cars and vans is an important achievement," said Miguel Arias Cañete, commissioner for climate action and energy, in April. "We are putting the transport sector on the right pathway towards clean mobility, helping EU industry to modernise and strengthen its competitive position on the global stage."

On its own website, the EU states it "works for social equality... and tries to protect the weakest. It seeks to prevent social exclusion and discrimination."

Brushing aside Cañete's corporate boilerplate, I contacted a number of UK MEPs to see if they wanted to comment on the vote, the standards it has rushed in and their effect on the small A-segment cars and the individual transport choices available to their most vulnerable constituents in the most far-flung parts.

To date, I have not received a single reply.

"Ah yes," said Peugeot boss Jean-Philippe Imparato when I told him about this lack of response. "You vote on Sunday and you pay on Monday..." A

COULD KEI CARS BE THE ANSWER?

Celebrating their 70th anniversary this year, Japanese kei (light) cars were originally created in 1949 with the establishment of a set of maximum body-size and engine-capacity limits for a class of vehicle that would provide economical transport for individuals and businesses, get the country moving after World War II and encourage the establishment of a domestic car industry.

With their distinctive yellow numberplates, kei cars and commercial vehicles attract significant tax advantages. They are also exempt from the requirement to prove that you have a parking space before you can own a car, a precondition that still operates in many towns and cities outside Tokyo.

These Japanese 'people's cars' have proved incredibly popular: witness the fact that kei cars represented almost 36% of the 62 million cars on Japanese roads in 2017 and 33% of the almost 4.4 million new-car registrations.

Initially restricted to a maximum length of 2.8m, with no more than 150cc four-stroke or 100cc two-stroke engines, the requirements for kei cars have been revamped several times over the years. They now stipulate a maximum length of 3.4m and width of 1.48m, with engines displacing no more than 660cc and producing no more than 63bhp.

But could they provide an economical alternative to A-segment cars, which are so hard to produce at a profit? After all, they are small enough, their R&D costs have been amortised in Japan so they could be marginally priced, and they're already proving a big success in countries such as India.

At the recent Tokyo motor show, the signs were mixed.

"Kei cars would be ideal," said Hiroshi Nagaoka, R&D boss at Mitsubishi, which shares design and production of kei cars with its alliance partner Nissan. "Suzuki runs a big kei car business in India and it has achieved a big market share. But compared to Japan, Indian regulations are more relaxed. On the other hand, Europe is the toughest... To meet European standards on emissions and safety would be difficult."

His colleague Guillaume Cartier, Mitsubishi's sales and marketing director, also pointed out that kei cars aren't very profitable.

It was a similar tale at Suzuki and Nissan, where engineers said the market is very tight and only just profitable (hence the number of co-operation deals), and they gave a thumbs down to getting kei cars past Europe's tough safety and emissions requirements. Apparently, it's side-impact protection that is the big problem and it's almost insurmountable without radical and costly surgery.

It would take a lot of innovative thinking by European legislators to find a way to allow these little cars into Europe – speed restrictors, perhaps, or restricted access to motorways? The trouble is, if you allow derogations for one, then they should be for all A-segment cars, and like the 2.0-litre company car tax era in the 1980s, the unintended consequences could create a monster of unsafe tiny vehicles on our roads.

So for the moment, it doesn't look very likely that kei cars will save the day.


About one-third of Japan's cars are kei cars


Kei cars must be no more than 3.4m in length


Vauxhall withdrew the Adam from sale earlier this year


Peugeot has made no announcement about replacing 108


Will city cars like these become the last of their breed?

* UK energy gen CO_2 contribution of 276.6g/kWh (source: Department for Business, Energy & Industrial Strategy, 2019 government greenhouse gas conversion factors for company reporting) multiplied by Porsche batt energy capacity of 93.4kWh divided by Taycan Turbo best case WLTP range 280km equals 92.2g/km

LF-30's in-wheel motors produce 536bhp and 516lb ft

TOKYO MOTOR SHOW

Lexus sets out electric vision

Bold-looking concept is an imagined 2030 EV that's underpinned by a 2022 platform

The dramatic Lexus LF-30 Electrified concept car was unveiled at the Tokyo motor show as an overtly design-led insight into how its electric car future will look in 2030, as well as showcasing some of the autonomous and technical functions being developed by the firm.

Among the more expressive design flourishes are the roof-mounted doors and dramatically short front and rear overhangs. It is, however, based on a new electric platform that will underpin Lexus and Toyota EVs from around 2022, which underlines its more immediate relevance.

As such, elements of the LF-30 do have clear production potential. Its dimensions are close to those of the Jaguar I-Pace, albeit marginally exaggerated, and it is fitted with a solid-state 110kWh battery that can charge at 150kW and offer a range of around 310 miles – all in the ballpark of the figures for EVs already on sale made by rivals using current lithium ion technology. However, the LF-30 is charged wirelessly, thus using no cables.

The car has in-wheel electric motors, exploring the superior handling characteristics that fully controlled, instant torque would give. "This is beyond the possibilities for cars as we have them today," said Takashi Watanabe, chief engineer for Lexus electrified projects. The system, called Advanced Posture Control, is currently in development.

Although conceptual, the LF-30 is said to offer 536bhp and 516lb ft of torque. Although its top speed is limited to 124mph, its 0-62mph time is a relatively pacey 3.8sec. Watanabe hinted that Lexus was as focused on delivering battery durability and faster charging as it was extracting more power or range.

Inside, the LF-30 is also highly futuristic, with a steering wheel that retracts when the car is in an autonomous mode and extends when the driver wishes to take control. There's little switchgear on display beyond buttons on the steering wheel, which link to a heads-up display, so as not to distract the driver. Functions are controlled by gestures instead. Meanwhile, glass-roof-mounted screens are available for rear passengers to stay online and interact with the car using augmented reality.

The driving position was also highlighted by Watanabe for its driver-centric design, described using the Japanese word 'tazuna', which equates to 'reins', as used to control a horse. "A horse and rider have a connection, a mutual appreciation," he said. "We are aiming for the same with the steering controls."

> "Although its top speed is limited to 124mph, its 0-62mph time is 3.8sec"

A steer-by-wire system removes any mechanical connection between the steering and the wheels, too, allowing "more flexible control and a more precise steering feel", according to Watanabe. Infiniti has previously tried such a system in production to highly critical reviews.

Lexus is due to unveil its first electric car this year, although it will be based on an existing model, believed to be the UX, its smallest SUV. In China, parent firm Toyota already sells an electric CH-R, which shares its platform with the UX.

JIM HOLDER

MY SHOW STAR

Alpina B3

MARK TISSHAW

If you think the world of fast saloons is a bit glum right now with the recent Mercedes-AMG news (see 16 October issue), the Alpina B3 couldn't be better timed. Its spec oozes desirability and you know the performance will come with no lack in everyday usability.

Mazda MX-30

LAWRENCE ALLAN

Mazda's first electric car isn't its most visually arresting model, but its specs are intriguing. A relatively small battery and modest power output should, in theory, make it a lot lighter than rivals. Could this be the most fun-to-drive electric-powered SUV yet?

LEXUS: SMALLER CARS ADD UP NOW

Lexus could expand its line-up and make smaller cars as a result of the shake-up of buying norms sparked by the SUV boom, according to its executive vice-president, Koji Sato.

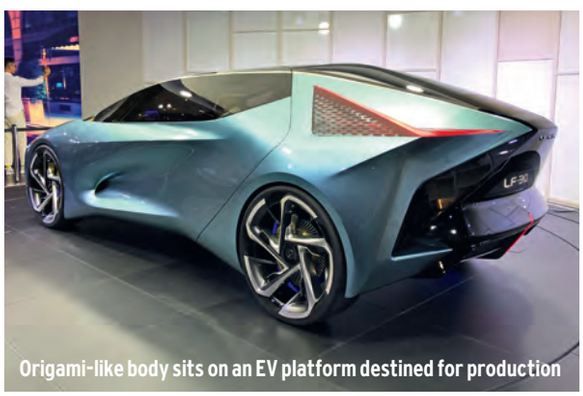
Speaking at the Tokyo motor show, Sato admitted that there was growing evidence that smaller cars could be sold for higher prices if they were well executed, as a result in shifts in how customers perceive value. In particular, SUVs are more profitable than same-sized hatchbacks because they are perceived to be bigger as a result of their raised ride height.

"Smaller doesn't always mean cheaper now, so trends are changing," said Sato. "I can't say clearly that it is something we will do, but we are looking at all vehicle opportunities."

Such an SUV would be positioned below the UX in the Lexus line-up, with a likely starting price well below £30,000. However, Sato hinted that part of the appeal of creating smaller cars was that buyers are increasingly willing to raise the transaction price by buying options. "What customers want is individuality," he said.

Sato also vowed to keep making distinctive cars, including convertibles and F-badged performance cars propelled by powerful, unelectrified engines. "We must cater for people who enjoy their driving," he said.

UX may get a smaller sibling



Origami-like body sits on an EV platform destined for production

Wheel retracts in autonomous mode. Gestures control functions

Toyota reassures 'petrolheads'

TOYOTA REVEALED THE e-Racer concept at Tokyo. The two-seater is designed to re-emphasise the firm's belief that a future of electric and autonomous cars will still have room for driving enthusiasts. No technical details of the car were released, but it is believed to be a concept in the truest sense rather than a pointer to a production model. Show visitors are able to simulate driving it around a famous race circuit of their choosing.

Two-seat e-Racer aims to show driving fun has a future

Solid-state batteries move closer

Toyota e-Palette could be used at 2020 Olympics

TOYOTA WILL UNVEIL a vehicle powered by solid-state batteries at the 2020 Olympics, the firm's chief technology officer, Shigeki Terashi, has revealed.

The tech – which promises longer range from smaller and potentially cheaper battery packs that recharge faster – will not reach mass production until the middle of the next decade, Terashi added. That timeline still puts Toyota at the forefront of solid-state battery tech.

The car is expected to be a one-off prototype that will form some part of the opening or closing Olympic ceremony.

Suzuki Waku

RACHEL BURGESS

Not only is the Waku the retro-styled hit of the show, but it also morphs from an estate to a coupé, depending on your preference. If that doesn't blow your mind, I'm not sure what will, even if it's not exactly going to solve the world's motoring issues.

Lexus LF-30

JIM HOLDER

The LF-30's designers were given three goals: to be brave, artistic and futuristic; and while they understand that this 2030 vision will test tastes beyond the limit for some, it's hard to argue that the car has done anything other than hit all of its targets.

TOKYO MOTOR SHOW

Gas-turbine engine-generator powers two motors on each axle

The quirky quad-motor Mitsubishi

Radical Mi-Tech plug-in hybrid concept uses a gas turbine but no combustion engine

Mitsubishi's Mi-Tech compact SUV concept for the Tokyo motor show previews a new type of plug-in hybrid drivetrain that has no combustion engine and hints at the design of the next ASX, due in 2021.

The roofless concept's downsized plug-in hybrid range-extender system replaces the petrol unit used in Mitsubishi's existing PHEV drivetrain with a gas-turbine engine-generator.

Mitsubishi claims the generator is around half the size of a conventional combustion engine but just as powerful and is able to run on a variety of fuels such as alcohol, kerosene and diesel, allowing it to be adapted to suit different regional requirements.

The generator powers four electric motors, two on each axle, in what Mitsubishi calls its Quad Motor 4WD System. The system is a development of that seen on the e-Evolution concept from 2017, which used three motors, and demonstrates Mitsubishi's desire to continue to offer high-performance drivetrains after killing off the Evo as a separate model.

Such a radical switch towards gas-turbine technology does not yet have serious production intent, however. Engineering boss Hiroshi Nagaoka said that the technology had only been in development at Mitsubishi for a short time, and it was a long way from proving itself in areas including heat management and control, and suitable materials for durability.

That said, it is now the

SORRY, EVO FANS, BUT MITSUBISHI NOW HAS OTHER PRIORITIES

Tokyo's Mi-Tech concept comes two years after the e-Evolution at the same show. Back then, the use of that famous name and the concept's high-performance three-motor drivetrain raised hopes that a return for the Evo as a stand-alone electric crossover was very much on Mitsubishi's agenda.

It may have been then, but it isn't any more. Even if the Mi-Tech concept has an even higher-performance four-motor electric drivetrain, the Evo name is now nowhere to be seen and any executive you speak to confirms that the car no longer has a pulse.

Back in 2017 when the e-Evolution was launched, Mitsubishi was in the honeymoon period at the Renault-Nissan Alliance (now Renault-Nissan-Mitsubishi) and the concept showed just what could be possible.

Now the role of Mitsubishi has been more clearly defined, with a laser focus on four-wheel-drive electrified SUVs (a new Outlander, new ASX and plug-in hybrid Eclipse Cross all in development), there isn't the capacity for anything else.

"What any OEM struggles with is investment capacity," said sales and marketing boss Guillaume Cartier. "Twenty years ago, you could bring big new cars and technology. Now you have to bring the same cars that you just have to make compliant. R&D budgets are spent in just complying.

"The cost to launch a new car is bigger now than it used to be, as the cost of compliance is bigger than in the past."

E-Evolution briefly raised hopes of an Evo return

MUSTANG-INSPIRED EV LAUNCH IS SET

Ford will launch its 'game-changing' Mustang-inspired electric SUV on 18 November, before it is displayed at the Los Angeles motor show. The car, which is set to begin the firm's EV push, is said to have a range of more than 370 miles.

SEAT OFFERS BONUSES WITH FIRST EV

The Mii Electric, Seat's first zero-emission car, has gone on sale with prices starting from £19,300 (after the UK government grant) and an official range of 162 miles. The first 300 buyers get a package of bonuses including a home charger.

Mi-Tech's bold styling could inform next ASX


Augmented reality and grab handles feature inside

subject of an "advanced development" programme, and Mitsubishi will hope to overcome the reliability and durability issues that have prevented gas turbines catching on in road cars.

It is understood that an electric version of the next generation of the ASX is being lined up due to the challenges of downsizing a plug-in hybrid system effectively.

The pure concept car positioning and looks of the Mi-Tech means it is not intended as a direct preview of a new model, but it does still provide some clues about the next ASX and points to a desire to make that car stand out more.

The four-motor set-up is said to improve on-road handling and off-road control through integration with a revised version of Mitsubishi's Super All Wheel Control (S-AWC) system.

One such feature is an ability to maintain drive even with two wheels off the ground, while another allows for 180deg spins by counter-rotating the left- and right-hand-side tyres.

MARK TISSHAW

Nissan Ariya previews imminent 'Leaf SUV'

NISSAN REVEALED AN electric crossover concept at the Tokyo motor show that previews a new production model due within the next two years.

The Ariya Concept is 4.6m long and 1.92m wide – similar to the Nissan X-Trail – yet the roofline is a good 100mm lower than that car. The firm claims it is signalling "a dawn of a new era for Nissan as it embarks to redefine its brand philosophy for the next evolutionary phase of the automobile".

Autocar understands that a production version is due to follow imminently, possibly before the end of next year – the long-mooted 'Leaf SUV', in effect. The fact that the concept has been shown with conventional door handles and wing mirrors suggests serious production intent.

"When Nissan gives a car a real name, rather than a codename, it is always because the car is approaching production," revealed head of design Alfonso Albaisa.

The concept car is built on an all-new electric-only vehicle architecture that will be rolled out across the Renault-Nissan-Mitsubishi Alliance for future models. The architecture is modular, and allows for vehicles of multiple shapes and sizes, with a varying number of motors and battery packs.

The Ariya takes clear inspiration from Nissan's previous electric crossover concepts, such as the IMx and IMs. Thin LED lights blend into the grille, itself a unique adaptation of the firm's 'V-motion' design, with an illuminated logo and geometric pattern.

There is a minimalist dashboard layout inside, with buttons only used for the climate control and keyless start, alongside a rotary dial for the 12.3in display. Thin-frame seats boost visibility and space, while the rear chairs are positioned to ensure all passengers have a clear view.

Nissan is also showcasing its latest semi-autonomous systems with the Ariya. The crossover's ProPilot 2.0 tech allows hands-off single-lane driving capabilities and hands-off cruising in a given lane.


Production version could arrive next year

Further technology includes the ability to sync with the driver's schedule to pre-heat or cool the car prior to journeys, a Virtual Personal Assistant, a video chat function and over-the-air updates. Nissan Energy, a function that would allow the car to power homes or even sell battery energy back to the grid, is supported.

Nissan hasn't detailed the car's electric powertrain beyond calling it a "high-performance, 100% electric drive system". It uses dual motors, one mounted across each axle, to deliver all-wheel drive and power "equal to or better than many premium sports cars".


Concept is built on new EV platform

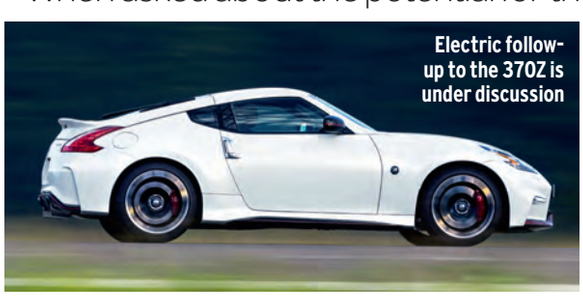
NISSAN 'WORKING ON' SUCCESSORS TO THE 370Z AND GT-R

Nissan is plotting successors to both its 370Z and GT-R sports cars and is open to electrification and outside collaborations in their creation.

Speaking at the Tokyo show, Nissan product planning boss Ivan Espinosa said the two sports cars are "at the heart of Nissan and we are actively looking at and working on them". Espinosa also said we "can expect something soon" on both models, which have been on sale in their current forms for a decade or more.

When asked about the potential for the 370Z's successor to go electric, Espinosa said it is something Nissan is "discussing all the time". However, he questioned whether traditional sports car buyers are ready to go electric.

Speaking more generally, Espinosa said he was open to conversations with other car makers on sports cars.


Electric follow-up to the 370Z is under discussion

FIRST PEEK AT CHINA-ONLY SKODA SUV

This is the first sketch of Skoda's new China-only Kamiq GT ahead of its reveal. Similar in looks to the larger Kodiaq GT, it is based on the Chinese Kamiq, which is built on a different platform from the small SUV of the same name sold in Europe.

ASTON MARTIN GOES MOTORCYCLING

The Aston Martin logo will appear on a motorcycle for the first time in a collaboration between the firm and Brough Superior. The two have teamed up on a new luxury machine, which will be revealed at the EICMA motorcycle show in Italy next year.

Crosstar is a new crossover version of the latest Jazz

TOKYO MOTOR SHOW

New Jazz to be hybrid only

Model kicks off Honda's fast-tracked electrification plans for Europe

Honda's European arm has unveiled its new-generation hybrid Jazz, including a rugged Crosstar variant, and outlined a faster schedule for the electrification of its mainstream cars in Europe.

Katsushi Inoue, president and COO of Honda Motor Europe, announced that the company's plans to hybridise nearly all of its European line-up by 2025 have been pulled forward to the end of 2022.

Six electrified models will be launched over the next two years, starting with the Jazz and Honda E battery-electric city car next year. All the models will use new e-Technology branding.

They will be joined between 2021 and 2022 by four other new models, one of which will be another battery-electric vehicle, possibly a compact SUV. It's also expected that one of the new models will be a heavily facelifted Civic fitted with Honda's i-MMD drivetrain, as seen in the CR-V.

The company has high hopes for this rapid shift to electrification. Currently, over 60% of all CR-V sales in the EU are of the hybrid model. Honda will also phase out its diesel engines in Europe, although they will still be available in other global markets.

No decision has been made yet about whether the Civic Type R will survive in the next generation as a conventional petrol vehicle, although Honda said the i-MMD hybrid could be used for a performance model. Honda sources said they were "thinking deeply" about the Type R's future.

The new Jazz will be sold as a petrol hybrid only and go on sale in Europe in the middle of 2020. Since the Jazz's launch in 2001, Honda has sold 7.5 million examples globally. The Crosstar variant is a crossover-lite model, with a moderately raised ride height, exterior cladding and roof rails.

The latest Jazz is substantially new, with only the floorplan being carried over from the previous version. Honda said it has used much more high-tensile steel in the structure and redesigned the suspension mounting points and front crash structure as part of its bid to improve comfort and refinement. To this end, the new front seats are wider and higher backed, too. Honda engineers have also slimmed the car's main A-pillar by more than 50% to improve the driver's view.

Honda would not release any specific technical details, other than to confirm that the Jazz powertrain is a "miniaturised" version of the i-MMD system used in the new CR-V. That means the Jazz operates as a range-extender much of the time, with the engine directly driving the front wheels at higher speeds only.

HILTON HOLLOWAY

Q&A KENTARO YOKOO, PROJECT LEADER, HONDA JAZZ

How did you fit a full-hybrid system in such a small car?
"One of the advantages of Honda's 'two-motor' hybrid system is that it does not use a gearbox, making it space efficient. We also think we are the first maker to package the conventional 12V battery in a hybrid engine bay, ensuring the Jazz's unique load bay packaging [in which the fuel tank is mounted under the front seats and the rear seats fold down into the rear footwell] is preserved."

Why is the i-MMD drivetrain inexpensive enough to be used in a city car?
"Because it's also scaleable so that it can be upsized for use in large Honda models. You might see the current CR-V as the mid-point size for using the i-MMD. Because the i-MMD system is also Honda's only electrified [hybrid] powertrain and it shares components with Honda E's battery electric drivetrain, costs can further be driven down."

HONDA TO LAUNCH THREE NEW WAYS TO CHARGE YOUR EV

Honda Europe announced that it will roll out three new types of EV charging.

Next year, Swedish power company Vattenfall will be responsible for installing wall chargers for Honda customers. For the upcoming E city car, there will be a 7.4kW single-phase charger or a 22kW three-phase charger, the latter replenishing the E's reserves in just over four hours.

The second innovation is a 'smart charging cable', which will work with Ubitricity chargers and directly charge the driver's own home electricity account when using public chargers.

The final development is a bi-directional charger, which will not only charge the vehicle battery but can also sell electricity back to the grid from the car's battery, potentially making a small profit for the EV owner.

The bi-directional charger will also be 'intelligent', charging a vehicle when renewable power might otherwise be lost, such as during the night.

CONFIDENTIAL

MITSUBISHI SHOWED A gas turbine range-extender powertrain at Tokyo, but don't get your hopes up about it making production. Engineering boss Hiroshi Nagaoka said the technology has been in development for only a short time and is a long way from proving itself in areas such as heat management and control.

BIZARREST MOMENT of the Tokyo show was Toyota boss Akio Toyoda unveiling an e-broom. Although no technical details were given, it appeared to have an electric wheel at the end of the brush that propelled a man on rollerskates around the show stage. "It doesn't fly yet," said Toyoda, ruefully, as the slightly bemused audience looked on...

JAPANESE CARS HAVE some unusual names and the oddest unveiled at the show was probably Suzuki's Hustler. It's not a dodgy mag or a conman, but rather a Jimny crossed with an MPV. It looked charming, albeit without the desirability of the Jimny off-roader.

COULD COW DROPPINGS power cars? Toyota's chief technical officer, Shigeki Terashi, suggested that possibility while explaining why car firms shouldn't be railroaded into a single solution to lower emissions. "Methane from cows is one interesting solution," he said. "There are many different ideas and we must remain open to them."

TINY KEI CARS are hugely popular in Japan but Ivan Espinosa, Nissan's product planning boss, admitted: "I'd never buy one for myself or my wife today." He reckons they're too slow and noisy right now but will be better suited to electric tech.

The 3 (left) is tipped to be Mazda's first plug-in hybrid

TOKYO MOTOR SHOW

Mazda plots big push on EVs

First pure-electric Mazda signals the start of a wide-ranging electrification strategy

The electric MX-30 spearheads a new electrification strategy for Mazda that will usher in regular hybrid and plug-in hybrid variants of existing models, as well as more EVs developed as a result of Mazda's EV tie-up with Toyota and tech firm Denso.

Mazda has yet to confirm when its next electrified model will arrive, but a plug-in hybrid is expected within the next 18 months. It's likely to be a high-volume model such as the 3, in order to achieve new European emissions targets for 2021.

Although the MX-30, which was unveiled at the Tokyo show, is a stand-alone electric model, there are no firm plans to create a separate range of EVs. Ikuo Maeda, design and brand boss, said: "Some manufacturers are creating a separate brand for EVs, but we are not doing that. We want to establish EVs in our existing portfolio."

Mazda also wants its EVs to have the same styling as existing models. Talking about the MX-30, Maeda said: "We wanted to maintain a high quality of design. Instead of just pursuing something new simply because it's EV, we want to make sure it's fitted with our Kodo design language."

However, he added that the model reflects a different take on Mazda design: "If we don't trial different things, design would not evolve, but the fact we did this with the MX-30 is unrelated to it being an EV."

The MX-30 delivers 141bhp and 195lb ft via an electric motor powered by a 35.5kWh battery, offering a range of 130 miles. It will cost less than £30,000 after the UK government grant and could make up 3% to 5% of Mazda UK sales in its first year.

Mazda has set up a joint venture with Toyota and Denso to develop EVs based on Toyota's latest TNGA platform.

RACHEL BURGESS

Yamaha shelves car projects for 'foreseeable future'

YAMAHA HAS SUSPENDED all car projects indefinitely, having concluded that it would struggle to deliver a unique selling point for any of the vehicles it developed in collaboration with Gordon Murray Design.

The firm showed two car concepts at the Tokyo motor show in 2013 and 2015, the Motiv and the Sports Ride Concept. Both were based around Murray's iStream manufacturing system.

The Sports Ride stood out in particular for using carbonfibre in its construction, promising huge rigidity and an impressive power-to-weight ratio for the car. Exact details were not revealed, but it was rumoured to have weighed less than 900kg.

Although McLaren F1 designer Murray had said the iStream system could be employed profitably for production volumes of between 1000 and 350,000 cars, Yamaha spokesman Naoto Horie said at this year's Tokyo motor show that the projects would not proceed, with the firm preferring to focus on smaller, more bike-like mobility concepts if it strayed from its core motorcycle projects.

"Cars do not feature in our long-term plans any more," said Horie. "That is a decision taken by president Hidaka for the foreseeable future, as we could not see a way to develop either car to make it stand out from the competition, which is very strong.

"The sports car in particular had great appeal for us as enthusiasts, but the marketplace is particularly difficult. We now see other opportunities."

Sports Ride, developed with Gordon Murray, "had great appeal"

Q&A ICHIRO HIROSE, R&D BOSS

Is there potential for a more powerful version of the MX-30?
"Not right now. If there is considerable improvement in CO_2 emissions emitted during battery production, I think we can shift more towards performance. We will carefully watch how that goes. The introduction of EVs is for environmental conservation and we have to stick to that big picture. We are not introducing EVs for our enjoyment."

When will we see a second EV from Mazda?
"It depends on customer demand. At some point, there will be a huge explosion in EV demand. To be prepared for this, we have to prepare the technology beforehand and this is what we are doing [with the Toyota and Denso joint venture]."

You will introduce a rotary-engined range-extender variant of the MX-30 at a later date. How else can it be used?
"The revival of the rotary engine helps solve a problem [range] of electric vehicles. It is flexible, so we can change the scale of the generator so it can be used as a range-extender or hybrid or plug-in hybrid. The rotary engine is compact and lightweight with outstanding NVH [low levels of noise, vibration and harshness]."

New Levorg revealed

THE SECOND-GENERATION Subaru Levorg has been displayed at the Tokyo show ahead of its launch next year.

The new four-wheel-drive estate is built on the Subaru Global Platform architecture and was shown in Tokyo with a newly developed 1.8-litre turbocharged engine. Subaru claims the machine has been developed using a "grand touring philosophy", with a focus on comfort and safety, and offers a "truly pleasing driving experience".

The Levorg Prototype, which showcases the most recent iteration of the firm's 'Dynamic x Solid' design language, is fitted with the latest version of Subaru's direct-injection boxer powerplant. The engine has been developed to showcase lean-burn technology, which, Subaru claims, balances acceleration and strong torque with environmental performance. The firm has yet to reveal any performance figures.

The new Levorg uses a full inner-frame construction chassis, which is designed for maximum body rigidity. The car also features the latest version of Subaru's EyeSight driver assistance system, which uses a new wide-angle stereo camera and four radar systems, along with information gathered from high-definition mapping, for systems such as pre-collision braking, automatic speed adjustment heading into corners and hands-free driving in heavy traffic.

The new Levorg is due on sale in Japan in the second half of next year. A European launch date has yet to be set.

UNDER THE SKIN
JESSE CROSSE

MOVE OVER STEEL, ALUMINIUM AND CARBONFIBRE: AMC IS ON ITS WAY

Alvant is developing wheel motor rotors from AMC that are 40% lighter, reducing rotating and unsprung mass.

SO FAR MANUFACTURERS have relied on three main materials to reduce weight. High-strength steels, which you can use less of; aluminium alloys, which are lighter than steel, and carbonfibre, which is lighter than both of the other two. Now there's another kid in town called aluminium matrix composite. AMCs are not new but breakthroughs in their development are making them more suitable for automotive applications, especially in EVs.

AMCs are a combination of aluminium alloy mixed with either particles or long or short fibres. The concept is not unlike carbonfibre-reinforced plastic, except the plastic resin is replaced by aluminium. The material can be 50% stiffer and almost 300% stronger than carbonfibre, can withstand severe damage and is stronger than the average steel at half the weight.

It conducts heat well but, crucially, expands very little when it heats up compared with steel or aluminium. That's important when making precision components. The stiffness of AMC makes it ideal not just for increasing structural integrity but also for reducing noise vibration and harshness (NVH).

Although strong and light, carbonfibre doesn't withstand abrasion and ballistic impacts well. That's one reason it isn't used to make suspension parts on production cars, because it's so vulnerable to flying grit and stone. Carbonfibre components cannot withstand high temperatures, either, so cars made of it have carefully routed exhaust systems to avoid damage to the structure. Neither is carbonfibre suitable for making internal motor components.

Engineering consultancy Alvant sees huge potential for the use of AMC in EV powertrains and drivelines. It has developed a proprietary manufacturing process called advanced liquid pressure forming (ALPF), which works with any relatively low-melting-point metal such as aluminium alloy.

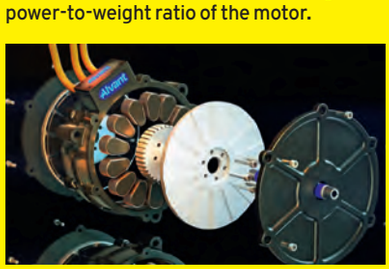
The process can be used with silicon carbide particles mixed into the molten metal to produce a lower-cost version of the AMC material. The lightest, highest-performance and most costly variant incorporates fibres derived from aluminium oxide. The fibres are pre-formed into the required shape in a mould and then injected with the molten metal to make the component.

Components can be made entirely from AMC or only specific areas of a component that are being subjected to especially high stresses or fatigue. The point of doing that is to reduce cost, using the new material only where it is needed most, while the rest of the component can be made from a cheaper conventional metal.

Alvant has been working specifically on rotors for axial flux (biscuit-tin-shape) drive motors for EVs. In conjunction with UK motor manufacturer Yasa, it has developed a rotor that is 40% lighter than the original. Elsewhere, a sandwich of AMC fibre-impregnated sheets with an AMC foam filling can work in a similar way to a bullet-proof vest, making it useful for protecting EV batteries at a fraction of the weight of a steel casing. Less weight equals smaller, lighter batteries, reducing cost and increasing range in the famous virtuous circle of weight reduction.

BETTER POWER TO WEIGHT

Because AMC is so stiff, it's possible to reduce the air gap between the rotor and stator (electro-magnet windings) in axial flux (biscuit tin) EV motors, increasing the power-to-weight ratio of the motor.



UK's limited hydrogen infrastructure is seen as one impediment

What future for hydrogen?

Can car makers tap the potential of hydrogen or will battery-electric reign supreme?

The drumbeat of enthusiasm for hydrogen as a road fuel has grown steadily louder this year, despite a general industry-wide acceptance that EVs will become the mainstream in most cases.

This culminated in Toyota's huge investment in the recently revealed Mk2 Mirai. A substantial overhaul has transformed an oddity built in small numbers into a stridently confident saloon that will raise Toyota's global ambitions for hydrogen next year.

The new Mirai will join the Hyundai Nexo SUV on the admittedly short list of commercially available cars powered by zero-emissions fuel cells, but others are in the pipeline. Mercedes could yet import its GLC F-Cell SUV to the UK and Toyota's fuel-cell partner, BMW, will roll out a hydrogen X5 in 2022. The PSA Group has said it will launch a fuel-cell van by 2021 that's likely to include a Vauxhall version.

In the UK, meanwhile, Wrightbus, the Northern Irish bus firm responsible for building London's hybrid 'Boris bus', was rescued from bankruptcy earlier in October by a company aiming to switch the UK's bus fleet to hydrogen.

Jaguar Land Rover (JLR) has said the fuel might be more suitable than battery-electric power for its largest SUVs as it works to cut emissions. "If you're not careful, you end up with such big batteries [with EVs], you make it so heavy that when you race down the autobahn, the range disappears. So other technologies could come into play, potentially hydrogen," said Nick Rogers, JLR's head of engineering.

It's easy to see the appeal. Hydrogen fuel-cell vehicles emit nothing but water vapour, have a long range (414 miles for the Nexo) and can be filled almost as quickly as a petrol or diesel car. As the scale of the challenge to persuade us out of user-friendly combustion-engined cars into EVs becomes clear, might fast-fill hydrogen be a better zero-emissions bet?

Not so fast, warns Carlos Tavares, CEO of the PSA Group. "Now people see EVs are going to be difficult, they are going to say: 'Oh, what about hydrogen?' You're going to see lots of headlines about hydrogen and everyone's going to have a hydrogen project," he said at the Frankfurt motor show in September. Despite Tavares' reluctance to be dictated to by headlines, the PSA Group has its own

Suzuki concepts include an estate that's also a coupé

DESIGN ELEMENTS OF the retro-styled Suzuki Waku SPO, a 'customisable' plug-in hybrid concept unveiled at the Tokyo motor show, could be used in the firm's future models.

One of three new concepts unveiled by the Japanese firm in Tokyo, the Waku SPO is an A-segment compact car, intended for shared use by a family. It features design elements that can be switched for personal preference, such as the ability to turn from an estate-style car to a coupé.

Designer Takafumi Ogiso told Autocar that it hadn't been decided which of the car's style features could make future production models, but hinted that the headlights and mirrors were under consideration.

The car gets its name from the concept of 'Waku Waku', a Japanese term that means excitement in English.

Suzuki also unveiled the Hustler concept, a Japanese-market-only MPV based on the Jimny off-roader, and the Hanare (which translates as 'small dwelling'), an autonomous pod-style vehicle.

The vehicles are intended to showcase the breadth of Suzuki's future technologies.


TOKYO MOTOR SHOW

Waku's design could inspire future models

hydrogen project (the 2021 van), but Tavares warned that it would be "very expensive".

Cost has always been a drag on fuel cells, which currently use around 30g-60g of the precious metal platinum on every stack. BMW has said a fuel-cell powertrain is currently still around 10 times more expensive than an equivalent electric one.

Other hurdles remain. It might be zero emissions at the tailpipe, but splitting water into hydrogen – the most common method of creating it – demands a lot of electricity. "It only makes sense if you're creating hydrogen with renewable energy," said Rogers. His predecessor, Wolfgang Ziebart, called fuel cells "complete nonsense" back in 2016 because of their poor 'wheel-to-well' carbon emissions.

The refuelling infrastructure is in desperate need of expansion. The UK has just 12 stations in operation, according to h2stations.org, and although early adopter California has more than 40, an explosion at a hydrogen production facility in June left many stations there without supply for weeks.

The safety fears haven't gone away, either. In South Korea, resident groups are opposing new hydrogen filling stations in their neighbourhoods following an explosion in May at a hydrogen storage tank in the city of Gangneung, killing two.

Even if these issues were all suddenly ironed out, hydrogen lost to lithium ion a long time ago as an automotive fuel, argues Andy Leyland, head forecaster at battery materials analyst firm Benchmark Mineral Intelligence. "The amount that has been committed to the lithium ion supply chain, excluding charging infrastructure, is around $600 billion [£470bn]. Hydrogen is maybe $30bn or max $40bn. It's a completely different scale," he said. "In many respects, lithium ion is too big to fail over the next 10- to 15-year period."

In the meantime, hydrogen is expected to fill niches where batteries can't compete, such as for high-mileage commercial vehicles that are too busy to be idled while charging. "We think it's good technology mostly for fleets and for cars that come back to the same point every night where you can leverage investment on the H_2 refilling unit," said Tavares.

The enthusiasm for the fuel in South Korea and Japan is expanding into partnerships, with car makers not so willing to start a programme of their own from scratch. Hence, BMW is linked with Toyota and Hyundai with Audi.

And the price will come down. "By the third-generation Mirai, we fully expect fuel-cell costs to be comparable with hybrids," Toyota Europe head of sales Matt Harrison said. "We believe fuel cell vehicles have a huge potential."

NICK GIBBS

Toyota's new Mirai, in concept form, was at the Tokyo motor show

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TESTED 25.10.19, LISBON, PORTUGAL **ON SALE** NOW **PRICE** £56,810

ALPINE A110 S

The A110 has earned a five-star Autocar road test rating. Does more power and a sharper chassis make it even more appealing?

This is not A110 v2.0. Alpine chief vehicle engineer Jean-Pascal Dauce – not so much the new David Twohig as the original, since he worked on the A110 project in the concept design phase when it was still a joint venture with Caterham and then returned to Renault's motorsport department only to be brought back when his successor departed – is very clear about that.

"We have had the S planned from the earliest stages of the project," he explains, "because we knew that a part of the Alpine customer base would want more from the car. More power, more speed, more grip and precision, and better track suitability. It's as simple as that. We're not answering any criticisms of the car with this version or addressing what we consider to be failings," he goes on. "Frankly, we don't think it has too many of those – and the reaction of the market and the media would seem to agree." To prove his point, he explains that the regular A110 is expected to outsell the new A110 S by about three to one.

If that turns out to be true, it'll prove yet again how special and unusual this compact, lightweight sports car is – in a segment where so many buyers gravitate towards the most powerful and performance-tuned version of the car they're considering by default. It'll prove that most Alpine owners really get the 'less is more' philosophy that underpins so much about this car.

And, after a good thrash on both road and track, I'm inclined to agree with what the gut instincts of that majority of buyers may be telling them. For reasons we'll get to, the A110 S is certainly faster, more precise-handling and more composed at track speeds than the regular A110 – and it can therefore be considered a success at broadening the capability and reach of the car, and at complementing the existing model range perfectly well. I'm not sure it's the one I'd pick, though.

It is, at its core, just an A110 running some extra turbo boost with some weight removed and some stiffer suspension components swapped in. The car's kerb weight drops by 7kg courtesy of some (typically optional) 18in forged alloy wheels and a carbonfibre roof panel (although both are now also available on the regular A110, and so the lightest A110 of them all remains the entry-level Pure version, confusingly).

Engine power from the car's 1.8-litre turbo four-pot is up by 40bhp to 288bhp. Peak torque is pegged at the same 236lb ft you get in the regular A110 (because that's the operating limit of the car's transmission) although it's available over a broader band of revs. The extra grunt is enough to knock off just under half a second from the car's standard kilometre acceleration claim, although it's →

> There's noticeably more spring in its step than with the regular A110 when you're rolling

A110 S is faster partly because it has 40bhp more than the standard car and the same torque output over a wider rev range

worth only a tenth to 62mph and 6mph in terms of top speed.

Alpine's suspension overhaul drops the car 4mm closer to the road; stiffens the coil springs by 50% and the anti-roll bars by 100%; retunes the dampers to suit; and adds 10mm of tyre contact patch at each corner as standard (although not if you have the optional forged 18s on a Pure- or Legende-spec car). Body control is twice as good, they say, than it is on an A110 Pure. Braking power, meanwhile, is improved courtesy of new 320mm discs front and rear.

And yet what Alpine has done to this car is perhaps not as significant as what it has resisted the urge to do. There is no grafted-on rear spoiler on the A110 S. It has no decals, no go-faster stripes. It doesn't even have derivative badging. If you buy one, you'll be doing so very much for what the car does rather than because you want the world to know you could afford the quick one. Nicely done, lads.

On the inside, you get an extra helping of Dinamica synthetic suede upholstery with orange stitching, as well as reupholstered versions of the same sports seats that the regular A110 has, so there's still no backrest angle adjustment but otherwise the driving position is very good. There's the same cockpit layout and digital instruments, too, so you start the engine with the big red illuminated starter button on the transmission tunnel; you engage drive, and switch between auto and manual transmission modes, using the 'D' button; you engage Sport mode using another red button, this time on the steering boss; and you juggle ratios using the car's well-placed shift paddles, which are column rather than wheel mounted.

Cabin is little changed, beyond new upholstery, but there are no complaints about that

There's noticeably more spring in the car's step when you're off and rolling. The A110 S picks up a shade more urgently than the regular A110 and seems to rev more freely and urgently. Moreover, since it's running in considerably less boosty tune than when appearing in Renault's Mégane RS, the car's 1.8-litre motor has much better throttle response and linearity of power delivery than it does in other applications. It still sounds a touch flat and workmanlike by £50k sports car standards, but not so much as to be an obstacle to enjoyment.

Low-speed ride is firmer than in other A110s, with the occasional jostle and thump disturbing the car around town. At greater speed, plenty of fluency returns and you wouldn't say this is a particularly firm-riding car by wider sports car standards. But that really distinguishing sense of suppleness and ride dexterity that

No badges or lairy spoilers mark it out as the harder-edged S model, but you'll soon appreciate the difference when you drive it

TESTER'S NOTE
Amazing how much more flexible and appealing Renault's/Alpine's performance four-pot engine becomes when you take torque away. I wonder if the next hot Clio will get the regular A110's calibration? Hope so. **MS**

a regular A110 has, and that allows it to deal so well with British B-roads taken around the national speed limit, is harder to detect.

Much improved body control, sharper and even more instinctive-feeling handling response, better mid-corner stability and more braking stability are what the A110 S delivers in return for that sacrifice – although most of the gains will require track use to fully appreciate them.

On the road, the car is crisper and keener on turn-in and has slightly meatier steering, with less of the flightiness of feel of a regular A110 around dead centre. Unlike the regular A110, it's also not a car you worry will bottom out through a fast compression. Those should be considered unqualified dynamic improvements by anyone's estimation.

On the circuit, the A110 S stays flat and level under much greater load than an A110 manages; doesn't roll into oversteer unless you absolutely mean that it should; and can carry quite a lot more speed with it wherever it goes. But whether any of that makes the A110 S more fun will depend mainly on the sort of driving you like to do on track days, and where exactly you like to do it. It certainly makes the car more dynamically competent. Quite a lot less nerve-jangling somewhere like the Nürburgring, too, I should think.

It doesn't make it the sort of sports car, sadly, that can be teased to lurid extremes of oversteer quite as easily as the regular A110 can be, though, because it isn't quite as easy to stabilise at that deliciously indulgent angle of mid-corner attack (witness my road tester's sad face). The A110 S's stiffer set-up and greater tyre footprint allow it to do serious track pace much more effectively than a regular A110, but handling playfulness notably less so.

And so, were I a track regular who cares as much about how fast I go as how I go fast, this is probably the A110 I'd have – although I'm not sure I'd be an Alpine customer in the first place in that case. For predominantly road use and the occasional circuit foray, however, I'd pick an A110 Pure on 17in wheels and one or two wisely chosen options. Getting serious is thoroughly overrated anyway.

MATT SAUNDERS
@thedarkstormy1

Red button by the steering wheel boss selects Sport mode

ALPINE A110 S

Has more grunt, tactile feel, grip and body control. So it's fast but perhaps not as much fun as a regular A110

★★★★½

Price	£56,810
Engine	4 cyls, 1798cc, turbocharged, petrol
Power	288bhp at 6400rpm
Torque	236lb ft at 2000-6400rpm
Gearbox	7-spd dual-clutch automatic
Kerb weight	1107kg
0-62mph	4.4sec
Top speed	161mph
Economy	WLTP figures tbc
CO_2	164g/km
RIVALS	Lotus Elise Cup 250, Porsche 718 Cayman S

TESTED 7.11.19, BARCELONA, SPAIN **ON SALE** THIS MONTH

AUDI S8

Clever tech gives the latest edition of Audi's mighty flagship saloon new-found ability

The engineering brief for the new Audi S8 is surely one of the most demanding in the automotive business. Here's a car that, on the one hand, must deliver top-shelf limousine-like behaviour. But at the same time, the most outwardly sporting variant of Ingolstadt's flagship four-door saloon is also expected to offer supercar-like performance while engaging the driver with the sort of dynamic qualities to see off its premium-brand rivals – all in a package stretching to over five metres in length and weighing all of 2230kg.

It's a balancing act that previous incarnations of the S8 failed to pull off with quite the same level of success as the high-end competition.

For this new one, Audi has left nothing to chance. With 563bhp, power has actually been wound back by 34bhp over the ultimate version of the third-generation S8 – the S8 Plus, launched in 2015. But with up to 1.8 bar of boost pressure, the new model's heavily reworked twin-turbocharged 4.0-litre petrol V8 delivers 37lb ft more torque, at 590lb ft between 2000 and 4500rpm.

Among its rivals, the BMW M750i xDrive's twin-turbocharged 4.4-litre V8 petrol engine delivers 523bhp and 553lb ft, while the Mercedes-AMG S63's twin-turbocharged 4.0-litre V8 petrol powerplant serves up 603bhp and 664lb ft.

The S8's solid reserves are sent through an upgraded eight-speed torque-converter automatic gearbox that has a manual-shifting Tiptronic function and Audi's quattro four-wheel drive with a sport differential that constantly varies the amount of drive sent to each individual rear wheel.

Audi says the new S8 is more efficient than ever thanks to the adoption of a revised cylinder-on-demand system that automatically closes down one bank of cylinders on light throttle loads and a new belt-driven 48V starter motor that operates with a lithium ion battery and a recuperation system capable of harvesting up to 8kW of energy during braking and coasting.

Acceleration is forceful, whether from a standing start or when on the move

Yet despite the new energy-saving technology, fuel economy drops from a previous 29.4mpg to 24.8mpg for an average CO_2 rating of 260g/km.

As always, there's little to tell the fourth-generation S8 apart from its less sporting A8 sibling. At standstill, the new model looks pumped but subtly so and without any obviously contrived design elements. Unique touches include a new front bumper, S8-specific front grille, wider sills, aluminium-look mirror housings and quad-tailpipe treatment.

When you open the driver's door, the S8's active suspension automatically raises the ride height by 50mm to ease entry. As the door is closed, the air springs return to their standard setting.

Inside, tactile materials combine with crystal-clear digital instruments, a standard 10.1in touch display for the infotainment functions, a superb multi-function steering wheel and highly supportive sport seats to provide a truly first-class driving environment.

TESTER'S NOTE
Every fuel saving helps. Audi claims the cylinder-on-demand tech and 48V starter motor-lithium ion regen combo save about 0.2mpg. **GK**

Hot four-door delivers pleasing composure and excellent high-speed stability

Driving environment is first rate and placing the car accurately is easy

> Its brawny engine is the star of the show and delivers sledgehammer performance

In Sport mode, the big Audi is brutishly potent, with earnest step-off and unrelentingly urgent in-gear traits. The brawny engine is the undisputed star of the show and delivers the sort of sledgehammer performance to propel it from standstill to 62mph in a scarcely believable 3.9sec.

The slick-shifting gearbox and fast-acting four-wheel drive also play an integral part in the explosive accelerative and top-shelf cruising ability, forming a formidable combination that is further enhanced by a convincingly realistic synthesised soundtrack.

Yet as effective as it is under full load in Sport mode, the S8's reworked engine is also compellingly smooth on more measured throttle inputs in the car's Comfort+ setting. In city driving, it proves wonderfully flexible even in Eco mode, where the cylinder-on-demand system turns it into a four-pot for brief periods.

However, the most remarkable thing about the new S8 is the added agility brought about by the adoption of Audi's Predictive Active Suspension and Dynamic All-Wheel Steering system. As well as varying the assistance acting on the front-wheel steering, it adds a steering function to the rear wheels.

The upshot is a new-found level of communication and response. Despite the S8's generous dimensions, you can place it with added precision and confidence in any given driving situation. On more challenging roads, there's a welcome liveliness and neutral character to the big Audi that was always found wanting in its predecessor.

The suspension's predictive function can alter the characteristics of the damping up to 18 times per second and the car can lean into corners in a manner similar to a motorcycle, which together help make the new S8 more composed and fluid than its predecessor. The S8's trademark directional stability, meanwhile, is better than ever.

Ride quality is also improved, especially at speed. However, it can be unsettled by larger transverse ruts and ridges at lower speeds.

Previous incarnations of the S8 were persuasive ownership propositions, yet they all lacked the inherent engagement that sets a truly great car apart from a merely good one. They were outstanding when driven flat out down an empty autobahn but disappointingly detached on more challenging roads.

This new model is different. It retains the traditional qualities that have made the S8 a car to cherish down through the years but brings a whole new dimension in dynamic competence. It connects with the driver on a totally new level. On top of this, its advanced suspension also provides Audi's flagship saloon with greater comfort, making it a highly competent all-season all-rounder.

GREG KABLE
@gregkable

S8'S SUSPENDED ANIMATION TECH

Audi relies heavily on its most advanced suspension to allow the new S8 to achieve its role as both limousine and supercar-chasing sports saloon.

The new air-sprung set-up, called Predictive Active Suspension, uses a camera to scan the road and electromechanical actuators to constantly vary the ride height.

Each wheel can be separately loaded across five driving modes. In Comfort+, the suspension tilts the body into corners to reduce lateral forces. In Dynamic mode, body roll is reduced to around half of that of a standard steel-sprung suspension, according to Audi.

The system works in conjunction with Audi's Dynamic All-Wheel Steering system, which steers the rear wheels by up to 5deg in the opposite direction to the front wheels at lower speeds and by up to 2deg in the same direction as the fronts at higher speeds.

AUDI S8

Characteristic understated looks hide a hugely potent saloon that is now more engaging than ever

★★★★½

Price	£100,000 (est)
Engine	V8, 3993cc, turbocharged, petrol
Power	563bhp at 6000rpm
Torque	590lb ft at 2000-4500rpm
Gearbox	8-spd automatic
Kerb weight	2230kg
0-62mph	3.9sec
Top speed	155mph (governed)
Economy	24.8mpg
CO_2, tax band	WLTP figures tbc
RIVALS	BMW M750i xDrive, Mercedes-AMG S63 4Matic

TESTER'S NOTE
Adding adaptive cruise control and active lane keep assist should add appeal for distance drivers, although the latter can be overly insistent at times. **TM**

TESTED 6.11.19, BARI, ITALY **ON SALE** JANUARY

ALFA ROMEO GIULIA VELOCE

Facelifted saloon brings new in-car tech to the compact four-door segment

As one half of a two-pronged return to form alongside the Stelvio SUV, the Giulia has helped re-establish Alfa Romeo as a purveyor of fine driving cars. But the model hasn't been the hoped-for sales success, losing out to rivals that may not be more dynamic but which are certainly better equipped.

The fact that improved infotainment was first on the press material bullet points for this facelifted version indicates how vocal critics have been about the Giulia's shortcomings. As such, this mid-life refresh seeks to add much-needed technology and overhaul cabin fit and finish rather than tweak an already stellar driving experience.

Beyond the handful of new paint options, the only exterior changes are to the trim level badges: silver lettering now signifies more mainstream models, while black is reserved for sportier versions. The range has also been simplified to Super, Sprint, Ti and Veloce, with a new Business Line dedicated to fleet sales in some markets.

The engine line-up also remains unchanged, with a 2.0-litre petrol and 2.2-litre diesel (both turbocharged) available in several states of tune. The 276bhp of our Veloce Ti test car is the most potent, until a refreshed Giulia Quadrifoglio comes on song next summer.

Almost every change has been made inside the cabin, with the centre console receiving the most attention. Cheaper black plastics have been exchanged for glossier fixtures, while the rotary infotainment dial is now much firmer and more substantial. The sharp-edged plastic gear lever has been swapped for a leather-wrapped version that instantly feels more premium, and an Italian tricolore now flanks the gearstick as a gentle reminder of the car's heritage. Wireless smartphone charging has been added beneath the central arm rest, which gains more stowage space than before.

The centrally mounted 8.8in display hasn't grown but does have a new interface, with improved graphics and easy-to-read text that makes much better use of space than the old system. The main screen can be customised with a series of widgets and is now touch-sensitive, although physical controls remain.

The 7in digital instrument cluster sees fewer changes, with a tweaked interface highlighting the additional driver assist systems, including adaptive cruise control, active blind spot assist, active lane keeping and traffic sign recognition. It's still flanked by analogue dials, though, which feels out of step with the fully-digital displays seen in the BMW 3 Series and Audi A4.

This Giulia remains a vigorous performer, with a noticeable forced induction shove towards the upper end of the rev range despite plenty of low-down torque. You wouldn't call it overly refined at idle, but the four-pot sounds pleasant enough when pushed, and increased soundproofing helps create a calmer atmosphere in the cabin while motorway cruising.

The eight-speed automatic gearbox reacts quickly to your foot, whether left to change cogs itself or when you take control with what are still some of the best wheel-mounted paddle shifters this side of a supercar.

The Giulia is still one of the sharpest-handling compact saloons on the market, with direct, responsive steering and just enough rear-driven character to entertain without threatening trouble when pushed (stability systems remain permanently engaged). Dynamic mode's sharper damper settings still feel like overkill on anything other than completely smooth Tarmac, but there's the option to override it and keep the softer standard setting while retaining sharper gearshifts and throttle response.

Given how rapidly the rest of the compact saloon segment has progressed, this updated Giulia merely maintains its position rather than challenging for superiority. That said, anyone searching for an engaging drive should still have one on their list alongside the BMW 3 Series and Jaguar XE.

TOM MORGAN
@tommorgan3

The Giulia retains its dynamic appeal; updated cabin trim gives a more premium feel

ALFA ROMEO GIULIA VELOCE TI 280

Dynamism and cabin improvements keep the Giulia in contention, but still not a challenge to the class's best

★★★½☆

Price	£47,000 (est)
Engine	4 cyls, 1995cc, turbocharged, petrol
Power	276bhp at 5250rpm
Torque	295lb ft at 2250rpm
Gearbox	8-spd automatic
Kerb weight	1429kg
0-62mph	5.7sec
Top speed	149mph
Economy	WLTP figures tbc
CO_2, tax band	WLTP figures tbc
RIVALS	BMW 330i M Sport, Audi A4 Black Edition 45 TFSI 245PS

TESTER'S NOTE
Electric 3 Crossback gets a different twist-beam rear suspension from its petrol/diesel siblings, to provide room for its underfloor battery. Engineers claim it doesn't compromise ride quality. **SC**

TESTED 24.10.19, PARIS, FRANCE **ON SALE** NOW

DS 3 CROSSBACK E-TENSE

Luxury-seeking compact SUV buyers can now go electric – and it's a good option

The first and most luxurious of the PSA Group's upcoming quartet of electric superminis shows they'll be major players in an exciting and emerging sector.

Drive 50 yards in DS's new baby electric soft-roader – the first premium battery SUV in the B-segment, as company people repeat ad nauseam – and you'll instantly get why the PSA Group chose DS, its smallest-selling marque, to be first with a concept it intends eventually to sell across its four brands: Peugeot, Citroën, Vauxhall and DS. In a nutshell, it is because of what the press blurb succinctly calls 'the silence inside'.

Purveyors of pure-electric cars have learned many lessons since they started selling in earnest and one of the biggest has been the unexpectedly strong buyer appeal of the silence, smoothness and ease of driving only a pure-electric car can bring.

Such characteristics especially suit DS, the group's slowly growing luxury brand. Its engineers have deliberately set out to surprise buyers (and rivals) by taking those innate natural characteristics to extremes with the sort of sound-killing steps you might expect in a Mercedes-Benz S-Class – using acoustically quiet trim materials in the cabin and thickening the door panels and windscreen glass to cut intruding noise from outside. The result is a small car so quiet that at the wheel you simply can't hear the mandated noise the car makes at low speed to warn bystanders of its progress.

Under the skin, the 4.1m-long DS has a new platform that can be used flexibly with equal success for combustion, hybrid and pure-electric models. In EV guise, it will soon to be applied to Peugeot's 208 hatchback and 2008 crossover, as well as the DS, using a permanent magnet electric motor, rated at 134bhp and 192lb ft, to drive the front wheels. The motor is fed by a 50kWh lithium ion battery mounted under the seats, giving the car a WLTP-calculated range of 200 miles. The rear-seat room is decent for the modest overall length and the boot is deep and spacious.

Find one of the new 100kW chargers and you'll need only half an hour to charge the car from empty to 80% capacity. The battery weighs 350kg, but the car's kerb weight rises by only 300kg – all of that mass low and centralised – because the engine and its ancillaries are no longer needed. The car covers 0-60mph in a decent 9.0sec (a time that belies its even more urgent-feeling 0-30mph time) and turns a 93mph top speed.

It's a very well equipped car. Even the £30,490 entry-level Performance Line model we test here (that price taking account of the £3500 government grant) bristles with big-car electronic gadgetry and niceties like Alcantara upholstery. And there are even plusher Prestige (£32,490) and Ultra Prestige (£35,490) models.

On the road, the car feels more supple than sporty, but the compactness gives it a good deal of agility. It deals softly with bumps, although without significant body roll, and its generously sized tyres give it good grip. It can occasionally bounce a little too much on lumpy road surfaces, but tyre noise is extremely low (although UK road surfaces will pose a sterner test).

There are three driving modes – Eco, Comfort and Sport, which progressively sharpen the accelerator response and gently increase steering rim effort. Sport is the best choice unless you're desperate to extend your range on a journey home.

In summary, the electric DS 3 Crossback (we don't see the odd 'E-Tense' part of the name playing well in the UK) is a fascinating arrival, offering a new kind of compact luxury to the market for electric cars at a price not too far adrift of less luxurious models. Best of all, it promises good things from electric versions of the 208 and Vauxhall Corsa, which will use the same powertrain. The market for pure-electric superminis just got much more interesting.

STEVE CROPLEY
@stvcr

DS 3 CROSSBACK E-TENSE PERFORMANCE LINE

Plays to its EV strengths by being a notably quiet and, at town speeds, brisk crossover. Well equipped, too

★★★★☆

Price	£30,490 (inc gov't grant)
Engine	Permanent magnet electric motor
Power	134bhp
Torque	192lb ft
Gearbox	Single-speed automatic
Kerb weight	1525kg
0-62mph	9.0sec
Top speed	93mph
Range	200 miles
CO_2, tax band	0g/km, 16%
RIVALS	Renault Zoe, Peugeot e-208 (due early 2020)

Electric power gives useful in-town performance and DS has ensured the well-equipped cabin remains extremely hushed

TESTER'S NOTE
The RX uses a new type of adaptive headlight system, called BladeScan, in which LEDs shine onto a spinning mirror to keep the beam focused without blinding other users. **LA**

TESTED 7.11.19, BERKSHIRE **ON SALE** NOW

LEXUS RX 450h F SPORT

Can revisions to this long-standing hybrid SUV give it the edge on the newcomers?

Diesel is one reason we've generally given Lexus hybrids a lukewarm reception. The truth is that an equivalent diesel model has typically been faster, more engaging and more readily capable of better economy. But oil-burner sales are plummeting and nowhere else does that have more of an effect than in premium large SUVs.

This Lexus, then, should be the car of the moment. While other makers scurry to make plug-in hybrids (PHEVs) – models capable of impressive economy but only if kept charged via a socket – the posh arm of Toyota has soldiered on with its proven parallel-hybrid set-up, which it dubs 'self-charging'.

To raise the appeal further, the RX has received an update that includes mild chassis revisions and a redesign for the front and rear bumpers, a new tail-light design and a fresh grille.

Inside, there's not a huge departure visually, but the touchpad-controlled infotainment system is also now operable via a touchscreen. There's Apple CarPlay and Android Auto for the first time, too, and the suite of safety systems swells a bit. Clinical minimalism is not the theme inside, with a complex architecture and buttons for everything, everywhere, but exemplary build quality and plush materials make it feel special.

This is not an antidote to fiddly touchscreens, though. Yes, there are lots of buttons, but most are for the heating and climate functions. So you'll find yourself interacting more with the touchscreen, which, although big, clear and now closer to the driver, still causes you to lean in and take your attention off the road to prod it. The infamous Lexus trackpad (replacing the horrid old mouse-style controller) doesn't solve that. It's usable, but far trickier to operate on the move than a rotary click wheel.

You'll have no complaints about the extremely generous kit tally in this F Sport model, though, and oddment storage is plentiful, as is interior space. It's no Land Rover Discovery in terms of outright versatility, but there's the seven-seat RX L for that.

So far, so decent enough, but powertrain bugbears remain. Gentle, about-town cruising is where it's most satisfying, where the seamless CVT gearbox, EV-only mode and general smoothness show the RX in its best light. It's fine once up to speed, too, but getting there briskly still involves a bit of noise as the V6's revs flair up and stay up.

Performance is ample, but not outstanding, and compared with rivals' torque-laden six-pot diesels, it makes a bit of a meal out of overtaking and motorway inclines. Whether the 33mpg it delivered in our hands justifies the sacrifice is negligible, too. Frankly, it all feels a bit old-school if you've spent time in any equivalent plug-in hybrids.

Elsewhere, though, the RX is more dynamically capable. Fresh hardware such as stiffer anti-roll bars and new shock absorbers combine with a new roll-reducing Active Cornering assist system. Thankfully, the ride hasn't become remotely choppy as a result. This is still a supremely comfortable way of moving about the place.

Handling is a bit more incisive now, though. The steering feels direct and consistently weighted and there's tidy body control for a two-tonne-plus SUV and reasonable grip levels. No, you won't be sneaking out the house on a Sunday to thread it down a B-road, but it's entirely as good as a car of this type needs to be.

If you're determined not to buy a diesel, and a PHEV or EV doesn't yet work for you, the RX is a distinctive, comfortable and well-equipped buy that feels totally different from the German establishment. But it still isn't a better all-rounder than something like a BMW X5 30d, which is more efficient, cheaper and even more refined and offers significantly better performance at any speed. The public may be turning its back on diesel, but it remains the most effective method of propelling a big SUV long distances.

LAWRENCE ALLAN

@loballan

Revisions improve the RX's dynamic performance and the cabin feels special, despite some ergonomic foibles

LEXUS RX 450H F SPORT

Likeable, comfortable and kit laden, the sharp-looking RX has left-field appeal but hybrid tech has moved on

★★★½☆

Price	£55,205
Engine	V6, 3456cc, petrol, plus two electric motors
Power	308bhp
Torque	na
Gearbox	CVT
Kerb weight	2100kg
Top speed	124mph
0-62mph	7.7sec
Economy	35.3-35.7mpg
CO_2, tax band	172g/km, 37%
RIVALS	BMW X5, Mercedes-Benz GLE, Volkswagen Touareg

TESTER'S NOTE
Left-hand-drive Capturs have a roomy pop-out drawer where you'd usually find the glovebox, which is what right-hookers will get because the conversion can't be made, sadly. **RB**

TESTED 22.10.19, ATHENS, GREECE **ON SALE** NOVEMBER

RENAULT CAPTUR

Popular SUV enters its next era with a fresh platform, new tech and a roomier cabin

Renault's Captur is Europe's best-selling B-SUV – that's small crossover to you and me – and its sales are still growing despite the passing of its sixth birthday and the creakiness of its 15-year-old Modus MPV-sourced platform. On the road, that age shows, so the fact that this new Captur is built on Renault's CMF-B platform, also used for the latest Clio, is good news. Early next year, it will also be offered with an ingenious plug-in hybrid option.

For now, mainstream powertrains include three- and four-cylinder petrol and diesel engines. The new Captur is a little bigger (the greatest growth benefiting rear leg room), it's considerably stiffer and it provides a wide range of driver assistance systems. But the essential Captur formula remains unchanged.

The cabin is where the biggest changes are to be found. The two standout features, literally, are the optional high-mounted 9.3in portrait infotainment screen and, beneath it, a pleasingly shaped peninsula providing a platform for the gearlever, be it manual or auto. Forward of this is a phone-charging mat and, beneath that, a storage tray.

'Life on board' (an obsolete Renault strapline, you may recall) is further enhanced by new soft-feel materials that improve the interior's ambience. If you like your cabins colourful, you can order an orange interior pack that provides slightly metallic-looking soft-feel inserts and other sun-hued trimmings – but frustratingly on the range-topping S-Edition only.

The powertrain most likely to propel the new Captur in the UK will be the 100 TCe, its 99bhp 1.0-litre triple paired with a five-speeder. The test model closest to that was the four-cylinder six-speed 128bhp 130 TCe in a trim equivalent to the Iconic – which sits between entry-level Play and S-Edition – and with 18in wheels.

These are suspended by MacPherson struts up front and a twist-beam axle at the rear. The electric power steering is an enabler for a suite of driver aids, such as lane keeping, which corrects a drift beyond a white line, and lane centring, which keeps the car plumb in the middle. These are standard, together with autonomous emergency braking and traffic sign recognition.

On the move, this new Captur immediately feels more structurally robust, better insulated, more cushioned and quieter. Like all B-SUVs, the Captur is some distance from being a machine to please the keen driver, but its steering weight is reasonably judged and it corners neatly enough and rolls little.

It'd be worth trading a little body roll for some pliancy over sharper peaks and troughs, though, because the suspension's calm absorbency across less testing terrain can occasionally be quite disturbed. However, in place of our test car's 18in wheels, the TCe 100 will get 17in rims and tyres of more pliant profile.

The cabin's extra width, a mildly high-rised driving position, comfortable front seats and the new-found civility make journeying fairly painless. The engine's slightly guttural delivery under load intrudes little and it revs smoothly. The TCe 130 is brisk, too, but it's easy to imagine the TCe 100 wanting for power when its rear seats are occupied. Backbenchers now enjoy more room, with their portion of the cabin less obviously cheap, too. The asymmetrically split rear seat slides and the boot is the biggest in the class.

As yet, no B-SUV is positively enjoyable drive and this Captur doesn't change that. But it's polished enough to be a challenge to the VW T-Cross that's the best of them and its interior is more interesting and more convenient. Above all, given the Captur's popularity, it's resoundingly better than the last while preserving the original's visual flair.

RICHARD BREMNER

Cabin looks and feels of a higher quality than before, a trend also reflected in the Captur's road manners

RENAULT CAPTUR TCe 130 ICONIC

A more sophisticated Captur. Refinement is decisively better, as is interior quality and equipment

★★★★☆

Price	£20,295 (est)
Engine	4 cyls, 1333cc, turbocharged, petrol
Power	128bhp at 5000rpm
Torque	177lb ft at 1600rpm
Gearbox	6-spd manual
Kerb weight	1234kg
0-62mph	10.6sec
Top speed	121mph
Economy	44.1mpg
CO_2, tax band	127g/km, 29%
RIVALS	Seat Arona, VW T-Cross

TESTED 14.10.19, MUNICH, GERMANY **ON SALE** NOW

BMW X6 M50i

Latest version is better than the car it replaces – in all but its ride

Few cars divide opinions quite like the BMW X6. But whatever you think about it, there's no denying its success. Since its 2008 launch, more than 446,000 have been produced – and global demand for the big BMW continues to grow.

For its 2020 model year, the X6 sports an evolutionary design, with a new interpretation of BMW's signature grille, a broad-shouldered body, heavily curved roofline and an arguably sleeker-looking rear end.

Heading the petrol line-up is the X6 M50i driven here, with a turbo 4.4-litre petrol V8 developing 523bhp and 553lb ft. It's joined by the 335bhp petrol xDrive40i, 394bhp diesel M50d and 261bhp diesel xDrive30d. All come with an eight-speed automatic and electronically controlled four-wheel drive, plus a rear differential lock on the X6 M50i.

The interior, largely shared with the X5, gains the latest iDrive system, complete with digital instruments and a 12.3in touchscreen. The new cabin also feels more luxurious and the driving position more genuinely coupé-like than before. Seating remains restricted to five, although those in the second row now benefit from more leg and shoulder room. Boot capacity stays at 580 litres (65 fewer than the X5).

On the road, the X6 M50i makes light work of its 2235kg kerb weight, with terrific flexibility and urgency on part-throttle loads and the ability to serve up performance that fully justifies its M badging when asked to. It's not only the engine that distinguishes itself, though. The speed and intuitive nature of the gearchanges also play a central role in the driving appeal.

We've always been impressed by the X6's handling and the latest one reinforces this feeling. The standard spec mates adaptive dampers to steel-sprung suspension, but our test car had optional air suspension. Along with the standard steering, it also featured the optional rear-wheel steer. The result is handling that's direct, consistent and, at anything below breakneck speeds, quite predictable.

The weak link is the ride. Even in Comfort mode, the X6 M50i never feels totally settled. It improves with speed, but is never cosseting.

It might not be as practical, roomy or comfortable as the X5, but the X6 does have its own special appeal. The M50i certainly feels brash and powerful, although the xDrive30d (over £16k cheaper) could, as before, prove the best buy in the range. For now, though, the new model appears to represent a major advance on its predecessor in every major area, except perhaps its ride.

GREG KABLE
@gregkable

Cabin feels more luxurious than its predecessor's and the car is better to drive

BMW X6 M50i

Initial top-of-the-line X6 is brash and brawny but also more luxurious and refined than the model it replaces

★★★★☆

Price	£76,870
Engine	V8, 4395cc, turbocharged, petrol
Power	523bhp at 5500rpm
Torque	553lb ft at 1800rpm
Gearbox	8-spd automatic
Kerb weight	2235kg
0-62mph	4.3sec
Top speed	155mph (governed)
Economy	WLTP figures tbc
CO_2, tax band	WLTP figures tbc
RIVALS	Mercedes-Benz GLE Coupé, Porsche Cayenne Coupé

BMW M340i xDRIVE

Price £48,555 **On sale** Now
What's new? It's the sole six-cylinder petrol 3 Series and BMW insiders call it the junior M3

WITH 82BHP MORE than any other current new 3 Series and bespoke M-tuned chassis, the new 369bhp M340i xDrive is aimed directly at the Audi S4 and Mercedes-AMG C43.

Running a 3.0-litre petrol engine, eight-speed auto and four-wheel drive, the car is very smooth, flexible and rapid (0-62mph in 4.4sec). It eats up motorway miles with unwavering resolve, with stability and refinement among its strongest suits. Yet on more challenging roads, it's engagingly agile, if not quite as delicate as an M-badged car can be.

With standard adaptive damping, there is sufficient compliance for refined progress on smooth bitumen, although it can become unsettled over uneven road surfaces.

Overall? Arguably, all the car you'll ever need – but at a high price. **GK**

★★★★☆

MERCEDES-BENZ GLC 220D 4MATIC SPORT

Price £39,500 **On sale** Now
What's new? New entry-level four-pot arrival fills a hole in fresh-faced GLC's diesel line-up

THIS LATEST ADDITION to the Mercedes GLC is almost certain to become the darling of the range. The 220d's 2.0 four-cylinder delivers 191bhp and 295lb ft to all four wheels, or enough for confident, if moderate progress, with noise largely isolated until you really hustle. The nine-speed torque-converter gearbox then reveals a slight hesitance to shift cogs quickly, but is otherwise capable of relaxed, comfortable cruising.

The standard suspension and 18in wheels of this Sport variant deliver a largely refined ride, but inside it misses out on the digital instrument cluster seen on more high-end variants. It's an otherwise capable, well-appointed SUV. **TM**

★★★½☆

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TESTED 6.11.19, BERKSHIRE **ON SALE** NOW

HYUNDAI IONIQ ELECTRIC

Longer range and updated infotainment bolster its appeal

The Hyundai Ioniq goes one further than its Toyota Prius rival in offering a fully electric model alongside hybrid and plug-in hybrid versions. This revised Ioniq Electric brings with it a larger battery (up from 28kWh to 38kWh) and a more efficient electric motor to increase the range by some 30% to a claimed 194 miles.

On first acquaintance after a full charge on a cold day, our Ioniq showed 171 miles of range, and that proved to be a true figure and more than enough for the commuter driving and routes the Ioniq is best suited to. When that range is depleted, the revised Ioniq Electric is faster to replenish than before thanks to an upgraded charging system.

Performance is brisk but not unruly in the way Hyundai's other electric car, the Kona Electric, is. While the two share a 291lb ft torque output, the Kona gets more power (201bhp plays 134bhp here). Yet the Ioniq's power delivery is much better judged and the car is much more drivable across all speeds.

This Ioniq forgoes the multi-link rear suspension of the hybrid versions in favour of a torsion beam to accommodate the lithium ion battery pack. As a result, it's not the most sophisticated car in the way it rides, being fine over smooth roads but crashy at lower speeds. That lack of sophistication extends to the handling, too. There's no dynamic sparkle here, with predictability the order of the day.

Everything about the Ioniq Electric seems done in the pursuit of efficiency. That brings good and bad: it's great fun eking out extra range by cycling through the steering wheel paddles to increase or decrease the level of regenerative braking, but the low-rolling-resistance tyres create significant roar at speeds to deny the Ioniq Electric the quiet, calm driving environment typical of its rivals.

You'll have to turn the radio up to drown it out and that radio is part of an upgraded infotainment system that's slick to operate and feature rich. Its modernity does jar slightly with the rather drab interior elsewhere, which majors on lots of dark plastics.

'Functional' is perhaps the best word to describe the Ioniq Electric. It's competent in all areas while being neither outstanding nor sub-standard anywhere. It's likeable for feeling so dependable, yet rivals shine brighter in other areas – including Hyundai's own Kona Electric.

MARK TISSHAW
@mtisshaw

Infotainment has been upgraded but the cabin ambience remains lacklustre

HYUNDAI IONIQ ELECTRIC

Improved efficiency increases the appeal and usability of Hyundai's EV but rivals have more dynamic flair

★★★½☆

Price	£29,450 (after government grant)
Engine	Permanent magnet electric motor
Power	134bhp
Torque	291lb ft
Gearbox	Single-speed reduction gear
Kerb weight	1475kg
0-62mph	9.7sec
Top speed	96mph
Range	194 miles
CO_2, tax band	0g/km, 16%
RIVALS	Kia e-Niro, Nissan Leaf, Renault Zoe

VOLVO V60 T8 TWIN ENGINE

Price £50,905 **On sale** Now
What's new? Rapid estate feels like Volvo's technological powertrain showcase and tops the V60 range until a Polestar-tuned version arrives

THOSE WHO FONDLY reminisce about the 150mph 850 T5 R of the mid-1990s will be drawn to the T8 version of the V60, which reprises the understated but supersonic Volvo estate theme, only in plug-in hybrid form. This time around, instead of a laggy five-cylinder brute, you get a turbocharged, supercharged 2.0-litre four-pot petrol mated to an electric motor that drives the rear axle.

This powertrain feels every bit the claimed 381bhp and 472lb ft in a straight line but is paired with a chassis that offers lots of competence but little driver satisfaction. Along with an uninspiring electric range of around 25 miles, it means the T8 V60, although impressive and very desirable, feels a little like the answer to a question nobody is asking. **RL**

★★★½☆

AUDI A6 ALLROAD 50 TDI QUATTRO

Price £50,600 **On sale** Now
What's new? A6 Avant gains considerable ground clearance and functions such as hill descent control, but it's no driver's delight

IF THIS IS the SUV epoch, a beefed-up estate like the air-suspended A6 Allroad seems a noble purchase. You're getting four-wheel drive, credible ground clearance, a colossal boot and a spacious cabin, and yet you don't need to shout about it.

Audi's brace of 228bhp 40 TDI and 282bhp 50 TDI mild-hybrid V6 diesel engines are also smooth, and only the economy-minded gearbox calibration detracts from an otherwise polished powertrain capable of delivering 50mpg on the motorway and effortless performance elsewhere.

As a 'tool' car, few do it better – except, perhaps, the pricier but more luxurious Mercedes All-Terrain, whose exceptional 400d powertrain is something of a wonder. **RL**

★★★★☆

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Kia Xceed

The latest Ceed has been well received, but Kia expects the Xceed to do even better

MODEL TESTED **1.4 T-GDi FIRST EDITION**

Price £29,195 ● **Power** 138bhp ● **Torque** 179lb ft ● **0-60mph** 9.3sec ● **30-70mph in fourth** 8.7sec ● **Fuel economy** 35.1mpg ● **CO_2 emissions** 134g/km ● **70-0mph** 59.0m

PHOTOGRAPHY LUC LACEY

We like

- More satisfying to drive than the class average, with good steering
- Attractive appearance gives the Xceed a good measure of personality

We don't like

- Low-speed ride exhibits hard edges, despite the raised ride height
- Expensive compared with some rival cars

If the design, ergonomics and credible dynamics of the most recent Ceed demonstrate that Kia should now be considered alongside any other European maker of mass-market hatchbacks, then the Xceed is the derivative perfectly tailored to the current tastes of European buyers.

And if that sounds like an exaggerated claim, consider this: half of car sales in the mammoth compact segment are now accounted for by crossovers of some description. The Xceed is therefore the car Kia would clearly be foolish to leave on the drawing board, and it duly ticks the boxes buyers in this class are looking for. Namely, the raised ride height and toughened-up styling cues but with C-segment dimensions, which remain manageable compared with mid-size SUVs such as Kia's own Sportage.

Shortly, we'll assess whether the Xceed has character to match strong credentials on paper, but it's also important to appreciate how important this model is for Kia's European business. The Korean brand is still a growing force over here, with its own factory in Slovakia and a design centre in Frankfurt that better allows it to tap into the specific tastes of local markets. Like so many rivals, however, in the coming years Kia will need to electrify its line-up with battery-electric and plug-in hybrid models, and at a time when buyers remain sceptical of the benefits such technologies can bring them.

In this respect, the Xceed is not only expected to bolster Kia's bottom line by becoming one of the strongest sellers in the Ceed range. It is also hoped that a familiar-feeling plug-in hybrid version introduced later this year will expedite the take-up of battery-equipped models in the Kia range and help the brand hit brutally strict CO_2 targets for 2020. Of course, if the basic product isn't up to snuff, an electrified version may prove academic.

DESIGN AND ENGINEERING

★★★☆☆

Kia describes the Xceed as a 'crossover utility vehicle', which is a term that has a vagueness to it bordering on tautology and hints that the increase in ground clearance over the standard Ceed hatchback is at best modest. In fact, the difference is only around 40mm, but because only the front door skins are carried over from the Ceed and even the headlights are new, the Xceed feels like an entirely fresh product.

Which, of course, it isn't. More generous body proportions beyond the rear axle mean the Xceed is 85mm longer than the Ceed and has a larger boot, but both cars are underpinned by Kia's recently developed K2 platform. The Xceed therefore benefits from independent rear suspension, albeit with a new 'dynamic damper' for the crossmember said to improve rolling refinement. The front struts are now also fitted with hydraulic bump-stops, which have allowed the spring rates to be lowered for further improvements in ride comfort. And in the same vein, Kia has increased the assisted level of the electric power steering, with the aim of making the Xceed easier to drive in town.

The powertrain line-up is also recognisable from that of the Ceed. In the UK, the Xceed will be offered with 1.0-litre and 1.4-litre turbocharged T-GDi petrol engines. For long-distance drivers, a 1.6-litre 'Smartstream' turbodiesel with a combined fuel economy of 57.4mpg is available, and engines will be paired with either Kia's in-house seven-speed dual-clutch automatic or six-speed manual transmissions. Meanwhile, the Xceed plug-in hybrid will use an 8.9kWh lithium ion battery and 44.5kW electric motor alongside Kia's 1.6-litre naturally aspirated Kappa engine.

Predictably, the driveline is somewhat more ordinary than the Xceed's wider body, chunky roof rails and utilitarian cladding for wheel arches and sills purport. There is no option for four-wheel drive, power and torque being delivered only to the summer-tyre-shod front wheels via an open differential. And while the Xceed has a drive-mode selector that can adjust steering weight, throttle response and gearshift →

Range at a glance

ENGINES	POWER	FROM
1.0 T-GDi	118bhp	£20,795
1.4 T-GDi	138bhp	£24,095
1.6 CRDi	114bhp	£22,045

TRANSMISSIONS

6-spd manual
7-spd dual-clutch automatic ■

The Xceed's trim walk is easy enough to understand, starting at '2' in the UK before moving up through '3' and First Edition models. Standard equipment is very good even at the entry level, though our test car's 1.4-litre engine only becomes available on 3 models. There are three engines to choose from: two petrols and one diesel. All of these units come with a six-speed manual gearbox as standard, though the 1.4-litre petrol can also be specified with a seven-speed dual-clutch automatic transmission.

Xceed is 85mm longer than Ceed sibling

● The top-spec First Edition Xceed sports a punchy wheel-and-tyre package, with 18in twin-spoke alloys and low-profile rubber. Despite the wheel-arch cladding and raised ride height, this car is built for the road.

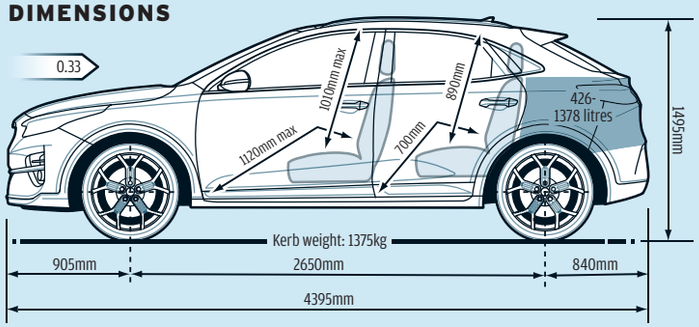
● Generously sloping rear hatch adds a dose of exoticism compared with the standard Ceed, and it's a design feature made possible by the Xceed's longer rear overhang. The wheelbase remains unchanged, however.

● 'CUV' status means a more aggressive front-bumper design, with a more prominent grille than the Ceed and a larger lower air intake. The LED headlights are also new, and are more rakishly swept back.

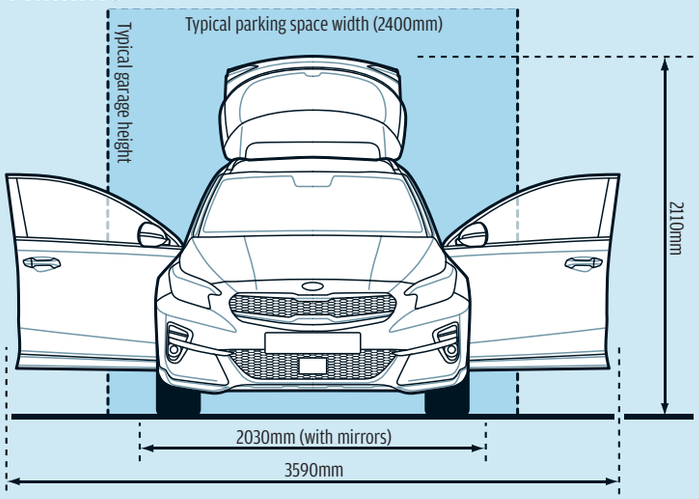
● Dual exhaust tips sit within the new silver rear valance. Why any 1.4-litre crossover needs such aggressive pipes is a matter for debate, but SUV buyer trends encourage extra visual impact.

Weights and measures

DIMENSIONS

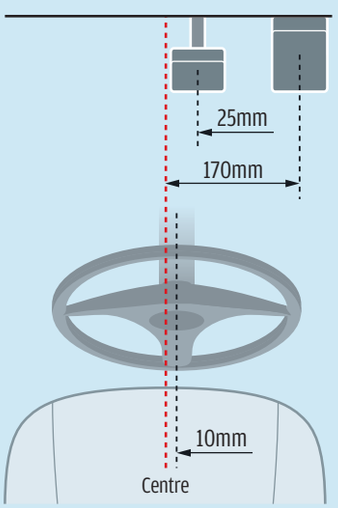


PARKING



WHEEL AND PEDAL ALIGNMENT

Brake pedal feels as though its mounted quite centrally, and there's a slight offset in the steering wheel, but neither compromises overall comfort.

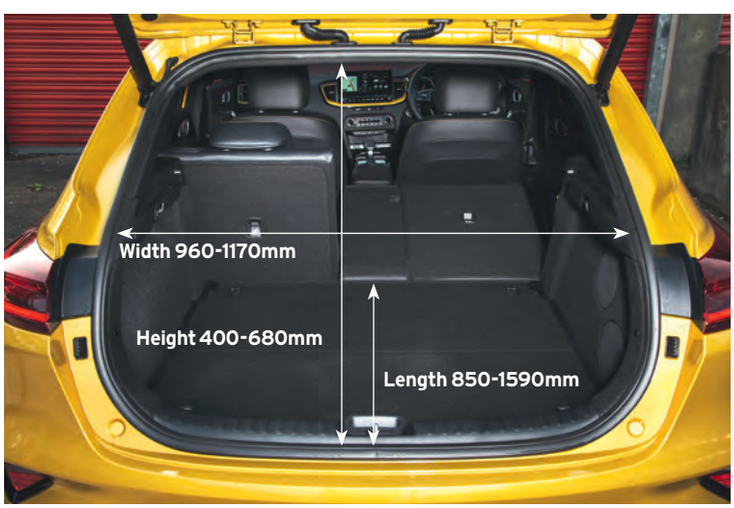


HEADLIGHTS

Automatic LED headlights work to great effect – beam strength and spread are considerable even on dipped setting. Automatic high-beam function works well enough, too.

● Contrasting yellow stitching is standard on First Edition models, matching the bold exterior and giving the cabin a likeable visual lift.

● Rear space is just okay. Taller adults will find their scalps in close proximity to the roof lining but should be comfortable enough.



● The rear bench folds down with a 60:40 ratio on standard Xceeds, liberating up to 1378 litres of space. On First Edition models, it splits 40:20:40 for more flexibility.

← characteristics, it goes without the electronics-based traction-enhancing systems found in some rivals.

INTERIOR

★★★½☆

In only 15 years, Kia has transformed its exterior design culture from one of often reprehensibly dull conformity to one that must, on occasion, draw envious glances from far more established European players. Quite the same cannot be said for the brand's interiors but, borrowing heavily from the Ceed, the Xceed's cabin still shows remarkable improvement, with a standard of perceived quality that must be a source of pride.

Even with some brightly coloured inserts on top-level models, this is a cabin that prizes robustness and sound ergonomics above feeling inviting or lavish. In the front, passenger space is generous and, adhering to the family-car brief, there are good storage options dotted around fittings made from a variety of plastics, some of which are soft to the touch, though many are not. So far, so Ceed – though the Xceed does come with the option of a new 12.3in TFT instrument binnacle and a 10.3in central touchscreen, both of which do their bit to lift the ambience.

Space along the rear bench is less impressive, and the difference in leg room between the Xceed and the class's larger hatchbacks, such as the Skoda Scala, is observable long before any road test tape measure need be deployed. The Kia's strength is that rear head room isn't noticeably compromised by the coupé-esque roofline and middle-seat passengers with longer legs will benefit from the almost perfectly flat floor. Boot space is also increased by 31 litres over that of the Ceed, to 426 litres – good if not exceptional by the standards of the class, and made better by the split-level floor and wide aperture.

Finally, while keen drivers are unlikely to queue up for the Xceed, it offers a decently adjustable driving position that's largely without vice, and the seats are generously bolstered.

PERFORMANCE

★★★☆☆

The Xceed's 1.4-litre T-GDi engine seems to major more on refinement and civility than any outright performance ability or charm. In low-stress environments, the motor is impressively demure, picking up from low revs and getting the car moving with little more than a barely audible four-cylinder drone. A useful spread of torque through the low and mid range is there to ensure progress is smooth and reasonably swift, while throttle response is suitably keen too. However, stray from this preferred means of operation and the powertrain's shortcomings begin to present themselves. →

● Uprated JBL sound system is standard on First Edition models. Sound quality is generally very good, although certain outputs can seem obscured at times.

● Wireless phone charging also comes as standard on top-flight models, as do heated seats and steering wheel to improve comfort levels in winter months.

● Steering wheel controls are laid out sensibly. Adaptive cruise control is handy, but can be a bit clunky in how it deals with stop/go traffic.

Multimedia system ★★★★☆

Uppermost 3 and First Edition specification Xceeds get Kia's new 10.25in touchscreen infotainment system as standard, while lower-rung models make do with the 8in unit that appears elsewhere in the Kia range.

Despite the new screen, the software itself will be immediately recognisable to those already familiar with Kia's products. The graphics are largely the same, if a touch sharper, while the operating system itself remains as intuitive and easy to use as ever. Generally, it operates in a slick, seamless manner, though it can take a while to properly boot up when you first turn the car on.

Standard equipment is typically comprehensive. Satellite navigation, Apple CarPlay and Android Auto preparation, DAB radio and Bluetooth connectivity are all present and correct, while First Edition cars also gain an uprated JBL sound system and a new 12.3in digital instrument cluster.

Chiefly, this is not an engine that enjoys being revved out – venture past 4500rpm and it runs out of puff at a fairly severe rate. Even so, on full-throttle-acceleration runs, the dual-clutch transmission seems hesitant to change up, instead preferring to allow the tachometer to spin up to near the redline before selecting the next gear. This prolongs those instances of breathlessness, and the nasal, droning noise the four-pot motor makes at these operating speeds isn't particularly endearing either.

The transmission reveals itself as something of a ponderous weak link during overtakes too. Put your foot down and it will change down in a reasonably snappy fashion, but it often seems to need to rifle through a few ratios before making a decision and allowing you to accelerate in earnest.

Speaking of which, with our timing gear rigged up, the Xceed managed to accelerate from 30-70mph (our indicator of real-world performance) in 8.7sec, and from 0-60mph in 9.3sec on a damp track. While the 0-60mph time is in step with Kia's 9.2sec claim, the 30-70mph time highlights something of a performance deficiency next to its more conventional hatchback rivals. The marginally more powerful Volkswagen Golf 1.5 TSI Evo we road tested in 2017 (an engine also available in the Volkswagen T-Roc) covered the same increment in 8.1sec, while the run from 0-60mph was half a second quicker than that of the Kia.

Finally, a brake pedal that doesn't always feel entirely consistent in its response comes as another – albeit minor – cause of frustration. It can feel vague and poorly defined before all of a sudden becoming a touch too grabby – though this is more of an issue at low speed than on the open road.

HANDLING AND STABILITY

★★★★☆

With its jacked-up ride height and more robust soft-roader aesthetic, any expectations of inherent sporting prowess aren't quite as pointed in the Xceed as they might be in the Ceed or Proceed. Nevertheless, while the Xceed might not be as immediately engaging or quick to react as its siblings, there remains a reassuring sense of sure-footedness and handling security about its dynamic character that puts it in good stead as a trustworthy family hatch – if not as a particularly exciting one.

With 2.5 turns between locks, its medium-paced steering makes for a front end that's responsive enough to inputs without feeling overly nervous or skittish, though the slightly contrived sense of weight common across the Ceed range still doesn't quite represent a convincing substitute for genuine contact-patch feel. That said, the consistency of its gearing allows you to guide the Xceed's nose through bends with plenty in the way of confidence and accuracy, though mid-corner bumps or uneven surfaces do result in a mild amount of jostling being transmitted back through the wheel.

As for front-end grip, the Xceed's 235/45 section ContiSportContact 5 tyres provide good bite, though you don't need to be driving particularly enthusiastically to approach the limit of their sticking power. That said, when that point arrives, the manner in which the Kia's nose begins to push wide is predictably gentle, while a lift of the throttle quickly returns the Xceed to its correct line.

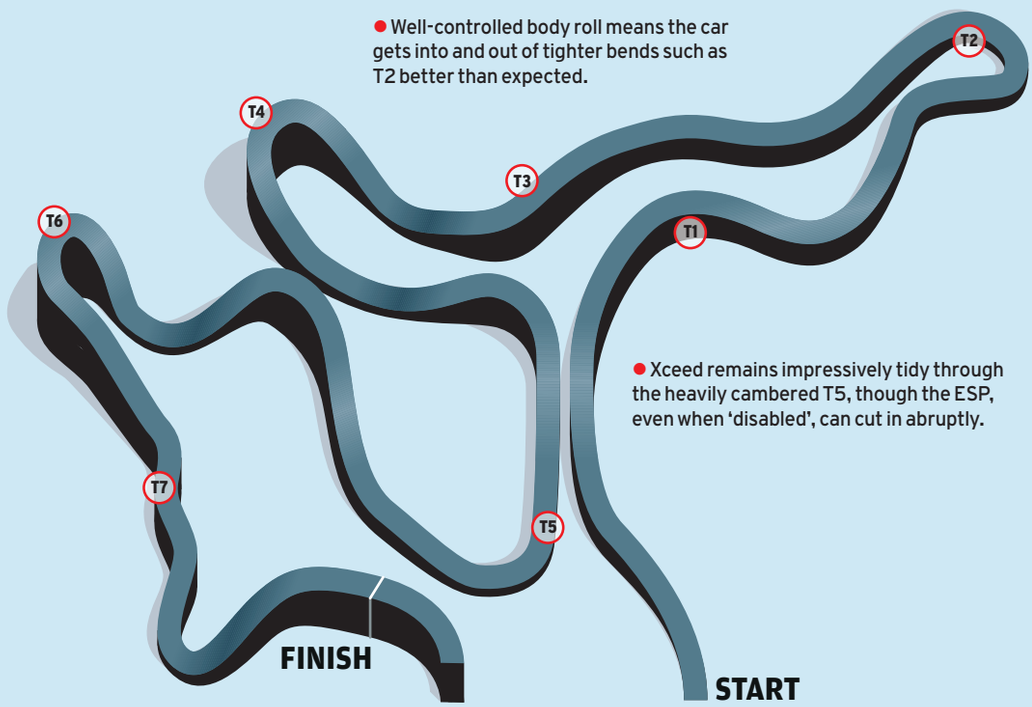
Body control is generally good,

● The top-spec Kia Xceed, around £10,000 more expensive than the Ceed we road tested last year, was also 0.6sec quicker from 0-60mph and 0.9sec faster from 30-70mph

Track notes

In a similar vein to Mazda, though not quite to the same extent, Kia is building a reputation for developing cars that handle with a little more verve than the class average. The Xceed is a case in point, and while it is still no Ford Focus Active in its sense of flow, there is a neatness to its body movements on the Hill Route at Millbrook that's underscored by good balance and accurate steering. In short, it is a surprisingly intuitive crossover to drive.

There is, of course, more body roll to contend with than you would expect to find in a low-riding hatchback like the Ceed, but the rear axle in particular feels well supported through compressions and quicker corners, and grip levels are good but not outstanding. In fact, it seems as though Kia has calibrated the car's electronic safety system to intervene earlier than necessary – an understandable strategy given the raised centre of gravity, but not actually needed.



too, if not quite as closely marshalled as in the Ceed hatch. On faster, flowing roads, the Xceed feels fluid and stable, staying tidy over undulations and through gentler corners. However, the lateral weight transfer that accompanies quicker directional changes isn't always quite as progressive or tidily controlled as you'd ideally like – though it's still far from confidence-sapping.

COMFORT AND ISOLATION

★★★½☆

The Xceed's ability to deal with challenging road surfaces doesn't always have the same level of polish as showcased by the best crossover hatchbacks in the class. Its elevated ride height does bring with it a good level of pliancy when moving at speed, which in turn affords the Xceed a controlled gait on faster, undulating country roads.

However, slow things down and things aren't quite as convincing. At town speeds, it can feel a bit too stiffly sprung, and the malleability present when travelling at pace begins to fade. While it would be a stretch to say it feels unsophisticated, a degree more grace here wouldn't go amiss. That said, the dampers' tuning seems pretty smart, and they work well to round off the sharpest impacts – although there's always a bit of thumping suspension noise on battered road surfaces. Particularly large ruts and bumps do test the limits of the Xceed's absorptive ability, however, and can often transmit a degree of kickback through the steering wheel.

Cabin isolation is more encouraging, although this seems to be more to do with an impressively demure engine than any uncanny immunity to wind and road noise – both of which make their presence known at open-road speeds. At idle, our microphone recorded a noise level of just 37dB, a reading that moved up to 67dB at a 70mph cruise. By comparison, the VW Golf 1.5 TSI Evo showed respective readings of 41dB and 69dB. However, at max revs in third, things level out – with both cars flashing up 74dB outputs.

BUYING AND OWNING

★★½☆☆

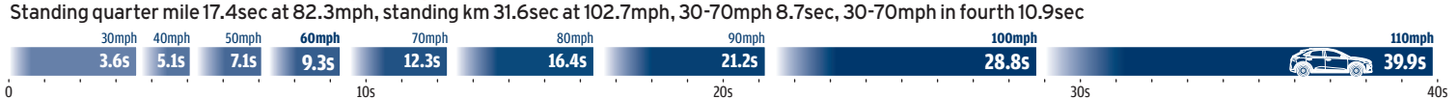
At just shy of £30,000, our top-spec First Edition test car is extremely well equipped but simply too expensive to recommend. The entry-level 2 model fitted with the less powerful 1.0-litre T-GDi engine and six-speed manual is a better option if the bottom line is your chief concern. It costs almost £10,000 less but still comes equipped with automatic lights, air conditioning and an impressive suite of safety technology. Mid-range 3 adds the new infotainment system, 18in wheels, heated seats and privacy glass, though the more spacious Skoda Karoq would be our preference at the price Kia asks for this trim level. It's also worth noting that the basic Ceed, though very nearly as versatile as the Xceed, also costs considerably less than its range-mate.

Elsewhere, the case for ownership isn't as strong as we had hoped. As discovered, the 1.4-litre engine tested here is impressively refined under low load but fails to deliver strong fuel economy, managing 47mpg at a cruise and falling to the mid-30s with a mix of everyday driving. It is also disappointing that only top trim levels get a five-star Euro NCAP safety rating. Standard versions without a safety pack have four stars owing to poor occupant protection in certain crash scenarios. →

ACCELERATION

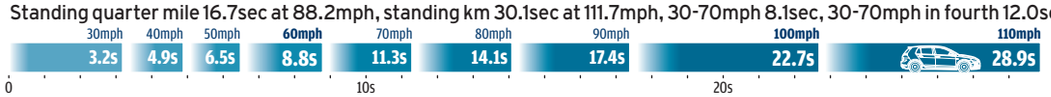
Kia Xceed 1.4 T-GDi First Edition (14deg C, damp)

Standing quarter mile 17.4sec at 82.3mph, standing km 31.6sec at 102.7mph, 30-70mph 8.7sec, 30-70mph in fourth 10.9sec



Volkswagen Golf 1.5 TSI Evo R-Line (24deg C, dry)

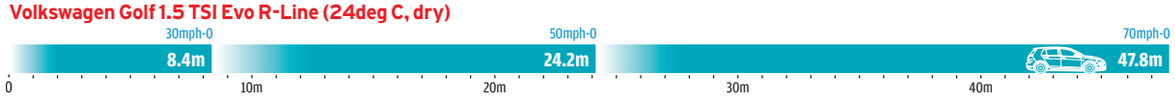
Standing quarter mile 16.7sec at 88.2mph, standing km 30.1sec at 111.7mph, 30-70mph 8.1sec, 30-70mph in fourth 12.0sec



BRAKING 60-0mph: 3.55sec

Kia Xceed 1.4 T-GDi First Edition (14deg C, damp)

Volkswagen Golf 1.5 TSI Evo R-Line (24deg C, dry)



Data log

KIA XCEED 1.4 T-GDi FIRST EDITION

On-the-road price	£29,195
Price as tested	£29,195
Value after 3yrs/36k miles	£12,000
Contract hire pcm	£319.25
Cost per mile	62.63p
Insurance	18A/£562

TYPICAL PCP QUOTE

37 months/36,000 miles £434.25

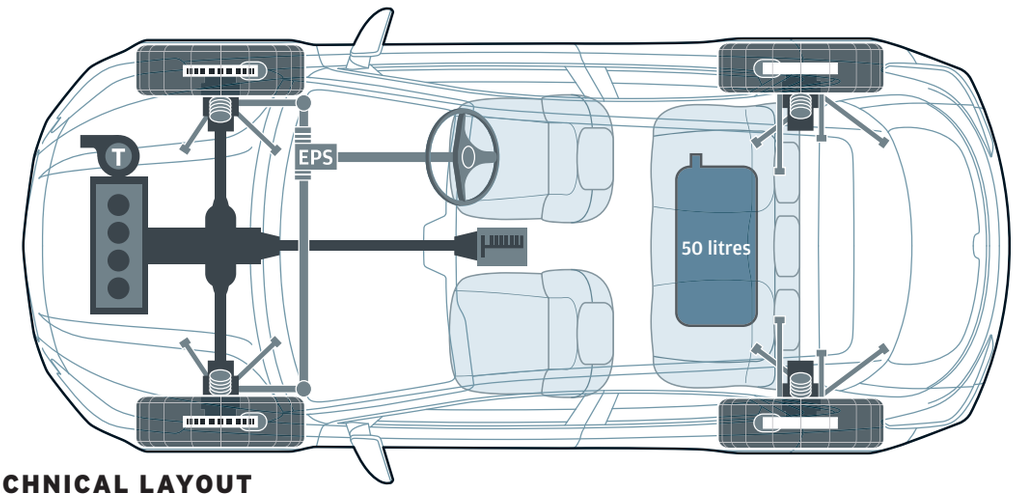
A customer deposit of £2919.50, along with a Kia contribution of £1250, will get you an Xceed for just under £435 per month on the above terms. Optional final payment stands at £10,989. Representative APR is 2.9%, with excess mileage charged at 9p per mile.

EQUIPMENT CHECKLIST

18in alloy wheels	■
Panoramic sunroof	■
Halogen headlights	■
Automatic LED headlights	■
Heated front seats	■
Heated steering wheel	■
Aluminium pedals	■
Dual-zone climate control	■
Adaptive cruise control	■
Smart Power Tailgate	■
JBL Premium sound system	■
Rear parking camera	■
Front and rear parking sensors	■
10.25in touchscreen infotainment including Apple CarPlay, Android Auto, DAB, Bluetooth, AUX, USB, MP3 and satellite navigation	■
Cloth and faux leather upholstery with yellow stitching	■

Options in **bold** fitted to test car

■ = Standard na = not available



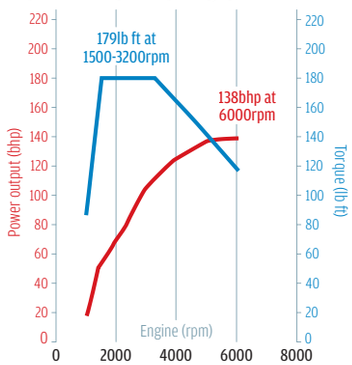
TECHNICAL LAYOUT

The Kia Xceed sits on the Korean firm's K2 platform, and utilises a MacPherson strut front suspension configuration with a multi-link arrangement at the rear. Compared with its Ceed range-mate, the Xceed's ride height is raised by up to 44mm. A 1.4-litre turbocharged four-pot is mounted transversely at its nose, driving the wheels through a seven-speed dual-clutch transmission.

ENGINE

Installation	Front, transverse, front-wheel drive
Type	4 cyls in line, 1353cc, turbocharged, petrol
Made of	Aluminium block and head
Bore/stroke	71.6mm/84.0mm
Compression ratio	10.0:1
Valve gear	4 per cyl
Power	138bhp at 6000rpm
Torque	179lb ft at 1500-3200rpm
Redline	6600rpm
Power to weight	100bhp per tonne
Torque to weight	130lb ft per tonne
Specific output	102bhp per litre

POWER & TORQUE



ECONOMY

TEST MPG	**Track**	21.6mpg
	Touring	46.8mpg
	Average	35.1mpg
CLAIMED	**Low**	32.1mpg
	Mid	42.8mpg
	High	47.9mpg
	Extra high	39.2mpg
	Combined	40.9mpg
	Tank size	50 litres
	Test range	386 miles

EMISSIONS & TAX

CO_2 emissions	134g/km (NEDC eq)
Tax at 20/40% pcm	£146/£292

CHASSIS & BODY

Construction	Steel monocoque
Weight/as tested	1375kg/1452kg
Drag coefficient	0.33
Wheels	7.5Jx18
Tyres	235/45 R18 Continental ContiSportContact 5
Spare	Spacesaver

TRANSMISSION

Type 7-spd dual-clutch automatic
Ratios/mph per 1000rpm
1st 3.93/4.3 **2nd** 2.32/7.3 **3rd** 2.04/11.2
4th 1.07/15.8 **5th** 0.82/20.5 **6th** 0.88/25.9
7th 0.72/31.7
Final drive ratios 4.643:1, 3.421:1

SUSPENSION

Front MacPherson struts, coil springs, anti-roll bar
Rear Multi-link, coil springs, anti-roll bar

BRAKES

Front 320mm ventilated discs
Rear 284mm solid discs
Anti-lock Standard, with brake assist
Handbrake type Electric
Handbrake location Switch on centre console column

STEERING

Type	Electromechanical, rack and pinion
Turns lock to lock	2.4
Turning circle	10.6m

SAFETY

ABS, ESC, LKAS, LFA, HBA, FCA, VSM, BAS, EBD
Euro NCAP crash rating 5 stars (Ceed)
Adult occupant 88% **Child occupant** 85%
Vulnerable road users 68% **Safety assist** 73%

CABIN NOISE

Idle 37dB **Max rpm in 3rd gear** 74dB
30mph 60dB **50mph** 64dB **70mph** 67dB

ACCELERATION

MPH	TIME (sec)
0-30	3.6
0-40	5.1
0-50	7.1
0-60	9.3
0-70	12.3
0-80	16.4
0-90	21.2
0-100	28.8
0-110	39.9
0-120	-
0-130	-
0-140	-
0-150	-
0-160	-

ACCELERATION IN GEAR

mph	2nd	3rd	4th	5th	6th	7th
20-40	2.7	3.6	-	-	-	-
30-50	-	3.8	5.0	6.6	-	-
40-60	-	4.4	5.2	6.7	8.8	-
50-70	-	5.5	6.0	7.2	9.6	12.3
60-80	-	-	7.1	8.1	10.9	14.5
70-90	-	-	8.8	10.1	12.3	18.1
80-100	-	-	-	13.3	-	-
90-110	-	-	-	-	-	-
100-120	-	-	-	-	-	-
120-140	-	-	-	-	-	-
140-160	-	-	-	-	-	-
160-180	-	-	-	-	-	-
180-200	-	-	-	-	-	-

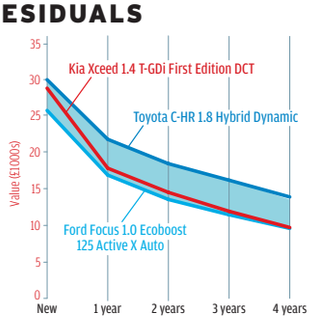
MAX SPEEDS IN GEAR

1. **28mph** 6600rpm
2. **48mph** 6600rpm
3. **74mph** 6600rpm
4. **104mph** 6600rpm
5. **124mph** 6600rpm
6. **124mph** 4789rpm
7. **124mph*** 3906rpm

* claimed

RPM in 7th at 70/80mph = 2205/2520

RESIDUALS



● Kia performs averagely here, outperforming the Ford but losing out to the Toyota by some margin.

AUTOCAR ROAD TEST

Read all of our road tests autocarmalaysia.com

VERDICT

★★★½☆

Looks good and drives well but lacks some practicality and polish

In a similar fashion to its Proceed sibling, the Xceed arrives as a bold signal of Kia's continued mission to be perceived as a bona fide upmarket brand. In many ways, this new compact utility vehicle hits that brief: its Stinger-esque front end and sharp creases give it the looks; it's incredibly well equipped; and cabin design and quality have gone from strength to strength. It's tough not to admire the once humble marque's lofty ambition and determination in this respect - but it's not quite there yet.

That's because the Xceed is still stumbling over pitfalls that have tripped its relations up in the past, and that you'd hope a near £30,000 car would simply skip over. The 1.4-litre T-GDi engine is quiet and refined during low-stress running but can't quite conjure the meaningful performance and outright flexibility you'd ideally like. Meanwhile, its handling is secure and flowing but fails to really engage meaningfully. And while it rides with reasonable fluidity at pace, it can struggle at lower speeds and on poorer surfaces.

But for these few niggles, the Xceed remains a likeable, recommendable crossover hatchback - if not an outstanding one.

Testers' notes

SIMON DAVIS
Brake pedal calibration at low speed is a bit odd, and you need to apply a bit more pressure than is ideally comfortable to stop yourself inadvertently rolling forwards. Auto hold has never been more welcome.

RICHARD LANE
The Xceed's got a lot more aesthetic character than the Ceed but, almost everywhere else you look, the basic hatch seems the better proposition. Mind you, even best-of-both options wouldn't tempt me out of the Ford Focus Active X.

Spec advice

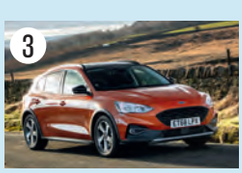
Obvious as it sounds, the best-value Xceed is the entry-level version, which is decently equipped for the price. The full 12.3in digital TFT instruments are only available on the First Edition model, however. Lesser ones get either a 4.2in or 3.5in alternative.

Jobs for the facelift

- Improve steering feel – there's a largely competent chassis beneath it all.
- Smarten up the dual-clutch transmission for quicker, smoother shifts.
- Engineer more character and flexibility into the 1.4 T-GDi.

ROAD TEST RIVALS

Verdicts on every new car, p82

	1	2	3	4	5
					
	SEAT ATECA 1.5 TSI EVO XCELLENCE DSG	**VOLKSWAGEN T-ROC 1.5 TSI EVO SE L DSG**	**FORD FOCUS 1.0 ECOBOOST ACTIVE X AUTO**	**SKODA KAROQ 1.5 TSI SE L DSG**	**KIA XCEED 1.4 T-GDi FIRST EDITION DCT**
	Sweet to drive and practical, too, owing to its more conventional SUV shape. Still the standout in this class.	Sacrifices some practicality to focus more on hatchback-style handling, but is all the better for it. Looks the part too.	Handles like a slightly raised Focus, which is no bad thing. Interior quality is a bit weak and engine could be stronger.	Practical, competent and secure in its handling, the Karoq is an excellent box-ticker. It falls flat on character, though.	Top-flight Xceed looks the part, but is slightly outgunned by its more upmarket rivals at this price point.
	★★★★½	★★★★½	★★★★☆	★★★½☆	★★★½☆
Price	£28,765	£27,300	£26,595	£27,500	£29,195
Power, torque	148bhp, 184lb ft	148bhp, 184lb ft	123bhp, 148lb ft	148bhp, 184lb ft	138bhp, 179lb ft
0-62mph, top speed	8.6sec, 123mph	8.4sec, 127mph	10.3sec, 122mph	9.0sec, 126mph	9.4sec, 124mph
CO_2, economy	124g/km, 38.7-40.9mpg	124g/km, 40.9-41.5mpg	116g/km, 37.7-42.8mpg	123g/km, 39.2-41.5mpg	134g/km, 40.9mpg

MANY HAP

The 31st running of Britain's Best Driver's Car pits our reigning champion, the McLaren 6

WATCH THE VIDEO
autocar.co.uk

BOWLER BULLDOG V8 SC
Price £180,000
Spec highlights 567bhp, 1800kg, 4.0sec (est), 130mph
WHY IT'S HERE We love it because it's totally mad, brilliant at what it does – and because it proves how many different routes there are to fantastic driver appeal

RENAULT MEGANE RS TROPHY-R
Price £51,140
Spec highlights 296bhp, 1306kg, 5.7sec, 163mph
WHY IT'S HERE Because it's just about the hottest and maddest of hatchbacks that we've seen this year – or, arguably, ever

MERCEDES-AMG GT 63 S 4MATIC+
Price £135,615
Spec highlights 630bhp, 2045kg, 3.2sec, 196mph
WHY IT'S HERE It's our favourite fast, four-wheel-drive GT of the moment, and one of our favourite AMGs as well

MAZDA MX-5 30TH ANNIVERSARY
Price £28,095
Spec highlights 181bhp, 1124kg, 6.5sec, 136mph
WHY IT'S HERE Here as our Best Affordable Driver's Car shootout champ, flying the flag for the little guy – and expected to do so in some style

PORSCHE 911 CARRERA S PDK
Price £93,110
Spec highlights 444bhp, 1590kg, 3.7sec, 191mph
WHY IT'S HERE No new car gets into BBDC on reputation alone – but if it did, an all-new Porsche 911 would

DALLARA STRADALE
Price £143,500
Spec highlights 395bhp, 895kg, 3.3sec, 165mph
WHY IT'S HERE Because it's the best new dedicated track car we've driven all year

PY RETURNS

oLT, against some familiar foes – and a Bowler Bulldog PHOTOGRAPHY LUC LACEY, OLGUN KORDAL

THE JUDGES

ANDREW FRANKEL
Senior contributing writer
Autocar's Handling Day don is the only bloke who could have written this year's extra-special anniversary denouement. Always the first one out of the pit lane; didn't pull a punch in the ensuing debate. An example to all present.

MATT PRIOR
Editor-at-large
Everyone's favourite tester and columnist deployed his votes with characteristic care, guided the chat and steadied the mood in the pit lane as gently and expertly as ever, and also made a few videos for our YouTube channel that you might like to watch.

MATT SAUNDERS
Road test editor
Arrived late, left early, threw his (considerable) weight around and achieved little, as ever – except for setting some benchmark lap times. Still, making an Ariel Atom go faster than a McLaren 'longtail' isn't too bad a result for a not- so-idle Tuesday.

RICHARD LANE
Road tester
Did such a great job with his report from Junior Handling Day that we nominated him to write a big chunk of this test. He was delighted. Also insisted that apples be included among the confectionery in the afternoon snack catering. That's millennials for you.

SIMON DAVIS
Road tester
Like Lane, was judging at an Autocar Handling Day for the first time, and treated the occasion with due seriousness. Looked like he might be enjoying himself at one point when driving something without a roof, but that could have been the light.

JAMES DISDALE
Road test contributor
Our go-to freelance road tester brought with him plenty of experience of similar giant tests in other car magazines on his Handling Day debut. Duly agreed that BBDC tops them all – not least because we were paying him to.

MAURO CALO
Special correspondent
About the closest bloke to Frankel in the "I've been to more of these than you've eaten KitKats" handicap chase, so we thought it was about time he had a vote. Did so many skids, he actually pulled a muscle.

A numbers-heavy proposition, if I may: across four days, 10 new cars, plus one winner from this feature last year, are considered for Britain's Best Driver's Car 2019. Each is awarded a score out of 50 points, evenly split between road and track, independently by seven judges, so the car that finishes nearest to 350 points wins. Yet more numbers will appear in the form of lap times, for reference, and there will be spec sheets, too, but those numbers don't constitute part of the judging.

And that, for the duration of our annual BBDC tournament, are the only numbers that matter. The numerals of price, power, capacity, consumption, outright speed, g-force and yet more absolutes are all secondary to feel, balance and feedback. And, above all, fun.

BBDC – Handling Day, informally – has had the same ethos in each of its 30 years. (Later on these pages, we'll see how some previous winners stand up today.) When modern cars are capable of posting extraordinary acceleration, top speed, grip and lap-time numbers, that ethos is more relevant today than ever. Simply, do they make us smile?

The McLaren 600LT did last year, so it returns to defend its title. This year, it goes up against these: the Ariel Atom 4, Bowler Bulldog, Dallara Stradale, Lamborghini Huracán Evo, Mazda MX-5, Mercedes-AMG GT 63 S, Porsche 911, Porsche Cayman GT4, Renault Mégane RS Trophy-R and Toyota Supra.

It's worth repeating that these are, already, the best cars of the year: any one of them is terrific company. But even so, there's got to be a winner. A top – if you'll excuse a last number – one. **MP**

30 YEARS OF BBDC

LET BATTLE COMMENCE

We start out with 11 cars, but only three can survive. **Richard Lane** takes up the mantle

If you think the glittering world of Formula 1 racing and Autocar's annual showdown of the finest new driver's cars have almost nothing in common, you're right. And yet just like in F1, to stand any chance of winning the mammoth group test informally known as Handling Day, your first order of business is to beat your team-mate. That is, your closest rival in terms of layout, performance and – though it shouldn't strictly matter – price. Take the McLaren 600LT and the Alpine A110. Last year they competed for victory but only after dispatching the Porsche 911 GT3 RS and BMW M2 Competition respectively. Pairing cars off early in proceedings also helps us judges refine our thinking during the daunting task of ranking so many models on both road and track. Best to break the field down into relatable blocks then cut loose stragglers before the more complicated cross-species battles begin.

Except that, looking down an Anglesey Circuit pit lane at this year's spectacular batch of machinery,

Reigning BBDC champ knows these Welsh roads well

There are hot hatches and then there's the unhinged RS Trophy-R

The 630bhp GT 63 S looks set to gobble up our 181bhp MX-5

I cannot pick out a single obvious pairing. Two of the cars cost about £70,000 and neither makes any effort to hide its track-day intentions, but the new Porsche 718 Cayman GT4 and Renault Sport Mégane Trophy-R otherwise have about as much in common as a Dobermann and a dachshund. As is tradition, last year's winner, the phenomenal 600LT, is recalled to defend its crown, and yet it's hard to imagine a more divergent take on the 592bhp mid-engined supercar than the new four-wheel-drive Huracán Evo. This car has taken Lamborghini to uncharted levels of technological sophistication and seems to prize personality above purity in a way that would have Ron Dennis foaming at the mouth.

It goes on. There is the Dallara Stradale, another Italian exotic of bottomless pedigree but bereft of any direct rival, though you could just about pit it against the product of an idiosyncratic Somerset firm founded only in 2001. The fourth-generation Ariel Atom is similarly radical in concept to the Dallara and, no, neither car has doors, but culturally these machines are still miles apart. And as crazy as it sounds, the closest genetic relation to the brilliant '992' Porsche 911 Carrera S is Mercedes-AMG's equally brilliant four-door GT 63 S. Or is it the GR Supra? Nothing is clear. But being front-engined, rear-driven, balanced and compact on the road, Toyota's resurrected icon had to be here. Rounding out the field are Mazda's MX-5 and Bowler's unmissable Dakar refugee, more on which in a moment.

The takeaway is this: almost every nook of the modern-day performance spectrum is represented by these 11 cars, and all bets are off. It's one of the most open-ended contests in the 30-year history of Britain's Best Driver's Car, with serious cachet on offer for the eventual winner, but we first need to whittle them down to three for the final shootout. And what better way to get things going than with a car that since its arrival three decades ago has remained faithful to the original's driver-centric philosophy?

"This is almost everything I want in a driver's car and in a pint-sized package," says Andrew Frankel of the MX-5. This example is in blazing-orange 30th Anniversary trim, with marginally stiffer Bilstein suspension than usual, a mechanical limited-slip differential and Mazda's new naturally aspirated 7500rpm 2.0-litre engine – truly a peach of a motor. At Anglesey, and on the roads of Snowdonia, it's the car everybody wants a crack in first, quickly showing why it remains a benchmark for accessible handling thrills with little threat of serious spills. The £28k Mazda is also an ideal palate- →


Christmas came early for our road testers

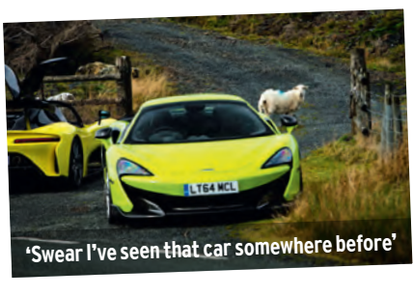

Yep, the Bulldog will have that effect on you

Do not adjust your mag – the Bowler doesn't do gravity

BOWLER BULLDOG V8
It's totally barmy. The noise is incredible, and arguably worth the price of entry alone. Every time you crack open the throttle, you laugh out loud. At least I assume you do, because you can't actually hear anything above the exhaust. Surprisingly precise on the road, allowing you to pick a neat line. **JD**

MAZDA MX-5 30TH ANNIVERSARY
Almost everything I want in a driver's car in a pint-sized package. The basics: light, normally aspirated, manual, rear drive. The detail: superb gearshift, well-matched control weights, consistent brake feel, even torque delivery. But most of all, it's the balance. Most modern cars don't handle like this any more. **AF**

> "It's the car everybody wants a crack in first and remains a benchmark for accessible handling thrills"



'Swear I've seen that car somewhere before'

cleanser before the corrupting influence of big tyres and easy-access torque arrive with price tags to really make one pause for thought.

"Simple still works, doesn't it?" says Matt Saunders. "Doesn't matter a jot that it's got only 181bhp, because the grip level matches it perfectly." And by 'perfectly', he means manageable, keep-you-on-your-toes roll-oversteer and just enough thrust in reserve to sustain generous slides on track. It's a car that invites you to take aim at the apex of a corner then splice through it at amusing angles, like the sports racing cars at the Goodwood Revival. Some judges find the short chassis a touch nervous at the rear and still too soft on track, but on the road the Mazda is uninhibited fun with neat control weights, good balance and totally transparent responses. Never before has anything followed up victory at Britain's Best Affordable Driver's Car, informally known as Junior Handling Day (28 August), with dominance at Handling Day proper. Genuinely, this could be the year.

So long as the little roadster isn't crushed by the most fearsome machine we've ever had the pleasure of hosting. The Bulldog looks like a rally-prepped Defender but is actually a bespoke silhouette rally-raid racer with lightweight panels, an exceptionally rigid rolling chassis built in-house in Belper and the 5.0-litre supercharged V8 powertrain from Range Rover's SVR catalogue. With its side-exit exhaust sprouting mere feet beneath the Perspex driver-side window, it's also loud enough to drown out the Huracán – itself a feat surely deserving of an award. Nobody believes it will win this contest because its métier is on gravel tracks and sand dunes, but the fact stands: somehow, this 567bhp Defender can handle.

Mixed performance on track put 718's top-three prospects in jeopardy


You can see the Bulldog coming a mile off – and hear it long before that


Pet Shop Boys tribute act still needs work

Extreme Mégane brought to mind the BMW M4 GTS, for good and bad reasons


They're nearly as good to look at as to drive

GR Supra's taciturn steering didn't do wavy Welsh B-roads justice

"Can't help but love the long-travel, any-bump-at-any-speed ride, and how precise and delicate the steering is despite the heavy-duty character," says Saunders, who, emerging from the Bulldog's caged and harness-laced innards like a badger from its darkened sett, is so clearly in his element it's hard not to crack a smile. "No shame that it's tail-end Charlie here – in its own totally inimitable way, it's utterly brilliant." But if progress on the road is unexpectedly precise – and once you're comfortable with the Marc Márquez lean angles, also amazingly secure – on-track progress is at best unfinessed, not least because the differentials are clearly tuned for muddier environments. And there is, to nobody's surprise, a fair bit of understeer with which to contend. But as Matt Prior notes, you could miss your turn-in utterly and carry on across the grass at exactly the same speed. The Bulldog will eventually finish 11th, but in the process secure its place in just about everyone's lottery-win garage.

By now, opinions from the seven judges start filtering through from elsewhere. The 911 is demonstrating its hallmark breadth and ability. Words like 'agile' and 'composure' abound following the road routes, and considering the 992 can come across as feeling heavy and lacking a little in delicacy, just about everyone is taken aback by how adjustable and accurately it handles on track – where, with the shackles removed, it feels decidedly old-school 911. The pillar of the Porsche brand since 1963 has an unmatched record at this event, and predictably the 992 is already at the sharp end of the scorecards. "It's one car that feels at home everywhere," says James Disdale.

Except that, if the 911 is to be toppled in 2019, its conqueror could well be one awkwardly close to home. 'Smash hit' barely does justice to the original Cayman GT4 of 2015, and this year's reprise hits the same high notes with its naturally aspirated 4.0-litre engine, manual gearbox and a degree of seriousness exemplified by the clinking of rose joints as the rear axle glides over Catseyes. And boy, is it good on these Snowdonia roads. For a mid-engined lightweight of usefully modest footprint, the new GT4 delivers jaw-dropping stability →

The Atom makes you feel at one with your surroundings

then overlays it with detailed steering of delirious accuracy and at times extraordinary delicacy.

"So involving," says Frankel. "I love the gearshifts, the steering linearity – its gearing, and the size and feel of the wheel, all of which is indicative of this car being designed by people who really get it." Simon Davis echoes the sentiment, and talks of a supremely coherent package, even if the pedal positions are not quite as perfectly placed as they are in the Mazda. For me, it's the ever-present sensation that the GT4 is perfectly distributing its mass between the balls of its feet, which in this case are the contact patches of four sensibly sized Michelin Pilot Sport Cup 2 tyres.

With the possible exception of the McLaren 600LT Spider – a sublimely communicative supercar that, only one year on from overall victory, really ought to make the final trio – the junior Porsche is the finest road car here. Which is why it seems all the more surprising that it will go no further. To a man, we all expected the Cayman to raise its game higher still on track, but it doesn't. Lap times aren't so important at Handling Day but it says something that the twin-turbocharged but heavier and more conservatively tyred Carrera S pips its sibling against the stopwatch. What it says is that the GT4 doesn't develop enough front-axle grip during turn-in and mid-corner to fully exploit its layout. One has to wonder whether this new engine, which is effective but lacking in torque and often bland on the ears, also holds it back in subjective terms. And though Porsche regards cog two as a go-to driving gear, most of us find the ratios too widely spaced. In the end, it's out. Talk about an upset.

The wild Mégane Trophy-R finds a similar fate. Several judges recognise shades of the sometimes electrifying but too often flawed and unpredictable BMW M4 GTS in the carbonfibre-wheeled Renault. And in fairness, what it does well, it does like few others can. It has composite body panels and so little weight to tug it off your chosen line that every inertia-free direction change is nothing short of breathtaking. I'd go as far as to say that, point to point along these Welsh roads, there's little to touch it here, so long as you can assert your will on the chassis – though this is more easily said than done. The front axle is particularly vulnerable to deflection and the suspension indecently stiff at times, and yet on track it lacks the balletic poise of its forebears. Misconceived? Just a bit.

"I want it to feel more like an old RS hot hatch on track and less like a lap-record car," says Saunders, who speaks for everyone when he adds that the off-the-shelf 1.8-litre turbo and manual gearbox don't justify the exorbitant price, either. In the end, not even a rear diffuser that looks as though it was ripped from a Lamborghini concept car can save the likeably hardcore but strangely unfulfilling Trophy-R from its eighth-place exit.

You'll need £500k for a driveway like that

Cayman served up a B-road masterclass. But was it enough?

Our evidence suggests brilliant driver's cars don't need doors

"The deeply uncompromising Dallara will do things on track the others simply cannot"

DALLARA STRADALE
A great track car, with a few flaws. One of them is the robotised manual's shift, the other is the brake feel, which is a pity because, otherwise, this is a fabulous thing. I like its road ride too. Steers well. Terrific. But too much money, to be honest. **MP**

And so to the Huracán Evo, a fighter jet on wheels whose demonic V10 almost fires it back onto the finish straight before the aural onslaught delivered at the far side of the circuit has even washed over the pit complex. What a character, but modern Lamborghini represents something of a conundrum for the car enthusiast and it's a conundrum encapsulated by the Evo.

The 5.2-litre naturally aspirated engine and dual-clutch gearbox are a match made in heaven, no question. In fact, this powertrain is by far the best we have here, and arguably the best on sale. However, while four-wheel steering and torque vectoring have given the revised Huracán the sort of agility even the Gallardo could only dream of, unlike in the Carrera S these technologies muddy the waters of communication between chassis and driver. Moreover, at what are admittedly stratospheric limits, the chassis still wants to understeer. And worse still, there's very little the driver can do about it other than back off and let some neutrality waft back in. Overly firm ride aside, the Lamborghini can come across as a fabulous road car, but on track it is further stymied by over-servoed brakes, nervous steering and the least transparent, malleable chassis here – all of which could be remedied, one feels, without incurring major R&D expense, because the consensus is that the underlying hardware is extremely capable. As it is, Disdale reads my mind when he wonders how a manufacturer that gave us the Performante could suddenly take such a backwards step. Were it not →

See what our timing gear recorded on p59

The full spectrum of performance cars was on display at Anglesey

> Both the Supra and the AMG love to go sideways. The GT 63 S is nothing short of an exhibition

AMG's 2045kg muscle car showed improbable dexterity on track

MERCEDES-AMG GT 63 S
A prime example of why you shouldn't judge a book by its cover. This car has no right to change direction with such incisiveness and energy when it's as long and heavy as a pick-up truck. The steering takes a bit of getting used to but becomes more and more intuitive as you pick up pace. **SD**

← for the more forgiveable flaws of the Bowler, the Lamborghini would have finished stone-cold last.

Conversely, it's difficult to imagine a manufacturer taking a more decisive step forwards than delivering its first road car in almost half a century of existence. The Dallara Stradale is a carbonfibre-monocoque, carbonfibre-body, double-wishbone track-day titan built in the mould of an old prototype racer, only bleeding edge in its execution. It is deeply uncompromising and fiendishly expensive but, for a very small community, its emergence will be a very big deal.

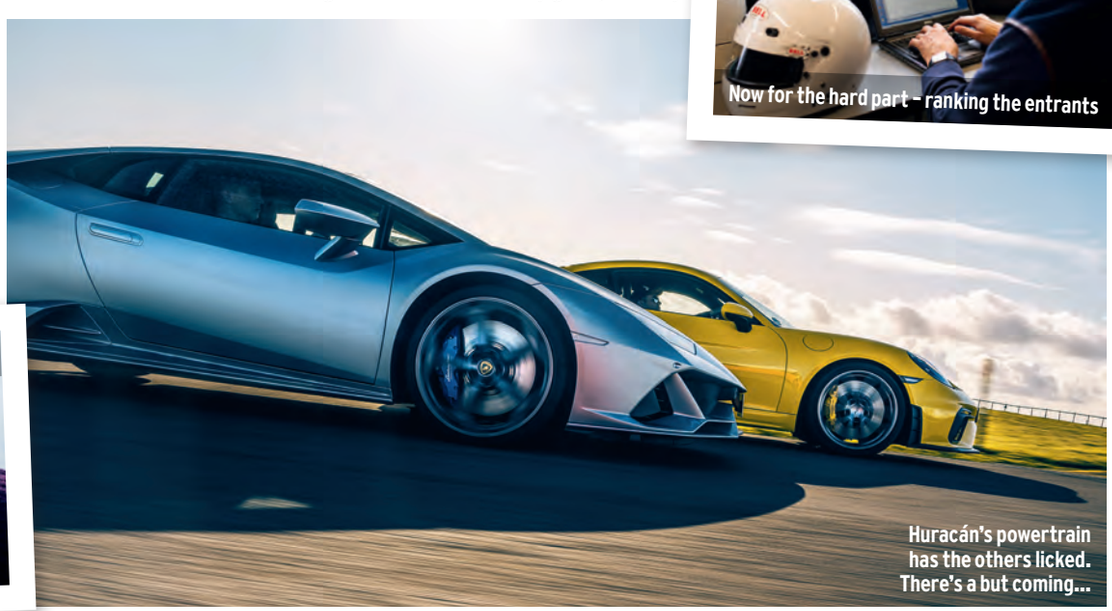
And, as Frankel observes, it will do things on track the others simply cannot, summoning unshakeable composure through fast corners like Church thanks to the exquisitely accurate, feelsome steering and palpable aerodynamic downforce. Nevertheless, talk of an overall win is short-lived. On the road, it fails to get under the skin of most judges, the brakes again feeling over-servoed and the robotised manual gearbox stilting progress.

"Very special on track when it's really working," says Saunders. "It becomes drivable and balanced, and tactile and forgiving and so quick, which it isn't on the road." Were this contest based solely on track, the Dallara would earn a guaranteed podium. As it is, it finishes sixth, leaving its mark by way of easily the quickest lap time and a driving experience few will ever forget.

Meanwhile, both the Supra and the AMG love to go sideways and as everyday options one could do a hell of a lot worse and not much better in their respective classes. The GT 63 S is particularly impressive – nothing short of an exhibition in calibrating chassis electronics to shrink an enormous car, and with barely a hint of artifice. Its rasping 4.0-litre twin-turbo V8 is also an endless source of amusement and is paired with nigh-on flawless suspension rates for road use. But although it's a fine representative from the world of big-boned family muscle cars, for obvious reasons this 2045kg AMG is also outboxed on days like today. And though the Toyota demonstrates fantastic beyond-the-limit balance and a likeably robust powertrain, the experience is undermined by the total dearth of steering feel and lethargic direction changes. Both cars are very good, but only something exceptional will get you into the top three.

With both the Cayman GT4 and the affordable, addictively fun MX-5 – without doubt our moral victor – just falling short, that's a clique consisting of the 911 Carrera S, the 600LT and... the Atom. I know: so far we've said almost nothing of the fourth-generation Atom. Let me assure you, that's about to change. →

Now for the hard part – ranking the entrants



Huracán's powertrain has the others licked. There's a but coming...

Will 911 Carrera S finish up on top of the pile?

THE FINAL THREE

Can the Atom or the 911 depose our reigning champion? **James Disdale** reports

There is a palpable sense of tension in the room as Matt Saunders taps away at the ageing Dell, each keystroke entering one of the judges' scores, and thus sealing the fate of another of our contenders. We'd hammered out the hard miles on the road and pounded around the picturesque roller-coaster of Tarmac that is Anglesey Circuit, but now we are going to find out exactly which cars made the grade in 2019.

I'm not going to reveal our champion here (be patient, it's coming) but, if you've read this far, you already know the shape of our top three. However, what you won't know (unless you've flicked ahead to read the scores, spoilsport) is just how closely marked our triumphant trio are, and how far ahead of the rest they finished.

To give you an idea of how tight it is at the top, a mere nine points separate first from third, but a gap of 12 points between the bottom of the podium and fourth place. What's more, all but two of our judges put this trio in their own top three, and those who didn't placed two of them in their personal triumvirate. While in previous years you could have had any one of four or five cars forcing their way onto the podium, in 2019 the result was emphatic.

Leading the charge is last year's winner, the magnificent McLaren 600LT, back for another bite of the cherry and the chance to join an elite band of back-to-back victors. But not if the astonishing Ariel Atom 4 has anything to do with it. Previous versions of the scintillating spaceframed sportster from Somerset have come close, but none had the breadth of ability of this latest offering. And then there's the Porsche 911, the evergreen rear-engined machine still hitting high notes after six decades.

We'll start with the McLaren, however, because, as our defending champ, it's the known quantity – the one with the target painted large on its aerodynamically honed rump. What's immediately clear is that the passing of 12 months hasn't diminished the Woking Wonder's appeal. Andrew Frankel speaks for most of us when summing up the 600LT: "Just so sensationally good everywhere," he muses. "When cars are this fast, it's all about →

Not much separates our top three – just nine points, in fact

confidence and I'm as confident driving this fast as I am the Mégane. Some might say it lacks character as a result, but for me it's as good this year as last."

As you'd expect, the Macca makes most sense on the track – this is a car built by a company steeped in motorsport tradition, after all. Around Anglesey, the 600LT is a car that rewards precision and commitment, getting better the harder you push it. With temperature in the tyres, there's tons of turn-in bite, while the car's ability to cope simultaneously with heavy braking and steering input leaves you slack-jawed in amazement.

Sure, it's not as expressive as some here, or as willing to play the apex acrobat, but it's a more engaging and natural companion than some of the firm's more aloof models. The hydraulically assisted steering is rich with feedback, while the smooth transition from slip to grip is faithfully broadcast to your bum and fingertips.

You do need to pedal it the way McLaren intended to get the best results, however, as Matt Prior points out: "It's great as long as you drive it its way, but I don't always like its way. Understeer, turbo lag, then lots of oversteer. So it's pushy often and loose sometimes. So close to brilliance."

On the road, it's the on/off boostiness of the industrial-sounding motor that's the frustration but, in all other respects, the 600LT manages to deliver sensorial rewards even at sane speeds (whisper it, but the Spider's drop-top configuration plays its part here, literally opening you up to even more on-the-move sensations). And then there's the mind-boggling damping that's both supple and supremely controlled – this is a true blue-blooded supercar, but one that's easy to live with. Almost as hassle-free as the 911.

In many respects, it's a surprise to see the Porsche finishing so high up, particularly in 'ordinary' Carrera S guise, and especially after it initially succumbed to the critical rite of passage that awaits every all-new 911 – namely that it's now too big and that it's been stripped of yet another layer of driver involvement. As Saunders noted: "A very, very good sports car by just about any reasonable measure, but it felt a little bit larger than I'd have liked it to on the road, and didn't quite communicate as clearly or vividly at normal speeds."

Not as raucous or compact as before, but a 911 still thrills

PORSCHE 911 CARRERA S
A bit 'Merc SL' on the road these days, but great handling on a circuit. Steers with a really nice oily slickness and has a great chassis through second and third gears particularly. Gives you options. Lovely. **MP**

A hot lap in the Atom is a draining but supremely rewarding experience

600LT is a track car first but entertains its driver on any surface

> "This 600LT is a true blue-blooded supercar, but one that's easy to live with"

He's right, of course – there is fractionally less chatter through the helm than before – but as Prior points out: "It steers with a really nice oily slickness." It's not the quickest rack in the world, but it delivers a delicious rate of response, allowing you to load up the front tyres just so, while the optional rear steer adds twinkle-toes agility. And if the 444bhp flat six doesn't sing as loudly and sweetly as before, it makes up for it with a hefty punch (the near-seamless eight-speed PDK is pretty sensational too) that makes you wonder why you'd ever need the extra muscle of the Turbo or Turbo S.

Yet it's at the circuit that the 911 earns its greatest plaudits. "With its blend of traction and adjustability, it's amazingly adept," suggests Richard Lane after one of many, many forays around Anglesey in the 911. Frankel is equally effusive, and particularly impressed at how a road-biased 911 bests the allegedly track-hardened Cayman: "Less understeer, more easily accessible and controllable oversteer. And all on standard street tyres. Very, very little not to like here."

The harder you push it, the more it rewards – the thrills increasing in proportion to the loads being put through the suspension. The 911 gives you options too – plenty of them. If you want to drive a nice and neat game of 'hunt the apex', then the grippy, stable and precise Porsche will happily oblige. You fancy something a little looser? With the stability switched off, the four-wheel-steered Carrera S can be backed into almost any corner and oversteer all the way from entry to exit. Yes, it's a bit of a hooligan, but it demonstrates the 911's impressively wide operating bandwidth.

The Ariel Atom 4 doesn't really do bandwidths: it's more of a total sensory overload sort of machine, particularly if you take it for a drive on the road without a helmet, where you're assaulted not just by the elements but also the deafening whistle, whine and chatter of the turbocharger and its ancillaries. It's an incredible noise, like being chased by an X-Wing fighter that's firing its laser cannons non-stop.


Testers' laptop is nearly as old as BBDC itself

It's a physical piece of kit too. Not only is it the only one of our trio with three pedals, it also eschews assistance for the chatty steering and the powerful, feelsome brakes. Technology is limited to variable control of the traction control and turbo boost. On the whole, it's just you, the Atom and whatever stretch of Tarmac you place it on. It all makes for sensational results, as Saunders reveals after taking some time to process his stint behind the wheel: "Physically challenging but manageable, and so rewarding when you work out how to get the best out of it."

On track, it's simply sensational, particularly with the boost turned up to its maximum of '3'. The turbocharged Type R 2.0-litre has real fire in its belly below 5000rpm, but beyond this the acceleration appears to increase exponentially – the Ariel powering forward with the explosive violence of, ahem, a split atom. So quick is the Ariel that it takes a lap or two for your brain to properly process what's going on.

Get in the groove, though, and you're in for a treat. Keep the traction control in one of its least intrusive settings and then simply revel in →

The Atom trumps its bigger rivals with 531bhp per tonne

Analogue Atom is a welcome throwback to the pre-digital age

ARIEL ATOM 4
Physically challenging but manageable, and so rewarding when you work out how to get the best out of it. Leave the traction control active but dialled back to level 1 or 2. Feed the wheel through your hands a bit during the tighter stuff. Keep close tabs on which way the front axle's pointing. Now just drive the wheels off it. Mega. **MS**

> "The harder you push the Carrera S, the more it rewards. It's a bit of a hooligan"

Porsche is poised and precise but willing to throw off the shackles

Carrera S shifts through gears and steers sublimely

And the winner is... oh no, it's crashed

← the poise, precision and endless flow of information that allows you to drive the thing up to and over the limit with confidence. With previous versions of the Atom, there was always the concern that the high-set mid-mounted motor's mass could bite you if you got greedy, but not in the 4.

It's not an ever-increasing-angles-of-attack car like the 911 – the steering requires a lot of muscle much past a quarter of a turn, deterring you from exploring the lock-stops – but such is the car's balance and the beautifully proportional nature of its controls (you get out exactly what you put in) that you can play with delicious little slip angles here, there and everywhere. It's a totally absorbing machine that draws you in, turning 'just one more lap' into 'just 10 more laps'.

It's a riot on the road, too, although perhaps the unusually clement late autumn weather played a part here. You don't have to drive it hard, however, to reap rich rewards. The Atom 4 makes you smile even when pootling because you can still thrill in the simple act of driving, its analogue approach a refreshing tonic to the increasing digitisation of everything automotive. Simon Davis nails it perfectly when he says: "You'd have to be utterly miserable to dislike this car." Quite.

So, that's it – our top three. Each is brilliant in its own right and, with all of our judges putting one of them at the top of their respective score sheets, any would be a deserving champ. But to delve into the clichés, there can only be one winner. Turn the page and all will be revealed. →

Impeccable damping lends the McLaren 911-like flexibility

At 70mph, the Atom puts out an ear-splitting 92dB

> "So quick is the Ariel that it takes a lap or two for your brain to properly process what's going on"

AND THE WINNER IS...

Not until the 31st time of asking has a car like this won the BBDC title. But then the Ariel Atom 4 truly is one of a kind

This annual meeting of the very best driver's cars might be in celebratory mood but, like any 30-year-old, it's changed somewhat over the years. And when all the judges' votes had been counted this year, we were reminded of a time when ultra-lightweight two-seater sports cars like the Ariel Atom were deliberately excluded from entry on the basis that it would be unfair on everything else to let them in. "Of course they'd win," the argument went.

Well, since the demise of that rule, we've had Caterhams, Ariels, stripped-out Lotuses and others like them in the BBDC mix – and, despite a couple of near misses, none of them has quite triumphed. Until now.

The Ariel Atom 4 has succeeded where so many cars of its ilk have fallen short. Beating the truly great and considerably more usable McLaren 600LT Spider into second place by a clear margin, this West Country marvel simply stunned us all. Some were visibly stuck for words to describe it; others, on reflection, settled for "exhilarating", "visceral", "absorbing" and "raw". Nobody awarded it fewer than 22 points for its showing on track, and nobody placed it outside of their top three overall.

When comparing the car to its immediate forebears from Ariel and summing up what makes it different, one juror remarked that, although he'd seldom failed to be excited by "over-driving" an Atom in the frenetic, physical, delicious little wrestling match these cars habitually engage you in, he'd often felt right on the knife edge of control with them – and sooner or later, therefore felt more inclined to back off than press on.

"With this one," he went on, "once you get on top of it near the limit of grip, you feel much more confident – with a bit of effort and concentration – that you can stay there. And the amount of fun to be had as you do is just incredible." **MS**

Pushing the Atom to its thrilling limits no longer feels like folly

	1 ARIEL ATOM 4	2 MCLAREN 600LT SPIDER	3 PORSCHE 911 CARRERA S PDK	4 PORSCHE 718 CAYMAN GT4	5 MAZDA MX-5 30TH ANNIVERSARY
Price	£39,975	£201,500	£93,110	£75,348	£28,095
Engine	4 cyls, 1996cc, turbocharged, petrol	V8, 3799cc, turbocharged, petrol	6 cyls horizontally opposed, 2981cc, turbocharged, petrol	6 cyls horizontally opposed, 3995cc, petrol	4 cyls, 1998cc, petrol
Power	316bhp at 6500rpm	592bhp at 7500rpm	444bhp at 6500rpm	414bhp at 7600rpm	181bhp at 7000rpm
Torque	310lb ft at 4000rpm	457lb ft at 5500rpm	391lb ft at 2300rpm	310lb ft at 5000rpm	151lb ft at 4000rpm
Gearbox	6-spd manual	7-spd dual-clutch automatic	8-spd dual-clutch automatic	6-spd manual	6-spd manual
Kerb weight	595kg	1297kg	1590kg	1420kg	1124kg
0-62mph	2.8sec	2.9sec	3.7sec	4.4sec	6.5sec
Top speed	162mph	201mph	191mph	189mph	136mph
Economy	na	24.1mpg	31.7mpg	25.7mpg	40.9mpg
CO_2, tax band	na	266g/km	205g/km	251g/km	WLTP figures tbc

ANGLESEY CIRCUIT TRACK NOTES

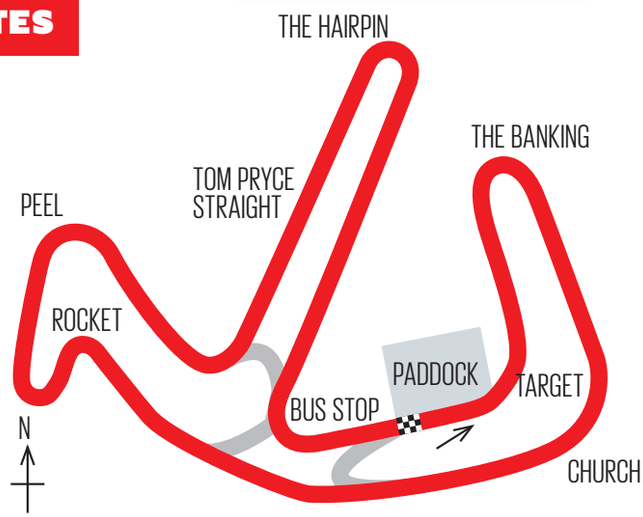
LAP TIMES*

1	Dallara Stradale	1min 33.4sec
2	Ariel Atom 4	1min 35.2sec
3	McLaren 600LT Spider	1min 35.6sec
4	Porsche 911 Carrera S PDK	1min 39.2sec
5	Porsche 718 Cayman GT4	1min 39.6sec
6	Mercedes-AMG GT 63 S	1min 39.9sec
7	Toyota GR Supra 3.0 Pro	1min 42.2sec
8	Renault Mégane RS Trophy-R	1min 42.5sec
9	Mazda MX-5 30th Anniversary	1min 52.1sec
10	Bowler Bulldog V8 SC	1min 56.3sec

*We didn't time the Huracán Evo at Lamborghini's request

TOP SPEEDS

Apex of Church	
McLaren 600LT Spider	84.6mph
Ariel Atom 4	82.4mph
Porsche 718 Cayman GT4	80.5mph
10. Bowler Bulldog V8 SC	63.7mph
Before braking for Rocket	
McLaren 600LT Spider	141.0mph
Mercedes-AMG GT 63 S	134.7mph
Dallara Stradale	133.0mph
10. Mazda MX-5 30th Anniversary	106.0mph
Apex of Peel	
Ariel Atom 4	53.8mph
Renault Mégane RS Trophy-R	51.7mph
Porsche 718 Cayman GT4	51.5mph
10. Bowler Bulldog V8 SC	40.0mph
Apex of Bus Stop	
Porsche 718 Cayman GT4	49.6mph
Ariel Atom 4	47.9mph
Dallara Stradale	47.6mph
10. Bowler Bulldog V8 SC	37.2mph



WHAT WAS QUICKEST AND WHY

Getting into the fine detail of our lap times from Anglesey is a fine way to confirm your impressions about some of the cars on test. Unfortunately, in some cases it also makes you question your own driving.

For instance, how could the car that set the fastest time overall – and by a margin of almost two clear seconds – not also be the quickest of the lot through any of the four speed traps we happened to pick? Well, the Dallara Stradale's pace was undeniable first hand, but it did suffer with a soft brake pedal, which ultimately made for slightly conservative corner entry. It was clearly one of a handful of cars that might have gone quicker given longer to get used to – but being fair with our BBDC lap times always means splitting your time equitably on the day.

By contrast, the Ariel's pace through Peel and Church corners hints at the huge confidence it inspired. The speed of the Cayman and Mégane, meanwhile, pointed to big reserves of simple mechanical grip, which you could certainly feel through every slower bend on the track – but which few judges might have been inclined to praise in their notes if it made them lack handling adjustability.

Among other interesting things to note was that the Supra went particularly well around Peel corner, carrying more speed than either the 911 or the AMG (which could have been down to the sweet combination of balance and outright lateral grip). The MX-5 also beat both the Supra and the AMG, and levelled with the 911, around the confidence-testing Bus Stop.

THE JUDGES' SCORECARD

	MATT PRIOR			MATT SAUNDERS			ANDREW FRANKEL			JAMES DISDALE			SIMON DAVIS			RICHARD LANE			MAURO CALO			OVERALL SCORES			
	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	ROAD	TRACK	TOTAL	RANKING
Ariel Atom 4	21	23	44	22	24	46	16	24	40	20	24	44	23	24	47	22	24	46	18	22	40	142	165	307	1
McLaren 600LT Spider	20	19	39	22	22	44	19	23	42	18	24	42	22	23	45	24	22	46	22	20	42	147	153	300	2
Porsche 911 Carrera S PDK	21	22	43	20	20	40	20	21	41	22	21	43	22	22	44	23	20	43	22	22	44	150	148	298	3
Porsche 718 Cayman GT4	22	20	42	23	18	41	20	18	38	22	19	41	24	19	43	21	21	42	19	20	39	151	135	286	4
Mazda MX-5	19	18	37	21	18	39	17	20	37	20	20	40	20	20	40	22	21	43	19	21	40	138	138	276	5
Dallara Stradale	19	19	38	15	21	36	14	22	36	16	22	38	19	23	42	19	23	42	18	19	37	120	149	269	6
Mercedes-AMG GT 63 S	18	19	37	16	16	32	15	16	31	18	17	35	19	17	36	20	16	36	20	19	39	126	120	246	7
Renault Mégane RS Trophy-R	17	20	37	15	17	32	14	14	28	16	22	38	15	17	32	17	18	35	19	19	38	113	127	240	8
Toyota GR Supra 3.0 Pro	17	17	34	18	19	37	16	15	31	17	16	33	16	16	32	18	17	35	16	18	34	118	118	236	9
Lamborghini Huracán Evo	16	17	33	17	15	32	18	15	33	19	15	34	18	15	33	19	14	33	18	16	34	125	107	232	10
Bowler Bulldog V8 SC	18	15	33	19	12	31	11	10	21	14	8	22	13	10	23	15	10	25	15	10	25	105	75	180	11

6 DALLARA STRADALE	7 MERCEDES-AMG GT 63 S 4MATIC+	8 RENAULT MÉGANE RS TROPHY-R	9 TOYOTA GR SUPRA 3.0 PRO	10 LAMBORGHINI HURACÁN EVO	11 BOWLER BULLDOG V8 SC
£143,500	£135,615	£51,140	£54,000	£206,552	£180,000
4 cyls, 2300cc, turbocharged, petrol	V8, 3982cc, turbocharged, petrol	4 cyls, 1798cc, turbocharged, petrol	6 cyls in line, 2998cc, turbocharged, petrol	V10, 5204cc, petrol	V8, 5000cc, supercharged, petrol
395bhp at 6200rpm	630bhp at 5500rpm	296bhp at 6000rpm	335bhp at 5000-6500rpm	631bhp at 8000rpm	567bhp at 6000-6250rpm
369lb ft at 3000rpm	664lb ft at 2500rpm	295lb ft at 3200-4500rpm	369lb ft at 1600-4500rpm	443lb ft at 6500rpm	516lb ft at 3500-4500rpm
6-spd robotised manual	9-spd automatic	6-spd manual	8-spd automatic	7-spd dual-clutch automatic	8-spd automatic
895kg	2045kg	1306kg	1495kg	1422kg	1800kg
3.3sec	3.2sec	5.7sec	4.3sec	2.9sec	4.0sec (est)
165mph	196mph	163mph	155mph	202mph	130mph
na	25.0mpg	35.8mpg	34.5mpg	20.6mpg	na
na	WLTP figures tbc	WLTP figures tbc	WLTP figures tbc	332g/km	na

30 YEARS OF BBDC

RETURN OF THE KINGS

Three decades of our Britain's Best Driver's Car contest have produced an array of different winners from the modest to the majestic. **Andrew Frankel** revisits his five favourites

PHOTOGRAPHY OLGUN KORDAL

MX-5 and NSX are the same age but the Honda feels almost like new

MAZDA MX-5
Good to try the old MX-5 when we had a new MX-5 on hand too: I love how compact they both are, how snicky their gearboxes are and how agile they feel. But both feel slightly like you're sitting on, not in, them. Both are a few subtle modifications away from being downright wonderful. **MP**

It seems strange to see them all again in a pit lane. Wisps of distant yet undimmed memories came floating over the mountains of Snowdonia to coalesce once more into metal, rubber, oil, fuel and water before us at the Anglesey Circuit.

Can it really be 30 years since our first contest to find what we call officially 'Britain's Best Driver's Car' but which has always been known colloquially simply as 'Handling Day'? It seems it has. We still call it Handling Day, too, even though the requirement to drive all cars extensively on road and track, plus photographic and video commitments, means it would now be more accurately described as 'Handling Week'.

To many, indeed to most gathered at Anglesey that day, this was largely a quaint collection of elderly relics you'd be more likely to find at a local noggin'n'natter classic car meeting than between the pages of a cutting-edge magazine like Autocar. But for one of us they were something else, frozen in time as the entirely modern, state-of-the-art machines they were when we first made our acquaintance all those years ago.

Which was me. Loathe the word 'veteran' though I do (at least when used as an adjective to modify the phrase 'road tester Andrew Frankel'), it is impossible to ignore the fact that at least one of these cars is older than at least one of the testers driving it today. Nor would I choose to forget I've been at nearly every Handling Day. I say 'nearly' because I remember the first all too clearly, or, more specifically, remember being told by my then editor I was not invited. Not that it still smarts three decades later, you understand.

Still, it means I get to write this and, with road test ed Matt Saunders, got to choose what turned up. How do you select five cars from 30 years? Quite easily, as it turns out: if it had won at least twice, in any generation, it had a prima facie case for being there. And all the cars here – the Mazda MX-5, Lotus Elise, Honda NSX, Ferrari 550 Maranello and Porsche 911 – qualify on that score.

But so too does the Porsche Cayman, and you could argue it should be there, but with only five slots, it would mean dropping the 911 – which would be preposterous – or one marque losing its space altogether so Porsche could have two.

You could also say the Ferrari 458 has had a rough roll of the dice because, if Ferrari had chosen to retain the name for the heavily facelifted and mechanically transformed 488 GTB, it too would have qualified, at least on paper. But that would mean dropping the 550, which is that rarest of rare things: a car that successfully defended its title. In the entire history of Handling Day, the only other cars to have done the double are the NSX and 911. None has won three years running.

I should say now that we were fully configured to have a sixth car present. The one unbreakable rule of Handling Day is that the only car that ever gets asked back is the previous year's winner. And in what I thought was the probably quite likely event that the McLaren 600LT would emerge on top this year as it had last year, we were ready to include it in the reckoning. You can read elsewhere in this magazine why it is not.

What first? Well, it has to be the Mazda, doesn't it? It wasn't our first winner, which was the Porsche 944 S2, but it was in existence 30 years ago, just not on sale in the UK at the time of that first test. In fact, we road tested it in the spring of 1990 – an event I recall because, well, I wrote the test, after which, and to no one's great surprise, it went on to win Handling Day that year.

Sit in it and before you even spark up the enthusiastic little motor, one word comes to mind, and it is 'timeless'. We thought this car pretty staggering then, but to see how well it has withstood the ageing process these past 30 years, well, it's astonishing. And hats off to Mazda for merely adding spice to the formula over the years. Drive the brand-new one and this one back to back and you simply won't believe it went into production before Daniel Radcliffe was born.

But there is so little to age it. The styling is fuss-free, the interior equally dedicated to functionality. And a normally aspirated, front-engined, manual, rear-drive two-seater open configuration is almost the definition of the traditional sports car, whose history dates back a century and more. In which context, those 30 years seem like nothing at all. →


The 911 R upholds a long tradition of Porsche Handling Day honour


Elise offers perhaps the purest driving experience of all

> To most gathered at Anglesey, this was largely a collection of quaint old relics

FERRARI 550
Strangely sluggish at first, but that's just the long throttle. Thickset gearshift and subdued V12 are also red herrings. For me, this is the definitive modern-era Ferrari GT: super-delicate at speed and so beautifully balanced that almost anyone could flow it along extremely quickly. In a word? Regal. In two? Bloody brilliant. **RL**

HANDLING DAY 1989

You look back at that first Handling Day and expect to find an embryonic version of the fully formed product we have today, perhaps recognisable in certain lights but really not the same thing at all. On the contrary and despite it being conceived very much as an office jolly, our 30-year-old contest was born fully formed.

The story ran in Autocar & Motor on 9 August 1989, under the banner: 'We Find Britain's Best Handling Car'. And as we have done on 30 successive occasions since, a list of contenders was created, a track was booked and the games commenced.

The rules were a little different, though. It took place on a single day and was all track-based. Invitations were issued on the basis of magazine seniority, not skill behind the wheel. No lap times were taken and no video was made, but then as now we had a fine set of cars: a Renault 5 GT Turbo, Peugeot 405 Mi-16, BMW 535i, VW Corrado, Mercedes-Benz 190E 2.3-16, Toyota MR2, Porsche 944 S2, Lancia Integrale and a Ferrari 328 GTB.

The Porsche ran out a deserving winner with the moral victory going to the superbly balletic MR2. But what attendees most remember was the sickening sound of a Ferrari coming to an abrupt stop against the Castle Combe scenery. We felt desperately sorry for the poor sod at the wheel and understand far better now how difficult Ferraris of that era were to drive fast. But it remains to date the only car to have been written off at a Handling Day. Given what we do with them, it's not a bad record.

HANDLING DAY 2049

Whatever happens to cars in the next 30 years, some things are not going to change. There will still be roads and there will still be tracks. Physical law will remain physical law. Which means then, as in 1989 and today, the car with the best chance of winning our 61st Britain's Best Driver's Car encounter will be the one that best aggregates the talents required for both street and circuit disciplines. It will still need to be light and structurally rigid. It will still need to control its body movements through flat-out curves on race tracks yet retain sufficient compliance to offer an accommodating ride on what will still be often terrible road surfaces.

Cars of the kind that will take part in this contest 30 years hence will still have four wheels and steering wheels, although many other things will have changed. The internal combustion engine will be either dead or dying, replaced by battery-electric or fuel cell powertrains. Which means no gearchanging and no meaningful noise. So they're going to have to find the fun elsewhere.

This is likely to be achieved through those electrics providing hitherto unimagined response times and body control. The car will always know where it is, and on track it will offer on-board tutorials with practical demonstrations: how to extract the maximum lap time, how to hold the most extreme drift angle and so on. The challenge is to make the driver still feel like he or she is making a difference. And that's likely to be the hardest task of all.

Mazda missed nothing here. You can tell just from the driving position, the perfectly matched control weighs, the large and perfectly geared steering wheel and the whip-crack movement of the stubby little gearlever around its well-defined gate that this car was designed by people who adored driving. But it is the way it still attacks corners, still resists understeer, still floods your fingers with feel that makes you realise why it won all those years ago and then did so all over again in its second generation back in 2003.

And so to the Elise, a winner straight out of the blocks in 1996 and then again in Series 2 guise in 2001. Interestingly, its more track-focused Exige brother has never won it, despite many attempts including, most recently, last year.

'Our' car is a 2003 111S belonging to Peter Lane and is in the very peak of good health. Peter's instructions were simply to 'go and enjoy it', which I duly did.

The original won because it was a car like no other we had encountered. Then as now a Caterham provided a more intense driving experience, but for sheer purity of feel nothing could come close to the original Elise back then, and I suspect precious few since. Truth is, it was a far from perfect car in 1996 and needed to be driven a certain way. It was tricky beyond the limit in certain regards that, were a modern car to exhibit such characteristics, would probably rule it out of contention today.

The Series 2, while heavier, is a far more forgiving car while losing none of the Elise character in the process. It's very much a car you wear, its various controls feeling more and more like natural extensions of yourself the harder you drive it. Even with the 156bhp of this 111S model, there is always more grip than go, which in another car might be frustrating. But the Elise never was one for power-sliding, and in fact one of the reasons its feel is so unpolluted and naturally balanced is because Lotus refused – and still refuses – to fit the limited-slip differential that is so essential for those who live to go sideways. It's a car for savouring driving at its simplest and most pleasurable, and at that it still stands comparison to anything out there.

Arms-out driving position is one of few NSX downsides

But while the Mazda and Lotus disguise their age quite brilliantly well, the Ferrari is quite the reverse. The 550 Maranello did the double in 1997 and 1998, but compared with the modern missiles Maranello makes today, it feels like it's from another era entirely. It feels soft even in Sport mode (yes, electronic dampers, even then), there's not much grip and in a straight line it doesn't even feel that quick. Briefly, I wondered what it was doing here.

I was forgetting some old Ferrari lore. If this car's modern equivalent – the 812 Superfast – was only fun when you really started to work it hard, no real driver would buy one because they would understand that the conditions in which it could be safely so driven don't exist on the public road. But down at the 550 Maranello level, such rules did not apply. Indeed, the key to enjoying this car stems from the very fact that, ultimately, it's not that rapid.

Which means this big old Ferrari, with its 5.5-litre V12, is very, very accessible. And when you start to drive it as its makers intended, the rewards are not only easy to find but they are also well worth the effort. No current Ferrari I've driven steers this well, and while the company now employs devilishly clever electronics to keep things pointing in the right direction, or to keep you on the track even when they're not, what the 550 has is simply the most delicious natural balance.

This car, kindly supplied by James Esdaile and looked after by Nick Cartwright Specialist Cars, felt a little soft in the quickest curves, but given the age of the car and the fact that its owner was waiting back in the pits, it didn't seem appropriate to push on further to discover whether the dampers were no →

Lightweight Honda tips the scales at 1430kg

HONDA NSX
At first it's the engine that dominates, the 3.2-litre V6 revving to the heavens and delivering a rich, orchestral soundtrack. There's beautifully balanced handling, too. Yet it's the all-aluminium Honda's standard-setting modernity and ease of use that really impresses even today. Electric aerial aside, you'd never guess this was a 30-year-old design. **JD**

Both the Honda and Ferrari can bite if not driven with respect

The mix of configurations, displacements and layouts is a Handling Day constant

> The Mazda and Lotus disguise their age but the Ferrari is quite the reverse

THE ONES WE WISH WE'D NEVER BROUGHT

BMW Z3 1.9
A sports car in looks alone whose primary achievement on track was to make you realise all over again just how good a Mazda MX-5 really was. What were we thinking?

McLAREN MP4-12C
Okay, it wasn't rubbish, but relative to expectations it was a bitter disappointment. One judge placed it behind a Corsa VXR. Shows how far McLaren has come.

MORGAN AERO 8
It sounded like a good idea at the time yet proved to be anything but. Didn't ride, handle or, in particular, steer. One for the theory, not the practice.

MERCEDES-BENZ SLK BLACK SERIES
I have no idea how MB signed it off like that. It should have been a hoot but turned out to be tricky, treacherous and with no reward of any value on offer.

FERRARI 348TB
Given what you'd expect of the brand – and what it has gone on to achieve in this competition – probably the most disappointing car yet to attend this event.

> “Once on the circuit, the NSX devoured the track as if born to the task”

LOTUS ELISE

My experience of the Elise is incredibly limited, but it was interesting how similar this car feels to the current model. Clambering over its wide sills to settle down in its low, enveloping cabin is as much a process, while the purity of its control weights and sense of connection they impart – even at low speeds – remains a class act. **SD**

longer in the first flush or whether that's just what they do.

Besides, in slower and medium-speed corners, it leaves all the choices to you: mild, steady-state understeer, a wide period of neutrality or, well, had this not been a private owner's car, as much oversteer as you could ever want for as long as your corner lasted.

It's funny to think the design of the Honda NSX is considerably older than that of the 550 Maranello because, even taking into account the fact that this immaculate Honda-supplied car was one of the very last, on track it feels thoroughly modern. Bizarrely so at times, in fact.

Okay, there are some aspects that age it – some good, such as its normally aspirated engine with its hauntingly beautiful voice and its manual gearbox, and some not so good, like its arms-out driving position and head room so limited I could barely drive it with a helmet on. But once on the circuit, it devoured the track as if born to the task.

Even before you've started to really push it, it feels like a thoroughbred, and a pretty damn light one, too. There is an infectious immediacy and accuracy to its response that clamours for more.

And the more you give it, the better it gets. All those who lament V8s downsizing to V6s these days wouldn't give a hoot if those V6s could sound like this howling, yowling unit, or come with such a short, sharp, brilliantly mechanical gearchange. But it's the way it corners you'll remember for longest: flat, fast and superbly damped, you can treat its chassis like it belonged to a brand-new car, not one designed more than 30 years ago, at the same time as the original MX-5.

Popeye MX-5 won Handling Day in 1990, then again in 2003

The Ferrari's performance is satisfyingly usable

Or at least you can up to around nine-tenths effort, which is what most people would describe as the limit. At that point you need to manage the brakes a little, because you can't treat them like they're a bombproof set of carbon-ceramics, and if you push into the area beyond the car's technical limit of adhesion, you are reminded why NSXs gained a partly deserved reputation for punishing those who failed to accord it the respect it deserved.

Actually, it's not vicious (or at least this one isn't; they varied) but if you switch out the traction control – which they all had as standard from the earliest generation – and are deliberately casual in the way you set it up for a corner, you're likely to find yourself really quite busy really quite quickly. I have witnessed in period (as a spectator, mind) what happens if you ignore such warnings, and suffice to say the outcome required a tractor and an embarrassing telephone call to Honda.

Which brings us to the 911. I'm sure we've had Handling Days without a 911 present, I just don't remember any. We may use different circuits, encounter different weather and conduct the test at different times of year, but the one constant appears to be the presence in the paddock of a car with a flat-six motor in its boot. There were so many we could have chosen from, but the very 911 R that won this competition at this circuit in 2016 seemed to be as good as any.

Despite its value and scarcity (just 991 were made), it is entirely to Porsche's credit that the 911 R was supplied on a fresh set of Michelin Pilot Sport Cup 2 rubber, which we set about melting in very short order.

The eternal irony of driving any one of the 911s that have

The MX-5's steering feel and feedback remain impressive

A 911 has been crowned on seven separate occasions

Both the Mazda and Honda major on tactile involvement

The Ferrari no longer feels all that fast but it is rewarding to drive

WINNERS TO DATE

1989
Porsche 944 S2

1990
Mazda MX-5

1991
Honda NSX

1992
Honda NSX

1993
Porsche 968 Club Sport

1994
Porsche 911 (993)

1995
Lotus Esprit S4S

1996
Lotus Elise

1997
Ferrari 550 Maranello

1998
Ferrari 550 Maranello

1999
Ferrari 360 Modena

2000
Porsche 911 (996) Turbo

2001
Lotus Elise II

2002
Lamborghini Murciélago

2003
Mazda MX-5

2004
Noble M400

2005
Porsche 911 (997) Carrera S

2006
Porsche Cayman S

2007
Audi R8

2008
Nissan GT-R

2009
Lotus Evora

2010
Porsche 911 (997) GT3 RS

2011
Porsche Cayman R

2012
Toyota GT86

2013
Porsche 911 (991) GT3

2014
Ferrari 458 Speciale

2015
Ferrari 488 GTB

2016
Porsche 911 R (991)

2017
Porsche 911 GT3 (991.2)

2018
McLaren 600LT

2019
Ariel Atom 4

visited Handling Day over the past 30 years is that almost all of them have behaved in a manner directly contrary to that suggested by the model's reputation. To whit, these are not cars whose limit is a hard and fast rule beyond which you stray at your peril; on the contrary, the limit is a rule to be studiously ignored, because it's only once you're beyond it that the real fun begins.

And while the location of that limit might change from year to year, the shrieking soundtrack that accompanies you as you approach it has not. Then you just kill the incipient understeer by doing that one thing you're told never to do, namely turning in and lifting off, and just wait until the car has rotated as far as you want before you catch it with the power.

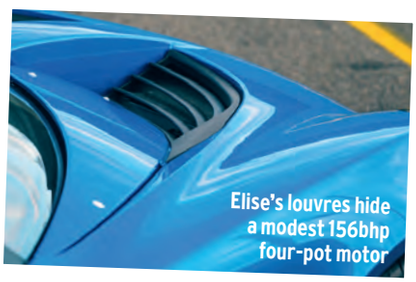
One of our younger testers came back with a look of shock on his face: "Do you know," he said, "I think if we'd entered it into the main contest today, it would probably have won."

But does that make this Porsche the Greatest Of All Time? Or should the honesty of the Mazda, the purity of the Elise, the charm of the Ferrari or the raw ability of the Honda be allowed to prevail?

It was never my intention to put these cars in a one-to-five order, not only because this is a celebration of the best of the best, not a gimlet-eyed assessment like the main contest, but also because it's as difficult to compare cars from across the eras as it is to compare drivers.

Even so, I think we need a winner, and however you look at it, it has to be the 911. Had I based the judgment solely on how they drove at Anglesey this year, the 911 would have won. But it's the fact that no fewer than seven of our past now 31 winners have been 911s, where no other has won more than twice, that seals it.

A 911 has won in every decade with cars from every generation, from 993 through the 996 and 997 to the 991. And judging by the outstanding performance of the standard 911 this year, it would be a brave person who bet against a hot 992 adding its name to the victory board in the years to come. A


Elise's louvres hide a modest 156bhp four-pot motor


The 911 R is still good enough to challenge for the win today

> It's as difficult to compare cars across the eras as it is to compare drivers

	PORSCHE '991' 911 R	HONDA NSX 3.2	FERRARI 550 MARANELLO	LOTUS ELISE 111S	MAZDA MX-5 1.6I
Price new	£136,901 (2016)	£60,000 (2004)	£152,345 (2002)	£25,995 (2004)	£16,545 (1990)
Price now	£320,000 (est, 2016, 1000 miles)	£100,000 (est, 2005, 25,000 miles)	£90,000 (1998, 35,000 miles)	£16,000 (2004, 40,000 miles)	£6800 (1991, 45,000 miles)
Engine	6 cyls horizontally opposed, 3996cc, petrol	V6, 3179cc, petrol	V12, 5474cc, petrol	4 cyls in line, 1796cc, petrol	4 cyls in line, 1598cc, petrol
Power	493bhp at 8250rpm	290bhp at 7100rpm	479bhp at 7000rpm	156bhp at 7000rpm	114bhp at 6500rpm
Torque	339lb ft at 6250rpm	224lb ft at 5500rpm	419lb ft at 5000rpm	128lb ft at 4650rpm	100lb ft at 5500rpm
Gearbox	6-spd manual	6-spd manual	6-spd manual	5-spd manual	5-spd manual
Kerb weight	1370kg	1430kg	1774kg	806kg	960kg
0-62mph	3.8sec	5.7sec	4.4sec	5.3sec	8.3sec
Top speed	200mph	168mph	199mph	132mph	126mph
Economy	21.2mpg (NEDC)	23.0mpg (NEDC)	na	34.1mpg (NEDC)	na
CO_2, tax band	308g/km, 37% (NEDC)	291g/km, 37% (NEDC)	547g/km, 37% (NEDC)	163g/km, 37% (NEDC)	na

PORSCHE 911 R

The chance to compare a few old champions with new contenders on the back of a special Handling Day contest is very rare, but this was also an opportunity to drive a new-generation Porsche '992' back to back with one of the very best '991s'. The 911 R had a lot more rear-engined charisma about it than the newbie: it was grippier and flatter but quite a lot more interesting with it. Here's hoping that the 992 GT cars can bring back some of the classic 911 dynamic flavour. **MS**

Our unofficial BBDC champion of champions is the Porsche 911

HANDLING DAY IN NUMBERS

NUMBER OF CARS THAT HAVE ATTENDED SO FAR

388

GREATEST/SMALLEST NUMBER TO ATTEND IN ANY GIVEN YEAR

26/7

MOST SUCCESSFUL MANUFACTURERS

11 wins Porsche
5 Ferrari
4 Lotus
2 Mazda, Honda
1 Lamborghini, Noble, Audi, Nissan, Toyota, McLaren, Ariel

MOST POPULAR ENGINE CONFIGURATION FOR THE WINNER

Mid engine 16 wins
Front engine 8 wins
Rear engine 7 wins (all Porsche 911)

FRONT-, REAR- OR FOUR-WHEEL DRIVE

Rear-wheel drive 27 wins
Four-wheel drive 4 wins
Front-wheel drive 0 wins

SKETCHLEY'S AWARD

To the tester who spun a **Bugatti EB110GT** through Goodwood's notorious near-flat Fordwater kink, beating a 30-year-old record for the longest set of skid marks ever laid down at that track.

MOST POPULAR VENUES

	NUMBER OF VISITS
Goodwood and Castle Combe	5
Rockingham	4
Anglesey Circuit and Bedford Autodrome	3
Croft, Silverstone, Oulton Park and Snetterton	2
Brands Hatch, Donington Park, Mireval (Goodyear test track near Montpellier)	1

MOST POWERFUL CARS TO ATTEND

Ferrari F12 and Lamborghini Aventador SV (both 730bhp)

LEAST POWERFUL CAR TO ATTEND

Audi A2 1.4 (75bhp)

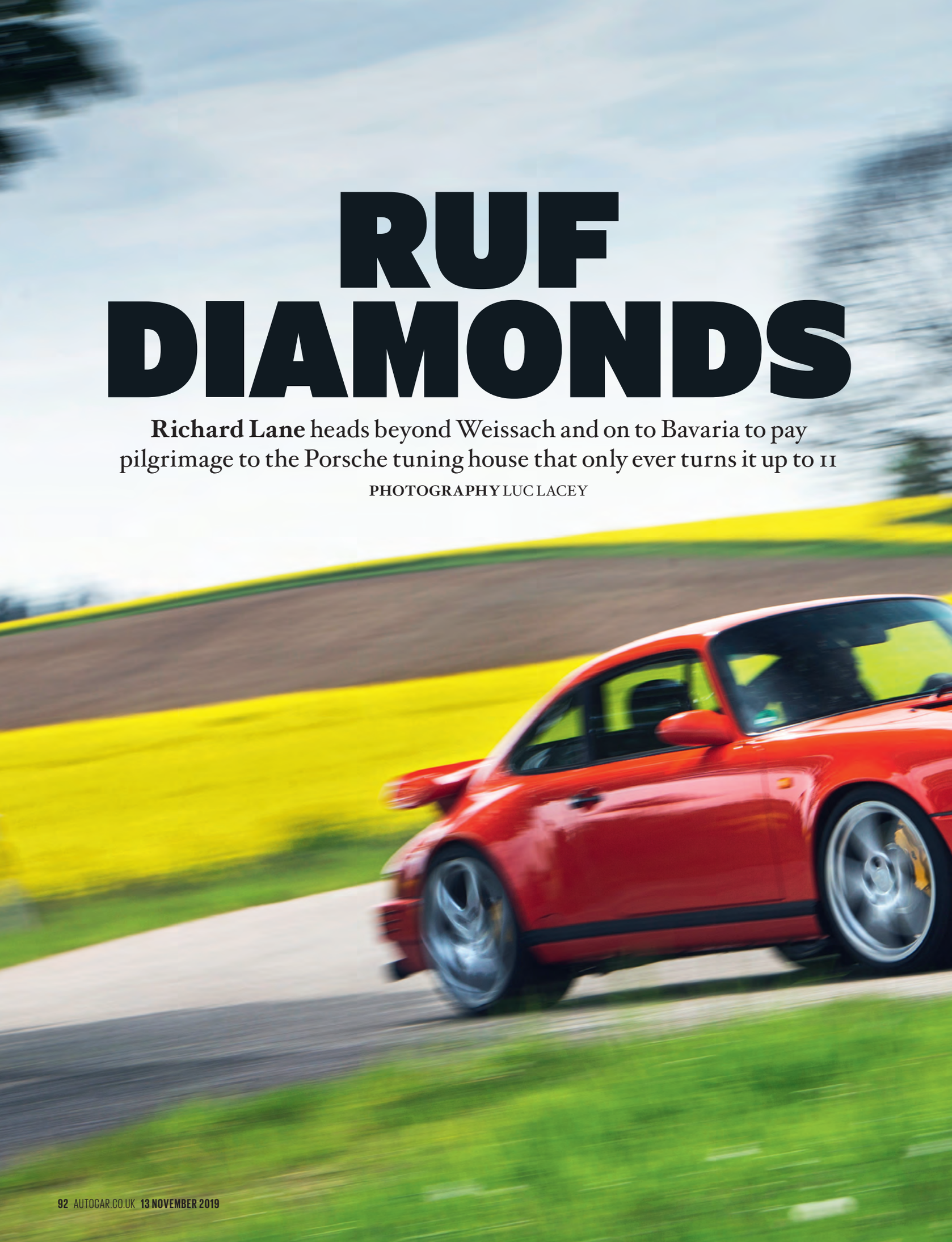
GREATEST HANDLING DAY TO DATE

There are many contenders but perhaps the finest field we have assembled so far was at Anglesey in 2016, where the standard was so high that the superb McLaren 570S could only manage fourth. The top three in ascending order were the **McLaren 675LT**, **Ferrari 488 GTB** and **Porsche 911 R**.

RUF DIAMONDS

Richard Lane heads beyond Weissach and on to Bavaria to pay pilgrimage to the Porsche tuning house that only ever turns it up to 11

PHOTOGRAPHY LUC LACEY



If anything encapsulates the madness of Ruf Automobile GmbH, it's a Porsche 550 Spyder hovering six feet above the red-tiled workshop floor. The rear portion of its tiny fibreglass shell has been stripped away to show the tubular chassis, but where you'd expect to find a 1498cc flat four with double overhead cams, there's only fresh air.

This being Ruf, all is not what it seems. The disc brakes and coilover suspension aren't period, so I'm prepared when engineer Rafael Riethmüller tells me one of the company's 4.1-litre flat-six Mezger engines is waiting to be installed. There follows a moment of silence, broken by an expletive. More than 400bhp in a car weighing 550kg with a chassis designed from the early 1950s isn't so much eccentric as psychotic. But Ruf will do that for you, if you want.

"It will be a real challenge to drive," says Riethmüller, helpfully. And on we go: to a military-green 964 911 Carrera whose conversion to Ruf specification is almost complete after three months' work and between €200,000 (£170,000) and €300,000 (£260,000) spent. It's so expensive because Ruf starts from ground zero, restoring the car while recrafting it in its own image. There's now an integrated roll-cage hidden behind soft leather that matches the exterior hue. All air-cooled Rufs also get upgraded Bilstein suspension and the 3.6-litre engine in this one has undergone a turbo conversion and now has an entirely new top end. It's unlikely many modern sports cars would keep up with this thing on the open road, and yet it still looks, feels and will sound very much like a machine of its time.

Elsewhere lurks an RT12R: Ruf's 800bhp take on a modern-day 911 GT2, said to lap the Nürburgring in under seven minutes. It belongs to founder Alois Ruf's son (also named Alois, and current president), as does the verdant green 356 Coupe outside the paint shop. This sensational piece of history benefits from 911 axles and a flat four tuned to 180bhp, because nothing here is ordinary. As if to underline that fact, Stefan Roser – the CTR powersliding hero of Faszination On The Nürburgring – has just appeared from the glass-fronted reception area.

Ruf's workshop exists in small Bavarian farming town Pfaffenhausen, and this year marks exactly eight decades since Ruf Sr set up shop as a mechanic on the same site. In 1949, the petrol station – now an Aral franchise, with 102-octane super-unleaded on draught – sprung up as an annex, and with glorious driving roads on their doorstep and access to both autobahn and Alps, it doesn't take a mastermind to see why Ruf never has felt the need to leave.

But Ruf is going places – if not geographically, then in terms of its ambitions. "People don't know what we are really doing," says Riethmüller, who as a suspension and tyres expert has the sort of brain a magazine road tester would trade his or her home to download. "Even people who are really interested in cars don't know how deep it goes in →

Ruf headquarters in picturesque Pfaffenhausen


SCR's 4.0-litre flat six howls past 8000rpm

To identify a genuine Ruf, there are two give-aways: the lack of gutters along the roof – to aid aerodynamics, mainly from an acoustic standpoint – and the roll-cage, which is almost seamlessly integrated into the pillars of the glasshouse.

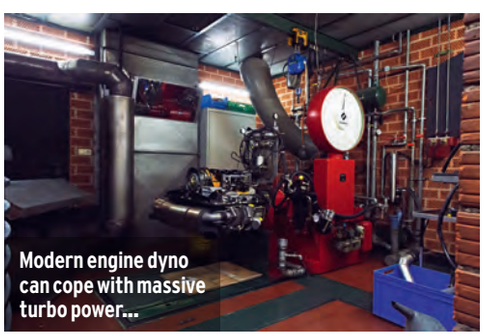

SCR prototype is based on modified 993 chassis with extended wheelbase

engineering." Which is where it gets interesting because, if toys like the 550 Spyder bring the madness, then the all-new SCR and CTR show some serious method. You may already know these cars. They're space-age reinventions of seminal Ruf models introduced in the 1970s: the new 3.6-litre CTR is still turbocharged, the 4.0-litre SCR its naturally aspirated sibling. They channel the 964 911 with upright headlights, narrow(ish) bodies and a droopy tail but, more than that, they are the first cars Ruf has ever conceived completely from scratch, and aim to feed on our current nostalgia-bred, Instagram-fuelled hunger for supercar throwbacks with bleeding-edge performance. Naturally they're not cheap, costing around €700,000 (£600,000), which seems extortionate until you're standing underneath one, chatting to someone who helped design and build it.

"The project started in 2012," says Riethmüller, "because that's when we had an RCT Evo on our stand at Geneva." Ruf clearly wasn't expecting the 199mph, 964-based Evo to generate such a buzz, but several were sold on the stand and that prompted Alois Jr to think about a truly modern 964 reincarnation. The new cars therefore look familiar but architecturally have more in common with a Lamborghini Aventador than a traditional 911. At each end you'll find double-wishbone suspension with pushrod-actuated dampers. There are then steel subframes bonded to a carbonfibre monocoque built by the same company that does the DTM monsters. In fact, the tub weighs less than me, and with every exterior panel also made from carbonfibre, the total kerb weight is 1200kg – roughly the same as a 993 GT2. The only original Porsche parts are windows and windscreen wipers borrowed from the 964 and 993 catalogues respectively. Even the six-speed manual gearbox is a bespoke job from engineering giant ZF – an otherwise stratospherically expensive venture made possible for an ultra-specialist such as Ruf only by Alois's personal connections in Friedrichshafen. The casing is even embossed with an italicised 'RUF'. Meanwhile, the steering will be hydraulically assisted – technology to which Porsche itself said goodbye almost a decade ago.

And now we need to issue an apology. On the day photographer Luc Lacey and I arrive in Pfaffenhausen, the Blossom Yellow CTR we're due to cover is out of action with an engine issue and there is no SCR simply because Ruf hasn't built one yet. We are offered this orange SCR prototype, though. It uses a 993 platform, only with the front axle brought 20mm further forward and the rear axle pushed back fully 70mm, and so while it doesn't benefit from the all-new €10 million (£8.64m) chassis, the wheelbase is the same. Let's not pretend, though. What promised to be some sensational driving impressions will have to wait for another day. And yet what this prototype does possess is very special indeed, and as yet inexperienced by anyone not on Ruf's payroll. It's the magnificent naturally aspirated engine bound for the finished car.

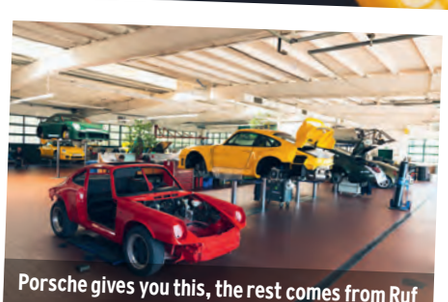
As with almost all Ruf's motors, the basis for


Modern engine dyno can cope with massive turbo power...


...and uses old-school dials – classic Ruf


Ruf will restore, modify or maintain any classic Porsche, including a 550 Spyder


Lane inspects the latest CTR, sadly out of action


Porsche gives you this, the rest comes from Ruf

Ruf will only build 30 examples of the 'new' Yellowbird – the turbocharged CTR – but the naturally aspirated SCR will be built to order with no limit on production.


Turbocharged CTR gets more than 700bhp

> "They feed on our hunger for supercar throwbacks with bleeding-edge performance"

this new unit is Porsche's 3.6-litre Mezger flat six. Experimental iterations were bored and stroked out to 4.3 and 4.2 litres, though precisely four high-revving litres was found to be the sweet spot. Ruf then fits titanium con-rods, forged pistons and the crankshaft from the Le Mans-going 997 GT3 RSR. The exhaust is made from Inconel, which is an alloy long favoured by Formula 1 teams for its strength and heat resistance, and altogether the system makes around 520bhp without a compressor wheel in sight.

We're only heading out for a short meet and greet with the car and for Luc to get some photos, so I try to absorb as many impressions as possible as quickly as possible. The clutch has an old-school heft, though Ruf will offer owners servo assistance. The SCR driveline also uses a single-mass flywheel and the clutch biting point is wafer-thin. The flywheel and valvetrain clatter gently as we nudge out onto public roads, and it gives me butterflies. The larger SCR's cabin will obviously feel different as this is a 993 shell, but they say it will be closely related: A-pillars sat well back for an endlessly broad field of vision; a telepathic awareness of where the car's extremities lie; an immersion in the driving controls. You'll wear the SCR, if you'll excuse the cliché, like a 520bhp glove.

We could talk about the ride and handling but, even by Riethmüller's own admission, the geometry on this powertrain prototype is slap-dash. Best focus on the engine bay. As a high-volume producer, Porsche is now obliged to fit sizeable particulate filters that limit the screech of its own 4.0-litre flat six. But Ruf isn't, and so this engine now feels in a different league of intensity. Sharp cams mean the mechanical backbeat laid →

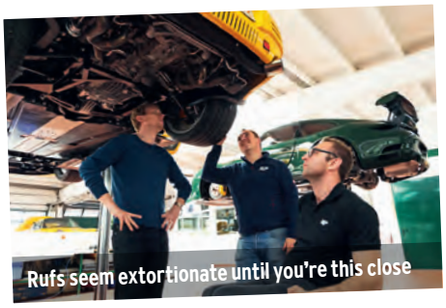

Ruf has sublime testing roads right on its doorstep

SO YOU WANT TO BUY A RUF...

Buying anything from Ruf is unlike buying even the most exclusive Porsche models. In the UK, your first port of call would be Richard Sekula, who since 2016 has acted as the marque's sole concessionaire.

Though Ruf builds a range of cars based on the 991-generation 911 – cars such as the Turbo Florio and RTR – there are no off-the-shelf models and the degree of customisation is never less than comprehensive, particularly for cars based on earlier Porsche series. In most cases, prospective owners are therefore taken to the factory in Pfaffenhausen to see the workshop, meet Alois himself and perhaps get some inspiration before a deposit – usually between £50,000 and £100,000 – is taken and the build commences.

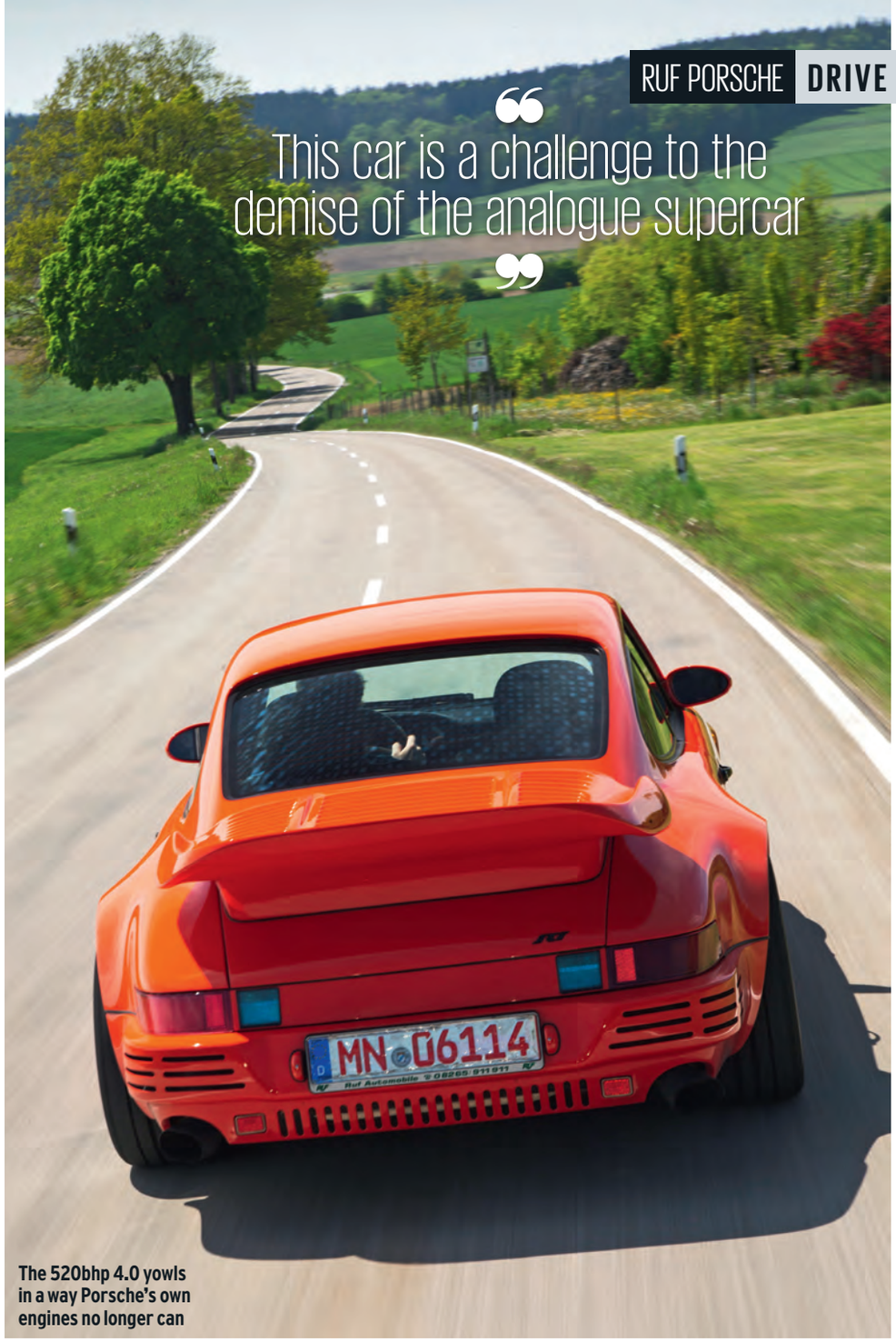
Those with less prescriptive tastes might be tempted by a second-hand example. At the time of writing, Ruf UK was offering a CTR2 with 49,000 kilometres and a 645bhp 2013 RTR 'Narrow body' for a cool £240,000.


Rufs seem extortionate until you're this close

down at idle continues as the tacho goes past 2000rpm. Then at 3000rpm the profile changes and the noise rises in pitch, smooths out and quietens ominously. This is the tidal ebb before a tsunami hits at around 5500rpm. The induction noise from this point on is simply extraordinary, the intake howling in a hollow fashion a bit like that of the 3.2-litre straight six in BMW's M3 CSL, only an order of magnitude more vicious. Approaching 8500rpm, the sound hardens to a singularity that among the SCR's expensive peers is comparable only to 12-cylinder Ferraris, but rawer still. Open the clutch and the revs then fall with the weightless immediacy of a feather in a vacuum, then off you go again.

With a new carbonfibre-rich chassis to propel, this engine will ensure the SCR is massively quick, but even were it not, would it really matter? I honestly don't think so. This is a powertrain of spectacular linearity and fist-gnawing precision. Just like Roser lighting up the Yellowbird on the Nordschleife for Faszination, objectivity doesn't matter.

We take the car back to base and then ponder on the drive to Munich airport. In 1978, Ruf built the original SCR in response to the 911's expected demise at the hands of the front-engined 928. That never happened, but there's a parallel. The SCR of today will be born into a world where such pure chassis engineering, manual transmissions, naturally aspirated engines and compact dimensions are rare enough individually, but in a single package? It doesn't exist. This car is a challenge to the demise of the analogue supercar – one that's out of reach of legislation because of Ruf's minuscule production volumes. With its Yellowbird lineage and gut-heaving turbo performance, the 710bhp CTR will grab the headlines, but on this evidence the SCR could be the real jewel.

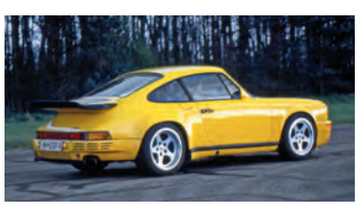


The 520bhp 4.0 yowls in a way Porsche's own engines no longer can

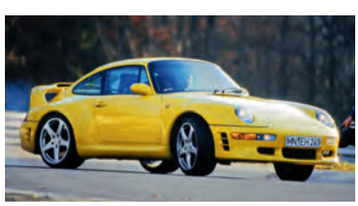
> "This car is a challenge to the demise of the analogue supercar"

RUF'S GREATEST CREATIONS

SCR 1978
Before the name Ruf became synonymous with high-output turbo engines, it built the beautiful SCR. Porsche's contemporary naturally aspirated flat six was enlarged from 3.0 to 3.2 litres and power duly rose from 178bhp to 214bhp, bringing with it 930 Turbo-like performance. With a model hierarchy to maintain, it would take Weissach six years to catch up without help from turbochargers.



CTR 'YELLOWBIRD' 1987
The most recognisable Ruf of all: 3.4 litres of twin-turbocharged flat six and star of a Nürburgring film that went viral long before the advent of YouTube. The official 469bhp is said to be conservative, with almost all Yellowbirds making more than 500bhp. Group C-spec brakes and Dunlop Denloc tyres helped contain the fury. "Imagine doing 212mph when a MkII Golf GTI was a fast car," says Riethmüller. Quite.



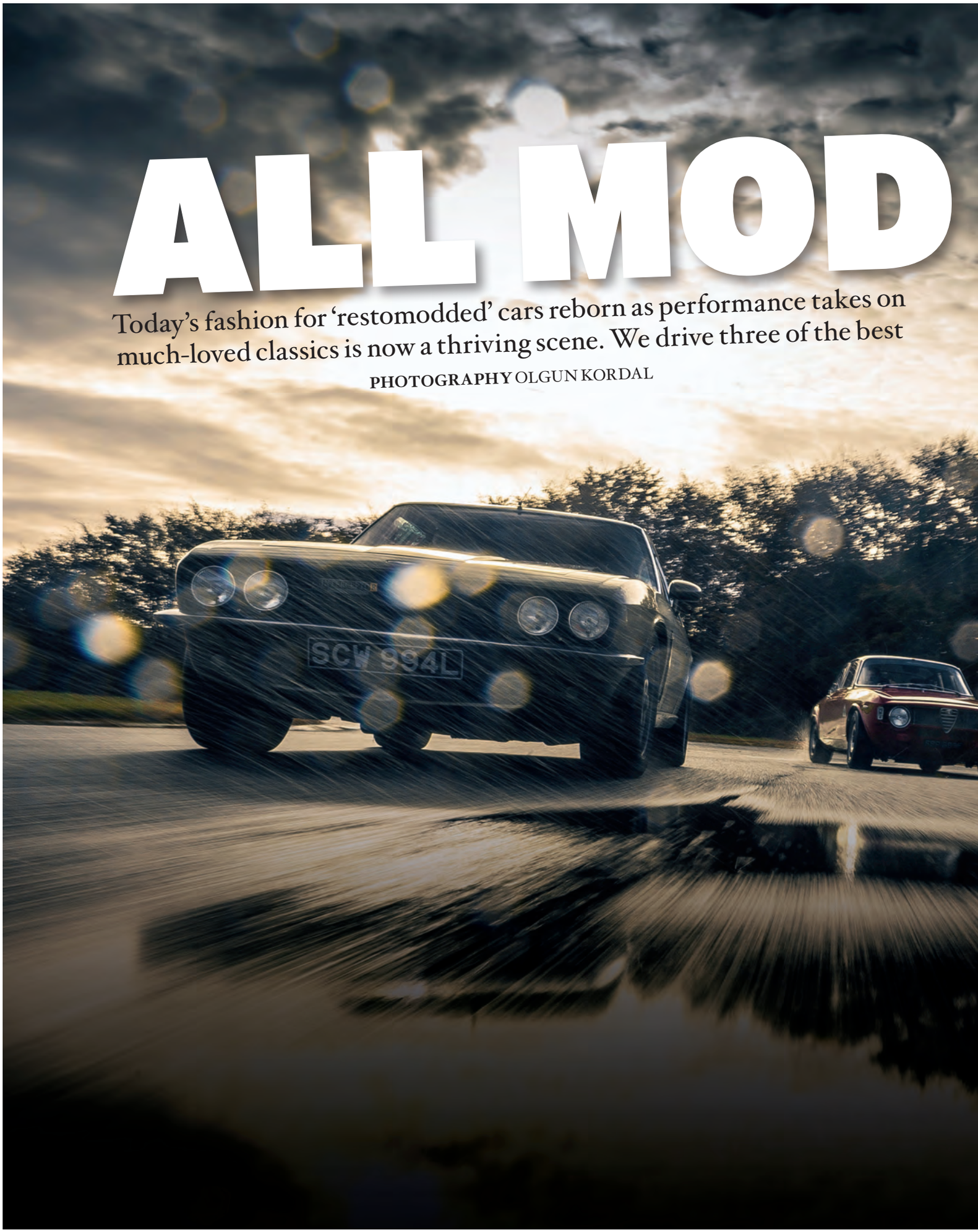
CTR2 1995
Ruf reprised the CTR name for the 993-generation 911, and scored a second-place finish at the 1997 International Hill Climb with the engine tuned to more than 700bhp – having driven to the event with licence plates attached. As you'd expect with taking a car as quick as the 993 911 Turbo as its starting point, the CTR2 was hugely fast: 213mph flat out and 0-100mph in 7.6sec.

CTR3 2009
The mid-engined CTR3 was Ruf's first stab at what many would now see as a 21st-century hypercar. And it had the numbers to back it up, making 691bhp from a twin-turbo flat six and putting it to the road through a six-speed sequential 'box and the rear axle alone. Top speed? A monumental 235mph. More than anything else, however, this was a fabulous driver's car, with surprisingly benign handling.

ALL MOD

Today's fashion for 'restomodded' cars reborn as performance takes on much-loved classics is now a thriving scene. We drive three of the best

PHOTOGRAPHY OLGUN KORDAL



CONS

I'd like to pretend there's an elegant reason why we've selected these three old cars with new or upgraded components – modernised classics, restomods, call them what you will – but the simple truth is that the concept is intriguing and we'd heard good things about these ones.

They're a new kind of performance car, if you like; all that modern supercars are not. They bring performance down to approachable levels but keep the craftsmanship and desirability sky high. At least, that's how I imagined it.

So here we are, at Llandow Circuit, south Wales, with three of the best of them. The idea is to have a track drive today and a road blast tomorrow, with some boring everyday driving in between.

All three cars do things differently. The smallest here is branded GTA-R by its specialist builder, Alfaholics. It's a GTA-aping Alfa Romeo that can be based on any 105/115-series coupé – this one started as a 1967 1300 GT Junior. Alfaholics can simply restore one of those for you but, if you tick the full gamut of GTA-R options, you'll spend the best part of £300,000 and have the kind of car you see here, with a 12-point roll-cage, seam-welded monocoque, titanium suspension bits, Alfaholics gearbox internals and a twin-cam, twin-spark four-cylinder engine originally from a 75, bored and stroked to 2.3 litres, fitted with lightweight internals and making 240bhp. The car weighs just 830kg.

Alongside it is a Porsche from specialists Tuthill, who do brilliant things with old 911s, including rallying them, racing them and ice-driving in them, which I'm told is the most fun you can have in a car. This is a bespoke customer build, a 1973 2.4-litre E-series 911, with a wide body. It's more road car than track car but lovely nonetheless. The engine is still a period 911 2.4-litre, and the car is prepped to usable, fast road spec.

Next to that is a Jensen →

These cars' bespoke nature means each is individually tailored

← Interceptor, modified by Jensen International Automotive with a novel twist: a supercharged 6.2-litre Chevrolet LSA V8 making 556bhp. So quite a lot of novel twist. JIA takes an Interceptor, tidies the shell, fits Jaguar-influenced independent rear suspension and installs the mighty motor. Subtle it is not.

A track car it isn't, either, but that's fine – its time will come on the road. For pictures and video, though, we run it around Llandow and, by gum, does it ever have an engine. The rear-drive Interceptor R Supercharged is ferociously fast in a straight line, driving through a six-speed auto here. You can spec a manual, but the auto suits the Interceptor's demeanour. This is a softly sprung, comfortable car, with a shell that lives without the stiffening of the Alfa so it feels more 'classic'. Still, it steers with slow slickness, and while the brake pedal is soft to the extent you might think it's here in an advisory capacity only, in fact retardation is good.

There's more to enjoy on circuit in the Tuthill-modified 911, although you suspect one of its 2.0-litre 'Cup' race cars would be more engaging still. But the 2.4 E's steering is lovely and the balance is good, albeit erring towards understeer thanks to a wide rear track and balloon tyres. The engine is lustful and the gearshift positive, and whatever Tuthill has done to the bushes and control weights, it feels terrifically solid. On narrower tyres and more track-focused suspension, I imagine you could swap some track focus for road focus. Tuthill will build you one however you want. After a day on track, I took the 911 on a motorway and then some back roads and loved it – and I've never felt cooler than getting out of it at the end.

More on that when Saunders and Disdale take up the story. Meanwhile, the GTA-R is an utter joy on track. It rides on relatively skinny 195-section tyres but still generates masses of grip. Its heavy steering is full of reward and its engine, while revving to 7500rpm, is as gutsy and tuneful as any road-going four-cylinder in existence. The long-throw five-speed 'box is more accurate than anything with a lever that long has any right to be, and the brake pedal is brilliantly weighted. Everything is unassisted.

But it's the handling that makes it. Before I drove the GTA-R, the man from Alfaholics said it was more rewarding than a Ferrari 430 Scuderia, which I humoured with a 'well, he would say that' sort of nod.

Yet its balance is so good that I think he's right. Going into a corner there's a touch of understeer, which you can trail brake through, or you can just turn in slightly too fast, get on the gas and power through, with the GTA-R telegraphing perfectly that it's about to slide, foursquare but slightly rear biased, through any turn you like. It might just be one of the 10 most enjoyable cars I've ever driven. On track, at least. On the road? Over to my colleagues.

MATT PRIOR

The 911 is down on power but more agile than the Jensen

Jensen feels big because, as you can see, it is

THE DAILY GRIND

A long day of full-on track driving has passed by the windscreens of our three restomods, and the closest we've come to trouble in any of them has been some hot, smelly brakes. What can you say to that – except 'bravo'? It proves beyond a doubt that the major mechanical renovation of cars like these isn't just for show; it achieves pretty remarkable results.

Now for some tough testing of a different kind. Our digs for tonight are 50 miles west, near Carmarthen. But before we can head for them, Disdale and I have a two-car mission to Magor services 50 miles to the east, to deposit a car that someone will eventually need for onward transport. Sounds like a simple trip, but much of it will be done in the dark and cold, in rush-hour traffic. These will be the sort of miles that modern cars make so easy but old ones generally don't.

I already know what kind of time Prior's going to be having as he pedals the Porsche westwards – because, after a dark, spluttering 6am start, I brought it from →

Alfa's tyres are skinny but it grips well; the 911's balloon tyres contribute to understeer; softly sprung Jensen majors on comfort

The Alfa is a physical experience but an absolute gem to drive

THE DEVIL IN THE DETAIL

JIA JENSEN INTERCEPTOR

Donor car 1973 Jensen Interceptor
Donor car cost na
Restomodification cost £320,000
Total cost £320,000

The Jensen's shell is shot blasted, then any necessary welding is undertaken and replacement panels are added. The interior is stripped and fully retrimmed in Bridge of Weir leather and fitted with a bespoke dashboard, and switchgear plus an infotainment upgrade and new Smiths instruments. Front suspension is rebuilt and rebushed and its geometry altered. Independent rear suspension is fitted in place of the live axle, with uprated springs and adjustable dampers. Cast alloy wheels or three-spoke JIA rims are offered. Engine is replaced with either a normally aspirated LS3 or supercharged LSA Chevrolet V8 and six-speed automatic transmission (new cars get an eight-speed transmission), RaceLogic traction control system and AP brakes with ABS.

Total man-hours 3000

"The closest we've come to trouble has been some hot, smelly brakes"

> The major renovation of cars like these isn't just for show; it achieves remarkable results

THE DEVIL IN THE DETAIL

ALFAHOLICS GTA-R
Donor car Alfa Romeo 105-series coupé
Donor car cost £10,000-£30,000
Restomodification cost £310,000
Total cost £320,000-£340,000

Alfaholics like to start with an original car or one that hasn't been restored for ages. The shell's seam is welded, it gets a 12-point roll-cage and carbonfibre doors, bonnet and bootlid. The aluminium twin-cam engine from a 75 is bored and stroked to 2.3 litres and uses Motec engine management. There's still a live rear axle but the close-ratio 'box and limited-slip diff get Alfaholics internals. Titanium top front wishbones, adjustable gas shocks and lightweight springs are also used. Power steering is an option.

Total man-hours 3000

You won't get much change from £300k for a full-on GTA-R

Stuck on high beam at night, the Jensen was almost sidelined

The Alfa's steering is heavy but full of feel; Porsche's helm is well balanced and weights up nicely; Jensen's is slow and slick

←the Midlands to south Wales this morning myself. But for some heavy controls and a particularly noisy set of pipes, though, our 47-year-old 911 is pretty easy to drive. The brakes are brilliant. The headlights and wipers are first-class. In many ways, it doesn't feel like an old car at all.

The car has lowered torsion bar suspension, which makes for a ride that feels a bit wooden over sharper bumps, and for a steering rack that needs plenty of heft to get it beyond a quarter-turn. If you took exception to either characteristic, though, you'd just commission the good people at Tuthill Porsche to configure the car differently. You can have what you want, after all; old 911s, they say, are supremely adaptable things. The carburetted engine is smooth, torquey, characterful and potent enough, with only the occasional tendency to stall when slowing down from a long cruise. It demands some care when you're accelerating from low revs so as not to over-fuel it, while the notchy gearbox likes a deliberate, well-timed shift and the odd double-dab of clutch. You soon get used to both, though. Other than that, you just need to be careful not to put petrol in the oil tank by mistake (an exterior oil filler just behind the driver's door was one of the curios of the E-series 911).

The Alfa? That'd take a bit more getting used to, as I find out when Disdale moves over for our return leg from Magor. Crumbs, it's really noisy when working; less so, mercifully, at a cruise – but it's still the sort of car in which, like the Porsche, you'd want to wear earplugs for a long drive.

The roll-cage, deeply sculpted seats and four-point belts make it the trickiest of the three to board by some margin – and there's less room in front of the controls than the other two have. But, Lordy, what rewards there are once you're getting stuck in. It sounds utterly rampant above 4500rpm and goes like stink. Handles sublimely, too, with more lightness and immediacy than the Porsche and better balance. Wherever you are, wherever you're going, you're very unlikely not to be enjoying yourself.

I certainly am – until the dusk around wherever we are descends to total darkness and I discover that the Alfa's LED headlights have a regrettable tendency to switch themselves off completely now and again. Only for a few seconds at a time – but long enough to focus the mind on an unlit motorway. Sometimes it will happen when you indicate or turn the heater on, at other times entirely without warning. Very Italian. Last time I checked, though, it's not something that 10-year-old Fiats do any more.→

BEST OF THE REST...OMODS

EAGLE E-TYPE
Arguably the most famous restomod there is, based on one of the most recognised cars in the world. Available in E-Type, Speedster, Low Drag GT and Spyder GT guises, all are exquisitely finished, fearsomely expensive and fantastic to drive.

MG LE50
It looked the part but the MGB was never great to drive. Not so the LE50, developed by Frontline Developments. It features a fettled 210bhp Mazda 2.0-litre, six-speed manual 'box and fully adjustable suspension. Decent value at £65,000, too.

LANCIA DELTA FUTURISTA
Could the 1980s be ripe for a restomod revolution? If so, this 330bhp aluminium and carbonfibre three-door Integrale by Italian coachbuilder Automobili Amos could be the car to start it. Just 20 will be made, each at £270,000.


Tuthill Porsche's modern feel impressed

Still, at least the Alfa's headlights work 99.5% of the time. As we get back to the Jensen for the last leg of our evening motoring, the mood of our trip takes a turn and the less palatable side of restomod ownership is revealed as we discover that the Interceptor's sidelights work fine, as do its main beams – but its dipped beams don't work at all. Ah. A call to JIA suggests we check the wiring to the footwell-mounted dip switch, and then the fuse box, but neither yields any luck.

All we can do is limp in convoy to the nearest garage, buy some electrical tape and blank off the car's headlights as much as possible. It's either that or let a blown fuse bring this whole test to a premature end. It's a comfy car, the Interceptor – and much more so than either of the other two here, it should be noted – but not nearly comfortable enough to stand in for a proper bed and a cooked breakfast for a road tester who's had a 16-hour day.

MATT SAUNDERS

ON THE OPEN ROAD

I'm sweating here, and it's not just because the Alfaholics GTA-R 290 doesn't have air conditioning, or that with its four-point harness pulled tight you can't reach the window winders. No, the reason perspiration is forming on the brow is that for something so flyweight the Alfa requires a fair bit of muscle to hustle.

It's a crisp and bright morning after the night before and last night's headlight woes are forgotten. We've wound our way from the hotel near Pendine (leaving the car park took longer than expected, as vehicles such as these attract the right sort of attention everywhere you go), to some twisting roads in the Black Mountains – the sort that should ideally suit these sorts of cars, where driving for the hell of it is what it's all about. Yet with their serpentine switchbacks, your arms and legs are working twice as hard as in a modern, and that comes as a shock to limbs pampered by power assistance. Yet like all things in life, the harder you work, the larger the rewards – and in the case of the GTA-R, the rewards are very large indeed.

The compact and quick Alfa is perfect for roads like these, dancing into and out of corners with dizzying agility (watching the boat-like Jensen in my rear-view mirror lurching hilariously from port to starboard as Prior tries gamely to keep in touch further highlights the GTA-R's nimbleness). There's just the right balance of grip and slip, while the steering is hefty but it's quick and precise and delivers real feedback – not as much as the Porsche, but not far off. The stiff and short-travel suspension is occasionally ruffled by sudden, sharp imperfections, but otherwise the GTA-R corners fast and flat, riding the bumps with aplomb.

And, of course, there's that glorious engine. Yes, it'll spin to the heavens, but on HM's highway you can short-shift and ride the wave of tractable, digitally managed torque. Even then it's still fast and physical, feeling closer to a Caterham than anything else here. That's not something you can say about the Jensen, although we all agree it feels more at home here in the hills than at the track. Of course, it's bigger and heavier, while its focus on cruising comfort means it's more of a point-and-squirt device than the maximum-momentum Alfa Romeo and Porsche.

Surprisingly, traction is good, and there's not much call for the RaceLogic traction control, while the power-assisted steering is easiest to manage here, even delivering some decent feedback. It's only when you really press on that the Interceptor starts to feel its age, quick changes of direction resulting in those nautical lurches. Of course, if you want a sharper drive, then the adjustable dampers can be firmed up, plus there's the option of an anti-roll bar at the rear. But when the long drive home from Wales beckons, it's the Jensen's long-striding cruising gait and wall-to-wall leather-lined and air-conditioned interior that I end up wangling my way into.

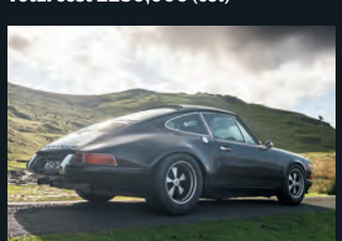
Falling between the two in terms of down-the-road dynamism is the 911. The aim for this example has clearly been to make it as benign and as usable as possible (the interior is exquisite), but that doesn't mean it's dull. The balloon tyres and wider track mean it never feels anything but secure, but in classic 911 style the nose bobs around in rhythm with the road and the steering constantly writhes in your hands, gently keeping you in touch with the Tarmac.


Alfa's four-pot 2.3 makes 240bhp


Jensen's LSA V8 produces 556bhp

THE DEVIL IN THE DETAIL

TUTHILL PORSCHE 911 2.4E
Donor car 1973 Porsche 911 2.4E (E-series)
Cost of donor car £90,000 (est)
Restomodification cost £150,000 (est)
Total cost £250,000 (est)



Shell treated and resealed, exterior rechromed, repainted and upgraded with widened body. Interior, boot and engine bay remodelled and retrimmed Competition pedal box, shift mechanism and steering wheel fitted; electronic air conditioning added. Engine reconfigured for carburettors and new exhaust fitted. Lowered and stiffened torsion bar suspension fitted along with new damper struts and wider wheels. Competition-grade brake upgrade with new master cylinder added.

Total man-hours 1500

> “Vehicles such as these attract the right sort of attention everywhere you go”

	ALFAHOLICS GTA-R	TUTHILL PORSCHE 911 2.4E	JIA INTERCEPTOR R SUPERCHARGED
	Wonderful driver's car is at its best on a circuit but rewards on the road, too	Lovely, lively, characterful and interesting classic to drive anywhere and any time	Big, bruising and wafty everyday drive with a difference. Epically fast
Price	£330,000 (est, depending on spec)	£250,000 (est, depending on spec)	£320,000
Engine	4 cyls in line, 2.3 litre, petrol	6 cyls, 2341cc, petrol	V8, 6162cc, supercharged, petrol
Power	240bhp at 7000rpm	175bhp at 6200rpm (est)	556bhp at 6100rpm
Torque	200lb ft	155lb ft at 4500rpm (est)	551lb ft at 3800rpm
Gearbox	5-spd manual	5-spd manual	6-spd automatic
Kerb weight	830kg	1075kg (est)	1600kg (est)
0-62mph	4.5sec (est)	7.9sec	3.8sec
Top speed	150mph (est)	136mph	174mph
Economy	na	25mpg (est)	17mpg (est)
CO_2, tax band	na, tax exempt	na	na

Like the Alfa, it feels delightfully compact, allowing you to pick from a choice of lines and yet stay resolutely in your lane, the front end going just where you place it thanks to strong bite and steering that ramps up the weight gently. Most surprisingly, there's no unruliness if you change your mind mid-corner; instead, the Porsche simply tucks neatly in. And the brakes are cracking, the firm pedal and progressive response bettering even the GTA-R's.

If there's a let-down, it's the engine. It sounds glorious as it wails away into your slipstream but, with less than 200bhp, it feels a little limp. It's not such a hardship on the track where you can keep it singing happily away near the redline, but out here the low-speed response isn't as strong, while those carbs occasionally cause some coughing and spluttering, allowing the Alfa and Jensen to pull effortlessly away out of the hairpins.

Naturally, you can upgrade the engine, adding both muscle and tractability, which is precisely what's happening to this particular car next. And therein lies the appeal of restomods like these. They are essentially blank canvases limited only by your imagination, taste and (significant) budget. You want a sharper Jensen? No problem. A quicker and more mobile-feeling 911? But of course. An Alfa with air conditioning? That'd be nice.

JAMES DISDALE

All three are fine examples of what can be achieved

THE 185MPH M1 SLAYER RETURNS

To celebrate 60 years of the M1, **Andrew Frankel** drives a modern version of the Cobra that once turned Britain's new motorway into the Mulsanne Straight

PHOTOGRAPHY LUC LACEY


www.lemanscoupes.com
VIL289
XPO

At just after 4.00am on 11 June 1964, an immaculately dressed racing driver climbed aboard an AC Cobra Coupé racing car and headed out of the Blue Boar services on the M1 motorway. His name was Jack Sears and among his claims to fame were already to have become the first British Saloon Car champion and being team-mate to Jim Clark. He's connected to Autocar too, his friendship with then sports editor and soon-to-be-editor Peter Garnier such that Jack was already godfather to Garnier's young son, Mark.

In the early morning light, he accelerated smoothly up through the gears. He was there to discover the car's top speed – not for fun, but crucially to make sure the car was stable and properly geared to race at Le Mans just nine days later. There was no track in the UK where you could run fast enough to simulate the Mulsanne Straight, for even at MIRA the car would not exceed 165mph.

The car passed that point with ease, Jack sitting back, hands light on the wheel, looking at the rev-counter needle (it had no speedometer) until at 6500rpm it moved no more. Information banked, he peeled off at the next junction and returned to base. There his team got out their slide rules, compensated for tyre growth and concluded that the car had reached 185mph. By 5.30am, Jack was on his way home for breakfast. To him it was an event without danger or drama: just one of many information-gathering exercises required before taking on an event like Le Mans in a brand-new car.

And that would have been that, had someone who'd been there at the time not talked about it in a Fleet Street wine bar – the last place on earth you'd go to keep a secret. The next thing he knew, the story was all over the papers and there were questions being asked in the House of Commons. The following Christmas, a trial 70mph motorway speed limit was introduced – a move made permanent in 1967.

Inevitably, people put two and two together and blamed Jack and his Cobra for the introduction of motorway speed limits, despite the fact that there is no evidence to support it and Jack himself always denied it. But it's easy to see how those considering such a move →

Cobra's Chevy V8 is of little use in an M1 snarl-up

Blue Boar no longer inhabits Watford Gap

This recreation of the original was made by Superformance

> "It has 480bhp, weighs 1200kg and goes like a maniac"

SIX THINGS YOU DIDN'T KNOW ABOUT BRITISH MOTORWAYS

1 The M1 was not Britain's first motorway, though it was the first so called. But before that, on 5 December 1958, a motorway opened to bypass Preston. It would eventually be incorporated into the M6.
2 The original design specification for the M1 was for 14,000 cars per day. It now handles more than 10 times that number.
2 Pigeons are believed to use motorways as navigation aids.
3 At 1222ft, the M62 is Britain's highest motorway – and technically more than 60% of the way to being up a mountain.
4 The M6 is haunted.
5 Britain's weirdest motorway is undoubtedly the M96, because it doesn't go anywhere, is not open to the public and no one's heard of it. It belongs to the Fire Service College and is a private road built to simulate road traffic incidents and accidents. It's located near Moreton-in-Marsh in Gloucestershire.
6 Although ideas for a motorway in Britain can be found as long ago as 1906, the first proper attempt to get one built dates back to 1923. Even if it had happened, it still wouldn't have been the world's first, which had already opened in Italy.

Called the Northern & Western Motorway, the plan called for a massive road to be built in sections, eventually linking London to Liverpool via Coventry and Manchester. It was killed off by a lack of interest (spelled money) from the government and concerted lobbying from the railways, which insisted that such would be the rise in rail use that a project like that would be doomed to failure.

MY M1 MEMORIES

MARK TISSHAW

My location means that I use the M40 rather than the M1 to head north, so M1 trips are rare these days. But when they do occur, it's usually to go to a football away game. And on those days, any service station is a colourful mix of hope in the mornings as people from clubs all over the country head to watch a game, and joy and despair (and tiredness and sore throats) in the evening as they head home, Burger King invariably binding everyone together. Another lovely quirk of British culture.

Jack Sears got the open road, we made do with a skinny latte

might have at least taken into account what even today seems like a fairly incredible speed to reach on a motorway, not least because of all the publicity it attracted.

Today, we're back at those same services in another Cobra coupé, a Shelby Daytona Coupé – albeit not one of the six priceless originals, but a car made by Superformance in South Africa to such a standard that Carroll Shelby himself allowed his name to be used on them (for a small fee). But it's a very different place today and ours is a very different purpose.

For a start, the Blue Boar services are now the Watford Gap services and the M1 is, well, the M1. The road is choked with lorries and roadworks and in the middle of our shoot we chance across a multi-car pile-up, with people still stepping dazed from the steaming remains of what until a few seconds ago had been their cars. We are mildly inconvenienced by the need to relocate to another part of the motorway to take our shots, but I fear some of them will have had their lives changed forever by whatever unseen occurrence triggered the accident.

Under such circumstances, it seems hard to celebrate the 60th anniversary of the opening of the country's first proper, inter-urban motorway on 2 November 1959. Then again, like the near 70 other motorways or 'M'-designated A-roads in the country, its current problems are entirely symptomatic of its success. In 1964, the traffic was so light at that time in the morning that when he did come across another car, Sears felt the need to back off to a trifling 120mph just so as not to scare its driver witless – not for nothing was he known to all as 'Gentleman Jack'.

Today, the M1 stretches 194 miles from London to Leeds and is one of the UK's longest motorways after the M6 and M4. In average traffic flow from junction to junction, it remains the busiest outside the M25. The first stretch to open in 1959 extended only from the northern outskirts of London to Rugby, with the remaining sections to Leeds being opened over a period from 1965 to 1968.

And, to be honest, it's no longer quite the place to exercise a Cobra. Even so, and despite the fact I was not alive at the time of Jack's record run, I still feel like a small boy climbing (I should say falling) into the ridiculously low slung interior.

And just so you don't think this is some kind of kit car despite the Shelby patronage, it was designed by the same Peter Brock who designed the originals in period. Except that back then, Brock could only rebody the existing Cobra with its many and manifest failings. When he designed this version, he did it as the car he'd have made all along had he been able to do so from scratch. So, and for instance, in place of the leaf springs and live rear axle you'll find on all original Cobras, this car has classic double wishbones and coil springs at each corner.

There are other refinements Jack would not have had on his car too, and I don't just mean a speedometer: this one has air conditioning, central locking and electric windows. It's also extremely comfortable, easy to see out of and has a big boot. But it still makes you feel like you've incurred the wrath of Thor when its 480bhp, 6.2-litre LS3 Chevy V8 fires up. And, yes, Jack's car would have had a Ford motor, but one listen to this and you simply won't care either way.

The interior is what you'd expect from one assembled using proprietary parts. Expect Porsche fit and finish and you're going to be sorely disappointment. But it does look appropriately period with all those little toggle switches and the Smiths instruments are clear and easy to see.

It's quite hard to manoeuvre around a service station because all the control weights are heavy – though the power steering can be adjusted under the bonnet – but once you've mentally dialled into it and adjusted your inputs accordingly, it's about 10 times easier to drive than it looks. The clutch is heavy but gentle, the gearshift heavy but precise. You'll

DRIVING A 'REAL' DAYTONA COBRA

There are only six originals, all worth many millions, but there are some built more recently that are, in all important regards, mechanically indistinguishable. At the time, the reason for the coupé body was to gain the top speed over the aerodynamic breeze block that was the original Cobra. Without a single extra horsepower, the Daytona Coupés went 30mph faster down the Mulsanne Straight.

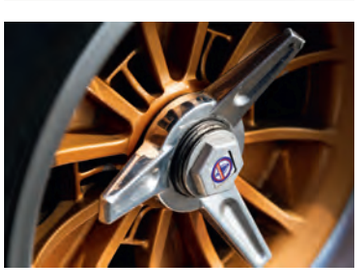
But there was another benefit: the way the body was attached to the chassis added considerable rigidity, which transformed the handling. I've been lucky enough to drive both, back to back, and while the normal race-prepped Cobra was inexact and unnerving to drive as I had read they all were, the Daytona handled beautifully well – not delicate like its great rival the Ferrari 250GTO, but consistent, trustworthy and great fun.

The result took the Cobra from a car that wouldn't (and frequently didn't) see which way a GTO went on a race track to one that trounced the GTOs at Le Mans in 1964 and the following year won the GT category of the World Sports Car championship. This was the first globally recognised international racing championship ever to be won by an American car.

"I'm foot down, engine bellowing and ready to do 185mph all over again"


It's a beauty, whichever way you look at it


Not every day do you spot a Shelby Daytona



notice the prevalence of the word 'heavy' in this paragraph because that's how it all feels. But it's not: weighing only around 1200kg if you choose the robust standard vinylester and glass composite bodywork (aluminium is an expensive option), it has a similar power-to-weight ratio as a McLaren 570S. Which means it goes like a maniac.

Which also meant that, on the M1, it felt like what Thomas Hardy once referred to as a 'netted lion', except he was talking about a person. I have to keep reminding myself that this story is about the motorway, with the car being used for the purpose of pleasingly relevant illustration. But it's no good – I'm much more interested in this machine than the clogged road on which I must drive it, so it is just as well that the photographic brief requires endless sprints between junctions, at which there are plenty of side roads and roundabouts on which to indulge my inner Jack. It rides ridiculously well, though were this my car, I'd stiffen its adjustable Ohlins dampers a bit to provide a little more body control. I'd prefer more steering feel too.

Just once I get a clear run up the slip road and, for perhaps no more than a couple of seconds, I'm foot down, engine bellowing and ready to do 185mph all over again. But of course I don't: my licence is my livelihood and I'm not Jack Sears.

I head back to Watford Gap at the 70mph limit in whose imposition he said he played no part, and thought what it would be like to be back in those quieter, more innocent times. Even when armed with a Cobra, today the M1 is a bore at best, an ordeal at worst. Sixty years ago, it must have seemed like the most exciting road in the country.

MY M1 MEMORIES

STEVE CROPLEY

A former Rootes Group engineer I knew once described how the opening of the M1 led to panic redesigns for the major mechanical bits of many British cars, largely because of the north-south orientation of the exciting new motorway.

In the UK, the wind usually blows from west to east. The unrestricted nature of the M1 led many a family dad to max his Austin or Hillman on the new road – the very first place that sustained high speed was possible in this country. Owners soon discovered that the cooling airflow required was simply not available. Cars had not been designed (or tested) to cope with the heat they could now generate. Radiators exploded, engines overheated, oil became so thin that oil pressure dropped and engines ran their bearings. Gearbox lubricants boiled, tyres overheated, brakes couldn't provide decent stopping from 80mph-plus and much more. Wind noise became a serious problem, sunroofs blew out, door seals were shown to be inadequate and the time-honoured front quarter-light rapidly became an anachronism.

It all led to crash redesigns of finned sumps, finned gearbox housings, bigger radiators, better lubricants, bigger air scoops and door frame mods. It also led (eventually) to gearing changes and the adoption of multi-speed gearboxes so that fast cruising didn't require engines to rev their heads off. You could call it the beginning of the modern era.

PLAYING THE PERCENTAGES

Just how much of a supercar's performance can you really use, and is something smaller – and cheaper – more fun? **Colin Goodwin** finds out

PHOTOGRAPHY LUC LACEY

I'm sitting in a McLaren 720S in Gulf blue with the same oil company's trademark orange used for stitching inside the cabin. It is the best-looking McLaren I've ever seen.

This is how I see McLaren's cars: the thinking man's saloon is a Saab, his luxury car a Bristol and his supercar a McLaren. It is a wonderfully bull-free brand and that's reflected in the car itself. No knobs and buttons on the steering wheel – the component is simply there to guide the car through probably the best steering system in any sports car made today. And McLaren calls the people who buy its cars customers, not clients.

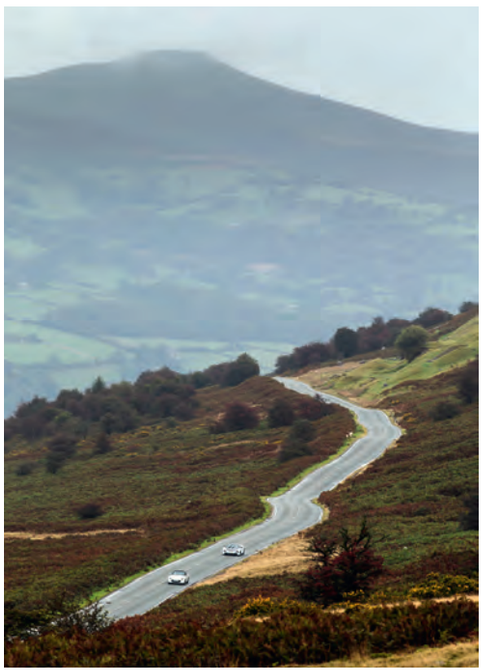
I collected the car from the Autocar road testers' secret bunker in Feltham. I drove the new McLaren GT a few weeks ago at its launch in St Tropez and it was much the same as the 720S: a comfortable ride, fantastic steering and a lot of power. Though not of course as much as the 720S. It's always exciting to step into cars like these.

Ten minutes later, I'm on the M3 and that initial excitement has been replaced by frustration and the same thought that I have these days when I'm behind the wheel of any outrageously fast car. They are completely pointless, utterly out of touch with modern driving conditions and enforcement of the rules of the road. Cars like the 720S are, of course, still excellent for posing, but that's no good to me because I love driving, not thrashing up and down outside Harrods in first gear.

But more than that, I love the feeling that I am using a machine to the outer edges of its abilities. Using as much of its power, grip and dynamic prowess as possible. You may remember that I built an aeroplane in my garden shed. It's been flying for six years and much of the joy has been using it right to the edge of its performance envelope whenever I want to. It will fly at 200mph and, if I'm willing to pay for the large amount of fuel it uses while doing so, then that's what I can do. It's legal. And so is doing a loop or a roll. In other words, I'm getting 100% value from my efforts in building it and the cost of owning and running it.

What percentage, I wonder, can one get out of a McLaren 720S on the public road? I was pondering on this while driving the GT in France and


The McLaren has its own built-in telemetry


The lead car set the pace while the second recorded data

MX-5's 1.5-litre four-pot produces a modest 130bhp


Litchfield's Dan Cook (right) gives Goodwin a quick demo

I suspect that at 70mph on a motorway, both cars are using the same amount of horsepower to maintain speed – and that will probably be no more than 50bhp.

realised there is a way that question could be answered. What if we drove the car on one of our favourite stretches of road, keeping to the national speed limit as far as possible, and then afterwards plugged a laptop into the car's on-board diagnostic system that, among other things, logs throttle position?

Better still, we could take that most usable of sports cars – the Mazda MX-5 – and do exactly the same. We would then be able to compare the data from both cars and even overlay them over each other to see the difference in percentage throttle used. We know that driving a car like the MX-5 to its limit is just about the most fun you can have but it →


The Mazda costs £225,695 less than the before-options 720S

would be interesting to put some numbers to it.

So that is why I am heading down the M3 in the McLaren. The destination is Crickhowell and the roads that I've been driving on for the past 30 years. But before that, I'm stopping off at Litchfield Motors in Tewkesbury. I have known Iain Litchfield since he started his eponymous business at the age of 19.

Iain and his staff of boffins forget before breakfast more about software and engine management electronics than I will ever know. Put simply, if Goodwin was to start mucking about with either cars' brains with a laptop, it would be a disaster. The poor car would probably end up thinking it was a Suffolk Punch lawn mower and run on just the one cylinder.

The reason for stopping off at Litchfield Motors was to check that it will be possible to extract the data, and in particular the throttle position. Iain knew that it was possible with the MX-5 but wasn't 100% sure about the McLaren. It turned out there was no problem. Better still, Iain is sending technical manager Dan Cook along to help us with gathering the data.

The next day, Matt Saunders, Cook and photographer Luc Lacey are in a car park on the B4560 above Crickhowell. It's a bit miserable with showers coming and going. Saunders has brought with him the MX-5. We've chosen a 1.5-litre version because its 130bhp will better illustrate the point we're making.

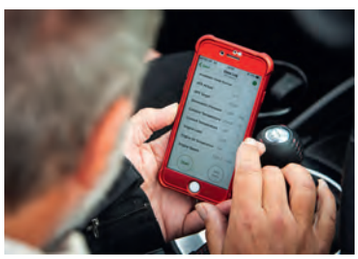
We plan to make three different runs. The first is the run up from Llangattock (a small village just outside Crickhowell) up to a T-junction where it meets the B4560. Once you're out of the village, it's national speed limit the rest of the way. We reckoned that the best plan was to drive up in a pair with the lead car setting the pace and the one behind it being the one whose data was being captured. For consistency, Saunders is to drive the McLaren on all the runs and me the MX-5. Cook will ride shotgun in whichever car is being 'data captured'.

The second and third runs we will make along the B4560 in each direction. Our first run is between fields and trees but the others are much less hemmed in and across open moorland. The first run is entirely uphill, the others mostly so. No point using long stretches of downhill because both cars will spend time coasting with closed throttles.

So here we go. Saunders in the 720S on run one with me following in the Mazda with Cook. He's not even using a laptop, just his mobile phone, which receives the data via Bluetooth from a widget that he's plugged into the car's OBD port. It's that simple.

On these damp roads, it's amazing how much effort I have to put into keeping up with the McLaren. Also, it's much easier to keep myself from going over 60mph than I expected it to be. Mostly I'm in third and fourth gear, only briefly into fifth.

With the run done, Cook slips into the 720S and it's their turn



You don't even need a laptop these days

MX-5 buyers get their money's worth

No speed limits were broken during the making of this feature

A PERFORMANCE CAR'S IDEAL SPEC

Rear-wheel drive is preferable but not essential. I'd have had as much fun chasing after Saunders in a 130bhp Ford Fiesta. Manual is still my preferred choice in a sports car because it involves using another skill. Power isn't really an issue, weight certainly is. Anything over a tonne is getting too lardy. A 0-60mph time of less than seven seconds is quick enough and a top speed of 120mph more than adequate.

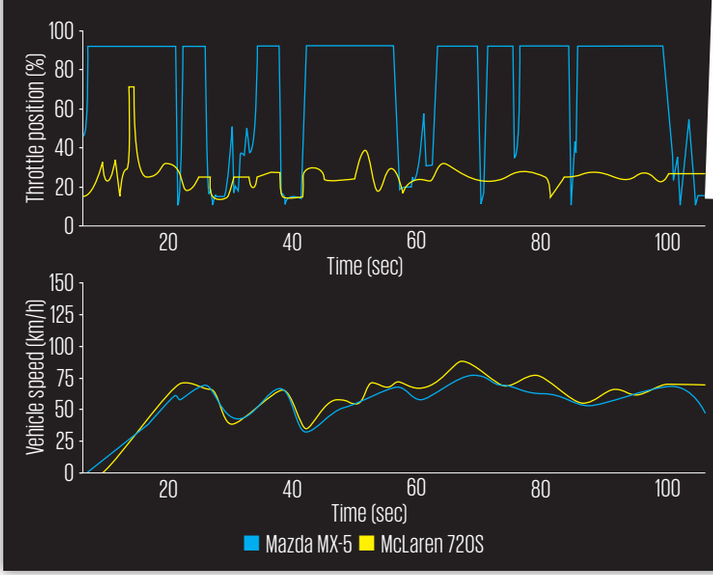
A wide sports car is a liability on roads that are full of SUVs, so no broader in the beam than an MX-5 or Alpine A110, please. Because we don't have huge amounts of power, narrow tyres are possible and therefore they're lighter and so are the wheels. The brakes need not be so big either, which will also reduce the unsprung weight and benefit the ride quality.

What I really want is a Lotus Elan Sprint with modern reliability and safety. No more power and no infotainment.

It was surprising how hard I had to work in order to average 60mph in the MX-5. Even got a bit of unplanned oversteer on the way up the hill.

Saunders (right) and 720S barely broke a sweat

HOW THE THROTTLE POSITIONS COMPARED



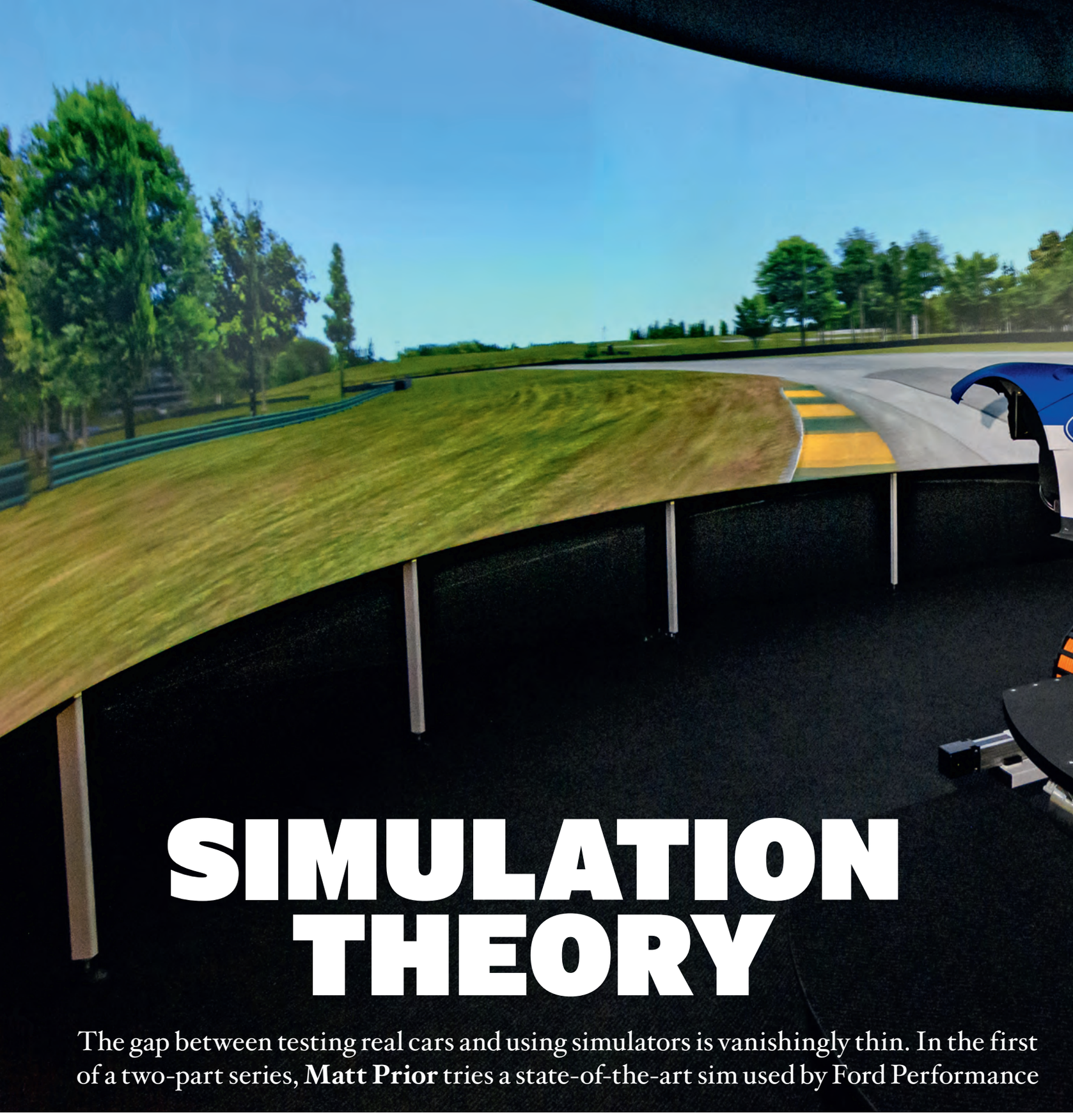
> “On these damp roads, it’s amazing how much effort I have to put into keeping up with the McLaren”

to follow me as I drive as near as possible at the same speed as before. I suspect Saunders is having less trouble keeping up with me than I did following him. Now to what we call the top road. Our first run on this route works perfectly and we later discover that we’ve managed to keep within two seconds of each other over a run that took 140 seconds. Unfortunately, on the run in the opposite direction we’re baulked by traffic, but no matter because the results from our first run up from the village and then our first across the open moorland are excellent.

Saunders reports that he’s been using hardly any throttle but I can’t wait to see what the data says. Cook produces a graph (which you can see opposite) that tells the story perfectly. For long stretches, the MX-5 used about 93% throttle (actually, the maximum opening possible), while in contrast the 720S only for one brief instant used 70% but averaged nearer 25%. Our speeds, as you can also see from the graph, were very similar – and more or less within the limit.

It has been an interesting day. The McLaren 720S that we’ve been driving costs £308,510 (without options, it’s £246,990) and the Mazda MX-5 £21,295. It doesn’t take a calculator to see who was getting their money’s worth. A

Litchfield Motors’ box of tricks plugs into an OBD port, from where it monitors throttle position (among many other things), sending the data to a smartphone via Bluetooth



SIMULATION THEORY

The gap between testing real cars and using simulators is vanishingly thin. In the first of a two-part series, **Matt Prior** tries a state-of-the-art sim used by Ford Performance

I think the first time I used a car simulator that felt half-realistic was at McLaren, when it was developing the MP4-12C, in 2011.

McLaren had two at the time. One was pounding virtual Formula 1 race tracks but the other had also been set up so it could aid development of McLaren's road car.

Back then, using a simulator was still a novelty for a lot of car makers. Today, hardly any would be without one. Or two. Or more. They save time, they save money and, fundamentally, they make race and road cars better. Or at least they should do.

In 2011, Chris Goodwin was McLaren's chief test driver and oversaw what the simulator was doing. Now he's doing a similar role for the development of the Aston Martin Valkyrie. The McLaren simulator's physics software was good. In F1, the differences between simulated laps and what happened when the car got to a circuit was within a tenth of a second. "What happens in here is exactly the same as what happens in the real car," Goodwin told us at the time.

But the way the simulator told the driver what was going on was quite different from the sensation of a real car. "Once you've learned what each movement and feedback means, you start to get it," Goodwin said.

I sense that, in the simulated world, much of the eight years since have been spent reducing the difference. The key to a great 'driver in the loop' (as in, a person is using it) simulation is that it feels like the real thing. And while the physics get more accurate still, and more advanced software lets engineers model ever more factors, the best sims are ones that make you feel like you're actually there.

And herein lies the problem. The earliest simulator that I, and perhaps you, saw was for

> “A sim is expensive. But if you can make one less prototype and save £15 million, it’s worth every penny”

Ford Performance’s sims are used for race and road cars

The software is so advanced that two drivers, one in each Ford simulator, can feel the side draft from each other’s cars during a Nascar lap.

aeroplanes. It was on The Krypton Factor (ask your parents) and it was in a pod, as flight simulators often still are. They sit on a ‘hexapod’, an arrangement of rams that gives plenty of degrees of movement, but, usually hydraulically powered, they’re slow to respond and, other than giving you an angle of lean, can’t maintain a g-force.

Which is fine for an airliner, because if you’re sustaining a big g, things probably aren’t going well. But imagine trying to replicate the g-forces of a car going through a fast corner. Take Monza: you’d need a pod travelling on rails and, while they do exist – usually for truck simulators – to sustain a big g-force, a simulator would have to be on rails that are, well, the size of Monza. Which isn’t helpful.

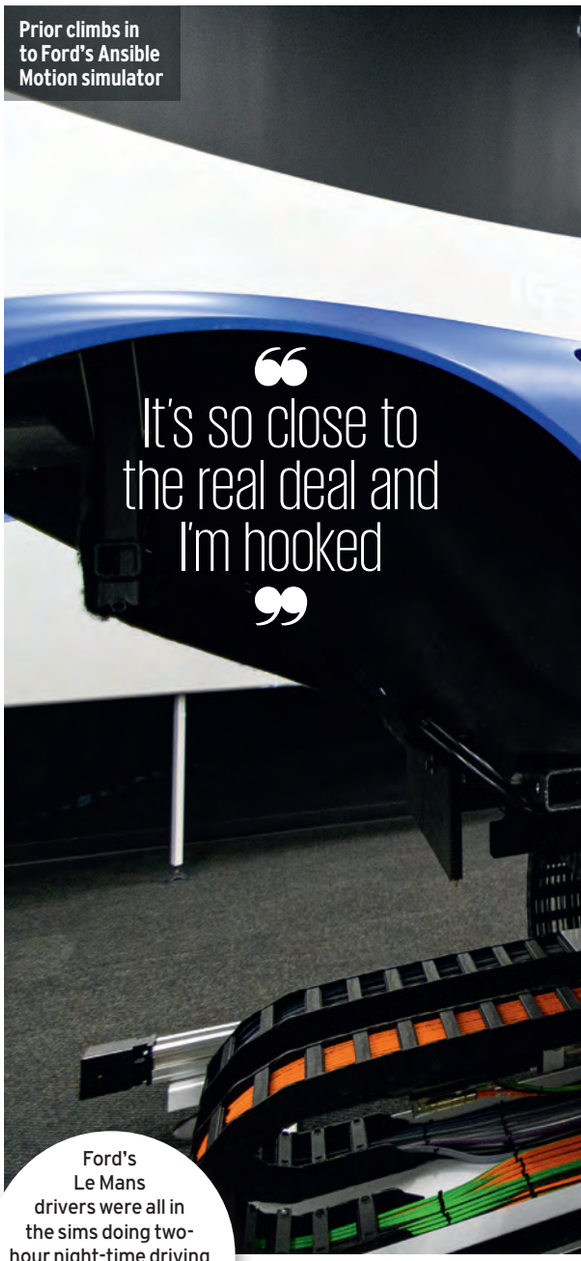
Besides, if you’re in a pod, you rule out easily changing the actual cockpit – and, increasingly, car makers like to sit drivers in simulators that have a realistic environment so they can test ergonomics.

So they want a simulator that can fit inside a room, in which one cockpit can be craned off and another dropped on, and which yet feels like it’s moving, without making the driver feel sick – a big problem with early simulators.

Those are the challenges. I’ve been to a couple of places that think they’re at the cutting edge of the answer, and both are in the UK.

Cranfield Simulation began making flight simulators for fighter jets and had to solve an issue: how do you make fighter pilots feel like they’re pulling big forces for anything up to minutes at a time? A pilot’s own equipment sparked the answer: in flight, they put on a g-suit, which inflates to stop them passing out. Inflate the suit, then, or in a car the chair or seatbelts, in the right places at the right times and you trick the mind into thinking that acceleration is matching what you see on →

It looks like expensive tech but it's a money saver



Prior climbs in to Ford's Ansible Motion simulator

> "It's so close to the real deal and I'm hooked"

screen. Hard right cornering? Inflate the left of the seat. Hard braking? Pull the seatbelts hard.

I've used a Cranfield simulator and it works brilliantly for driving on track. They combine it with other technology, too, such as high-frequency movements to replicate kerb hopping or eye position changes (if you're braking hard in real life, you slip in the seat and your view changes), a 'yaw platform' that gives cues to stepping over the limit and a suspension platform that pitches, rolls and heaves. I was hooked.

Ansible Motion, based at the Hethel Engineering Centre round the corner from Lotus, is arguably even more advanced. As with Cranfield's, you can pick and choose from a small limited-movement simulator to an all-singing, all-dancing one, but Ansible's sings and dances like nobody else's. Its range-topping Delta-series simulators have up to 13 axes of motion – the primary six (surge, sway, yaw, heave, pitch, roll, if you're counting) and then others up to and including helmet loads. And they're servo operated, not hydraulic. Trouble is, high secrecy and confidentiality mean nobody likes to say who the firm sells its simulators to.

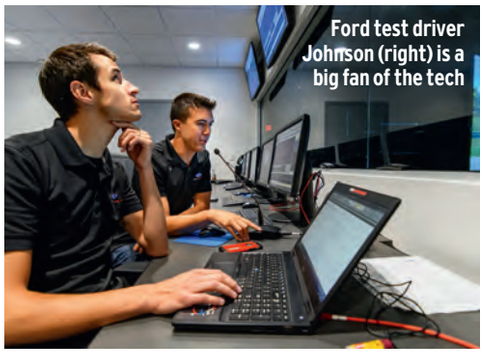
Until you walk into the Ford Performance Technical Center in North Carolina, which develops Ford's racing cars, where they have two of them, in two massive rooms. Mostly, they're used for racing, in everything from concept development through to having two Nascar drivers on the same oval. Who makes the simulators? "Ansible Motion," says Ford Performance's director, Mark Rushbrook.

They're in use all the time. "We thought one was enough," says Rushbrook. "Then we thought two was enough. And now the product guys are in there all the time, too, so maybe we need a third."

For road car products, the simulator is easily as useful as it is for racing. Sims are expensive. Nobody will say exactly, but let's call it a couple of million quid for a good one. But if you can make one less prototype and save £15m, it's worth every penny.

And it's not just the prototype cost, as Billy Johnson, Ford test driver and GT racer, says: "It might cost $200,000 to take a car and six engineers to the Nürburgring. Here, they take a flight to

Ford Performance director Rushbrook sees value of sims



Ford test driver Johnson (right) is a big fan of the tech

Ford's Le Mans drivers were all in the sims doing two-hour night-time driving stints, because there's so little testing allowed in real life.

WHAT ABOUT GAMING SIMS?

It's easy to find people who are a bit sniffy about gaming simulators compared with industrial-type simulators like these, but they're mostly trying to do a similar thing: make it feel like you're driving a real car, when you're not.

Some games telegraph what a car is doing in dramatic or delayed fashion because you've no real feedback. A simulator might tell you that a car is about to oversteer via motion cues, but a games console might not, so it tells you in other ways.

But it would be naive to think there's no relationship between the two. More gamers play with rFactor than engineers use rFpro simulation software, but both are based on the same 'engine'.

Besides, as Nissan's GT Academy and World's Fastest Gamer have proven time and again, you can give drivers thousands of hours of great practice in games, which translates to the real world where they end up on the podium at Le Mans.

Jann Mardenborough: gaming, then Le Mans

Charlotte from Detroit and drive a GT500 road car on six of the world's great race tracks in a day."

The modelling is so good – most simulators I've come across are running rFpro software, but the hardware will run all sorts – that ride and handling set-ups brilliantly replicate the real thing, and today what you feel in a simulator is much closer than it used to be to what you feel on the road.

So they say, anyway. To find out, I'm strapped in and will drive a Ford Mustang GT4 car and then a Ford GT race car, on a circuit I don't know.

The sensation is exceptional. The cars are loud, the GT4 bounces as it might given it's a heavy old front-engined thing, and the lower GT and the stability offered by its downforce mean it's an easier drive, even though it's much faster.

It feels pretty authentic, with the possible exception of braking. You get an initial motion when you hit the brake pedal but, between that point and turn-in, there's a curious dead zone where your mind expects cues to match the visuals but doesn't always get them. Conversely, on a straight, you're sometimes mildly aware that the sim is returning slowly to centre, to wind off the motion it gave you in a previous corner. But it's so close to the real deal that every kerb, every slip into over- or understeer is telegraphed and I'm hooked. As authentic as real driving? Here's the thing: in next week's magazine, in a real Ford GT race car, I'll find out. A

Ford sims can swap between, say, its GT and Mustang GT4

STRAIGHT SHOOTER

Matt Prior sampled the Ford GT on the road and in a simulator. Now he drives the outgoing racing car untamed and in its natural environment

They wanted to use a Mustang originally, you know. Ford, which won Le Mans outright in 1966 with the GT40, thought it would be lovely to return there, 50 years later, and win again. Senior Ford people reckoned that a Mustang, entered in the road-car-based GTE category, would be the perfect 'halo' global sports car to make a splash.

Trouble is, the Mustang is sufficiently big that it was once described on these pages, by a colleague with a sharper grasp of similes than me, as a car that "straddles British driveways like a killer whale stranded on a toilet cistern". And killer whales don't make very good race cars because their large frontal area creates more drag.

There are race regulations to partially offset this: endurance racing series employ a formula called Balance of Performance, which allows big cars to make more power than small ones to overcome the slipperiness deficit. But Balance of Performance can only do so much and wouldn't, Ford's engineers reasoned, let the Mustang be competitive.

Yet there has to be some kind of road car, delivered to customers before the end of the same year the car is raced. So Ford's engineers discreetly started working on something, in a basement, only presenting it to executives once they knew it was a valid proposition. Ford did already have form when it came to recreating the GT40, after all...

And so in late December 2016, a few of those Ford executives took delivery of their own road-going Ford GTs, a homologated road car that had, in race form, won Le Mans' GTE class six months earlier, 50 years to the day after the GT40's win. Job done.

Honestly, though? Road car shmoad car. Every other GTE contender is road car first, race car second. The GT was made from the ground up to win at Le Mans, and that shows on the road. Two occupants sit so close together that they might as well be in a Caterham and, if the GT40 was so called because it sat 40 inches high, this is still low enough to be called the GT41.8.

We drove the road car but Ford was reluctant to let it out on comparison tests or have its lap times recorded, because they wouldn't be on circuits where it was at its best: anywhere that included a Mulsanne Straight. While an intriguing car, and fun in its way, it always felt like the full GT experience would be found elsewhere.

Today, I'm going to try to find it.

The race car you see here, chassis number 005, took a class podium in 10 of the 26 races it entered, winning four of them, with its best Le Mans finish a second place in 2017. But Ford's official GT race programme is now drawing to an end, so the car's for sale. It's time to let some clowns with readers drive it.

I'm at Virginia International Raceway, a narrow, fast, heavily sloped and cambered 3.3-mile race track I'd never seen until a week previously when I watched it on YouTube, and yesterday when I drove round it in a simulator at Ford's performance car headquarters ('Simulation theory', 6 November).

In reality it looks narrower and steeper still. Some of the corners are very, very fast and, in the spirit of the curious American approach to health and safety that lets you buy a rifle but not a Kinder Surprise, none of the corners have gravel traps. It's just grass and then barrier, sometimes at a distance, sometimes not. If I was going to let strangers drive my race car along a 170mph straight, it wouldn't be this one, but here we are.

I get in. It's more snug even than the road car, owing to an FIA roll-cage within the carbonfibre tub, and while in the road-going GT you sit against the bulkhead and the pedals adjust, in here there's a tight Sparco race seat with broad head bolsters and restraining nets either side of that. A rectangular steering wheel pokes far towards your chest and there's bare carbonfibre where the instrument panel would be, with only gearshift lights there: a small LED pane on the wheel provides other info. There's an array of bright, clear switches on the dashboard centre and, while there are the vestigial remains of passenger space, in →

147bhp

When it races in the US IMSA championship, the race-going car makes at least this much less than the road-going alternative.

GT soaks up Virginia Raceway's bumpy bits consummately

reality the right side of the cabin is filled with battery, electrical hardware and a pump to charge the gearshift pneumatics, which whirs loudly, like a tyre compressor, for a few seconds every few seconds.

The GT uses a 3.5-litre twin-turbocharged V6 engine, to which the Balance of Performance regulations are unkind because the GT is so small and fast. In North American 'IMSA' race tune, it develops less than 500bhp. The road car makes 647bhp. I start with less than 500bhp, then, but am told a dial on the steering wheel will give 600bhp should I want it. This is somebody else's racing car on cold slick tyres and a track like a faster, narrower Cadwell Park, so I'm sure I won't.

Two laps later I have, and would turn it further if I could. It's no wonder this car wins races: it's so easy to sit in and drive as fast as you're able.

It seems weird to talk ride comfort in a race car but VIR isn't the smoothest track, and the GT absorbs and surfs bumps without a hint of harshness. The pedals are brilliantly weighted and spaced, the brake pedal particularly firm but retardation and modulation among the best I've ever felt, so you can lean on them hard without the merest suggestion of locking. Once rolling you can forget the clutch, brake with either foot, and gearshifts flapped through by wheel-mounted paddles are delivered immaculately every time, each downshift brapped to perfection.

The steering is quite heavy for a race car's, but millimetre precise with it. It gives you oodles of feel, and there's loads of self-centring, which makes the GT a formidably stable car. That's the aero at work, I imagine. Trailing the brakes into a corner helps the car turn but there's a lovely balance anyway – hints of entry understeer and exit oversteer if you look for them, but otherwise flat, fast and neutral. If I had to pick a road car it felt like – GT excepted, obviously – I'd say a Lotus Exige given how well it talks to you.

Even visibility is good. The windscreen is low, it's true, yet it's broad and you can use the side windows in slower, tighter corners to spot exit points. And while the engine, sometimes criticised in the road car for not having more than six cylinders, works magically here. It's a doddle to smoothly dole out power, albeit traction control and the sheer capability mean any throttle application is just 'flat' before long. And sure, it's less sonorous than it would be with more cylinders, but if you were in here for two hours at a time, that'd be no bad thing.

And you can be, if you have the requisite millions. Approach Ford with a World Endurance Championship programme in mind and you'll be offered a better deal than if you plan to put it into a collection. Ford would like the GT to keep racing. Good. Having tried both road and race cars, that is what it's best at.

Prior utilised all 600bhp on offer – but wanted more

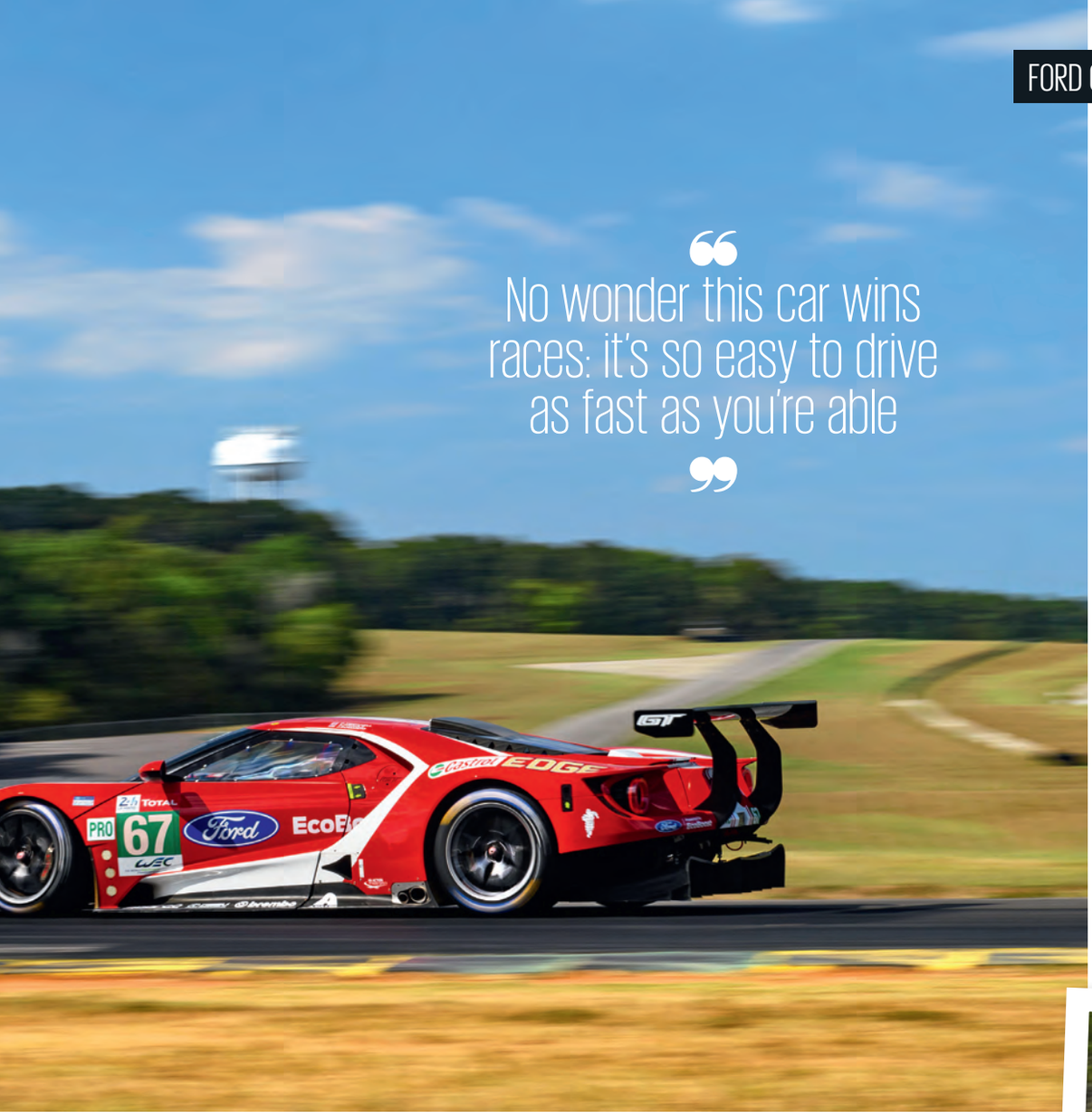
Gravel traps won't save your hide around these fast bends


Four-time-winning car finished second at Le Mans in 2017

£3m

Want to put GT 005 in a box and look at it? You'll find it's about this much. Want to race it? You'll be asked for less.

"Just say I put it into a barrier, would you be this cross?"



> No wonder this car wins races: it's so easy to drive as fast as you're able

COMPARED TO THE ROAD CAR

Few cars make the transition from road to race car with their character entirely intact and the Ford GT is no exception, but given it was designed to go racing in the first place, the two versions are closer than most.

Driving the road-going variant of, say, a BTCC or GTE car wouldn't be that much use as a familiarisation process, but the GT might actually be useful.

The driving environment is one big difference. The road GT is cosy but the race car brings another level of intimidation, until you're comfortable with the ergonomics and by how little room to move there is, which doesn't take long.

The road car has brilliant dampers that give it an eerily good ride, with adjustable ride height that slams itself on the deck in a heartbeat. The race car is keyed to the ground all the time, yet retains some pliancy.

Road-going GTs don't want for power, which they deliver through a seven-speed dual-clutch automatic gearbox. There is ABS too. No such conveniences in the race car – but the six-speed pneumatic sequential, which would be too harsh for road use, delivers power brilliantly.

FORD GT RACE CAR (ROAD CAR IF DIFFERENT)

Length	4763mm
Width	2004mm
Height	1030mm (1059mm)
Wheelbase	2710mm
Engine	V6, 3496cc, twin-turbo, petrol
Power	Less than 500bhp (647bhp at 6250rpm)
Torque	369lb ft est (550lb ft at 5900rpm)
Gearbox	6-spd sequential (7-spd dual-clutch automatic)
0-62mph	na (2.8sec)
Top speed	na (216mph)
Weight	1245kg (1385kg dry)
Fuel tank	98 litres (58 litres)

Now its campaigning days are over, this very car could be yours

GO AGAINST THE FLOW

Hydrogen offers an intriguing alternative to electric power. So what's a fuel-cell car like to live with? **Richard Bremner** spent six weeks with a Nexo to find out

PHOTOGRAPHY OLGUN KORDAL

"Wow!" A wide, gently curving beam of bright white light erupts across the nose of the car. At its ends, the light thickens and intensifies to echo another pair of lights that floats beneath. It's a little otherworldly. Are we looking at the future? Perhaps. These illuminations are performed by the Nexo, Hyundai's second production fuel-cell car, lighting up at night with a key fob's click.

Most car manufacturers – Toyota, Mercedes and Honda excepted – are miles from even offering their first hydrogen-fuelled production car, never mind a second. Hyundai's first showroom fuel-cell car was a converted iX35 SUV. The Nexo travels a whole lot further – literally, in terms of range and stack life – by sporting a bespoke and rather stylish design. In daylight, its looks aren't quite as out there as a front-end lighting signature that caused a car-nut mate to exclaim before I drove off into the dark, but this is a handsome SUV. As well as a shapely body, the Nexo flaunts plenty of pleasing visual details, such as the Ferrari-esque floating D-pillars and the ribbed inserts at the base of the doors that reference the innards of a fuel-cell stack. The Nexo's cabin is no less impressive: the broad, silvery sweep of its centre console is as striking as the canopied digital instrument pack and its offbeat displays of fuel cylinders.

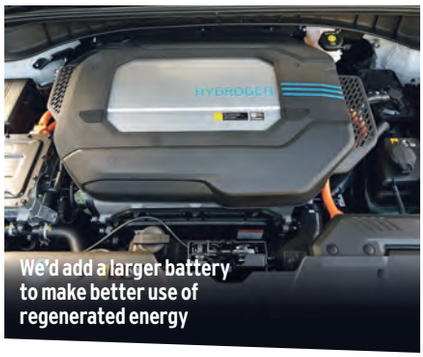
Never mind the show, though. We've been running this car for six weeks to see how practical it is to live with a fuel-cell car, and to drive it to the Frankfurt motor show – a round trip of just over 1000 miles from where your reporter lives in Hertfordshire. That home also happens to be only 15 miles from the nearest hydrogen pump – at Beaconsfield services on the M40, a few miles from the M25. Given the Nexo's theoretical range of more than 400 miles – way better than most EVs – living with this car is a lot more practical than it sounds given that the UK currently has only eight hydrogen stations. That most of those eight are in the south-east is helpful – if you live in the south-east, of course – and still more helpful is that you can refuel a Nexo in under 15 minutes, a replenishment time that no battery EV can hope to compete with.

Which begs the question – why aren't we switching to hydrogen fuel-cell cars rather than battery-electrics? That's too complex a question to fully answer here, but part of the reason for driving the Nexo to the Frankfurt show is to interview Hyundai's Dr Sae-Hoon Kim, who heads up its hydrogen fuel-cell business and can update us, besides testing the convenience of Western Europe's hydrogen network.

But first, there's savouring the Nexo itself. This is certainly a more exciting machine than the iX35 that it replaces, not only because it looks good and goes further (officially, 414 WLTP miles rather than 369) but also because it is very well equipped. A 12.3in touchscreen, power heated and ventilated front seats, adaptive cruise control, parking camera, an around-view monitor, wireless phone charging, a heated steering wheel, sunroof and a general air of luxury all add to an appeal that certainly doesn't feel save-the-planet →

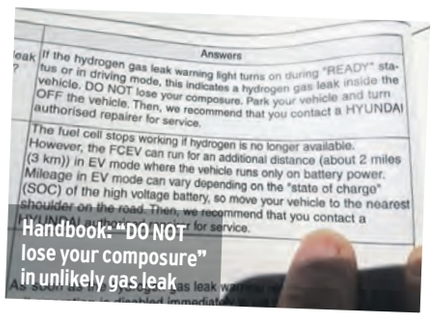

Damp patch is Nexo's by-product: pure water


Infotainment video explains how it works



We'd add a larger battery to make better use of regenerated energy

Zaventem station in Belgium. In UK, 1kg of hydrogen costs £14.40. On one fill, 63.7 miles per kilogram was achieved

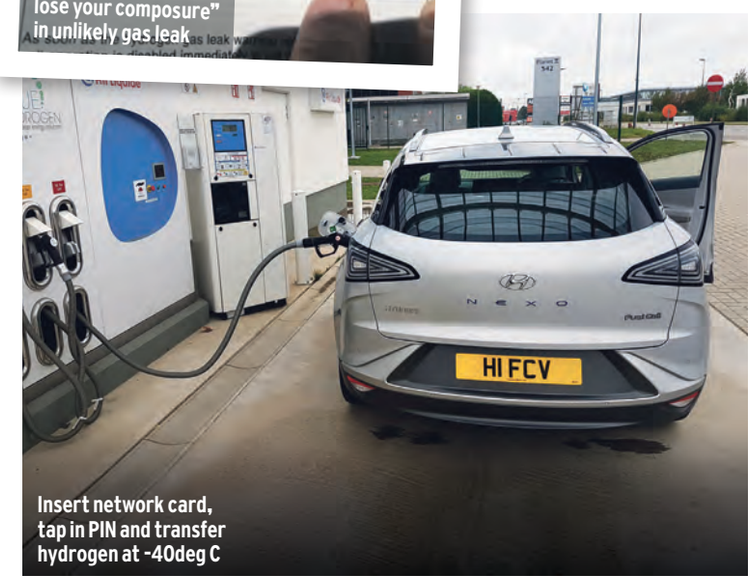

Answers

If the hydrogen gas leak warning light turns on during "READY" status or in driving mode, this indicates a hydrogen gas leak inside the vehicle. DO NOT lose your composure. Park your vehicle and turn OFF the vehicle. Then, we recommend that you contact a HYUNDAI authorised repairer for service.

The fuel cell stops working if hydrogen is no longer available. However, the FCEV can run for an additional distance (about 2 miles (3 km)) in EV mode where the vehicle runs only on battery power. Mileage in EV mode can vary depending on the "state of charge" (SOC) of the high voltage battery, so move your vehicle to the nearest shoulder on the road. Then, we recommend that you contact a

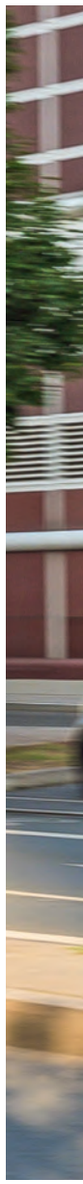
for service.

Handbook: "DO NOT lose your composure" in unlikely gas leak



Insert network card, tap in PIN and transfer hydrogen at -40deg C


Centre console looks good, but 'nav' and 'radio' buttons are the most distant



← spartan. Nevertheless, the seats are (attractively) part-trimmed with bio-fibres.

In terms of the driving, the Nexo feels just like an EV. That's because it is: propulsion comes from a 161bhp, 291lb ft electric motor driving the front wheels. The difference is that the amperes are supplied not by a battery but by a fuel-cell stack, supported by a fairly small battery that supplements its output during moments of heavy demand. The combination provides a steady stream of power and decently brisk acceleration to 60mph, after which it begins to tail off. The tailing off is especially noticeable at 85mph on de-restricted autobahns, when accelerating beyond this speed is occasionally necessary if you're not to be baulked. At this pace, the Nexo struggles to keep up with hard-charging Benzes and BMWs, but in Britain it's entirely adequate – if nothing like a ludicrous Tesla.

Running at high speeds like these is less than wise anyway, with the Nexo's hydrogen consumption increasing exponentially, as with any car. And as with any EV, you need to be aware of the whereabouts of your nearest hydrogen station. On mainland Europe, they're more evenly spread than in Britain, making the trip to Frankfurt less reckless than it sounds. You don't need to plan for an hour or three kicking your heels waiting for your EV's battery to charge, either, as colleague Julian Rendell did when he used a Jaguar I-Pace for the same trip to Germany ('On a charge', 2 October). A fill at Rainham in Essex was enough to get us to our next station in Belgium, having crossed the Channel by ferry because the Eurotunnel won't allow fuel-cell vehicles on its trains. Had that station not been functioning (it was unmanned, like the one in Rainham), we had the range to reach another in Belgium. It was open, but for some reason the pump wouldn't pump without a phone call from my Hyundai PR travelling companion, who was able to have its helpline operator remotely trigger a fill. Apart from this potential inconvenience, there's also the lesser frustration of not being able to achieve a 100% fill. The closest was a near-as-dammit 97% refuelling at an Air Liquide pump in Frankfurt – the trip computer subsequently estimating a 342-mile range – but more typical is 85%.

That last leg to Frankfurt was the closest the Nexo came to running dry, with 37 miles left. That there were two pumps within 15 miles of our hotel made this less alarming than it sounds. But in normal use, running it much lower than 80 miles felt slightly risky – I wanted the margin to get to the next nearest station if my nearest at Beaconsfield wasn't working, which does happen. That 97% fill was a one-off among a dozen refuels, the worst being a very unusual 50% score. The more typical 85% replenishment provides a 280-mile range. That's a long way adrift of the 414-mile WLTP range, and a deficit likely to have you feeling rather less smug about your hydrogen motor's advantages over a battery-electric car.

Less motorway pace and a more cavalier approach to running down the tanks will certainly stretch that 300 miles, but it would be great if a near-100% fill was regularly achievable. ITM Power pumps seem most prone to falling short (it operates the Beaconsfield services pump, among others), but this issue will doubtless be resolved with time. Further evidence of a technology in its infancy is the fact that you need multiple plastic access cards to operate the pumps of multiple providers, mirroring the same inconvenient territorialism suffered by BEV drivers.

Still, there's a pioneering frisson to be had from refuelling: hydrogen pumps are sometimes set aside from the rest, as at Cobham services on the M25, or even within a gated industrial compound, as at Rainham and Heathrow. You're unlikely to have to


▶ Replace hydrogen tank. Maximum number of refill cycles exceeded

This warning message is displayed when the number of times refuelling the vehicle exceeds the predefined number (4,995 times). The fuel cell system stops operation for safety even if the vehicle is refuelled enough and when there is no problem with the vehicle. In this case, we recommend that you have the hydrogen storage system replaced by a HYUNDAI authorised repairer.

▶ Check fuel cell system. Stop safely immediately

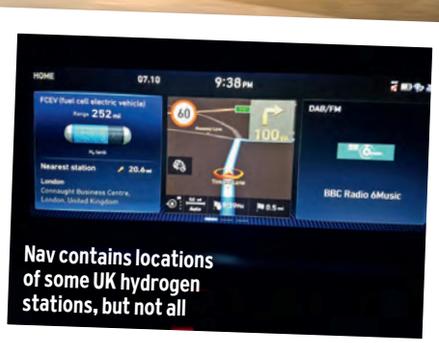
This warning message is displayed when any serious malfunction of the fuel cell system is detected.

In this case, immediately park the vehicle at a safe area and turn off the vehicle. Then turn the vehicle on again.

If the message is displayed again we recommend that you have your vehicle inspected by a HYUNDAI

Tanks can be filled 4995 times – equal to 1.5 million miles – before they need replacing

> “The Nexo is undoubtedly more convenient than a battery-electric car”



Nav contains locations of some UK hydrogen stations, but not all

queue, although the possibility of the gate not opening at these unmanned sites may add to your refuelling frettings. Not that I was ever barred, and at Heathrow you won’t need to wait long before another fuel-cell vehicle appears – another Hyundai, a Toyota Mirai or a converted Ford Transit, perhaps – this being the busiest hydrogen pump in the UK.

Despite these challenges, the Nexo is undoubtedly a more convenient zero-emissions vehicle than a battery-electric car. Even with a worst-case 250-mile range, it goes further than most, and once you’re familiar, you’ll be filling in well under 15 minutes. As range anxiety fades, your attention will turn to the Nexo itself, which proves a pleasingly convenient SUV to use, and the car’s functionality is entirely uncompromised by its propulsion system. Which is quite some achievement, and one that diminishes the impact of some more ordinary disappointments. They include an over-firm ride, the rather unyielding front seat cushions and a scattergun control layout that can take your eyes off the road for too long. The Nexo’s lane-keeping assistance may well counter your resultant drift off line, though many of us will turn this intrusive system off.

None of which spoils the pleasure of driving this handsome technology-stretcher. By the end of the loan, I was beginning to think that £65,995 isn’t so unreasonable, even if it’s more than double the price of a mid-range Tucson. If you live and drive within viable distance of a couple of pumps, you’ll soon enjoy living with the Nexo as if it were any other car. But only if you live in the south-east. Once you move north of Watford, the spread of pumps is limitingly thin, and thinner than in large areas of Europe. That will slowly change but, on the basis of this experience, ought to happen a whole lot faster. A

FUEL CELLS: THE FUTURE

“Sector coupling becomes reality.” This ugly corporate-speak contains good news, though – the phrase marking the moment when part of Europe’s electricity-generating industry linked to the hydrogen economy. In September, Switzerland’s Gösgen hydroelectric plant began using off-peak electricity to produce hydrogen. This first was achieved with cooperation and investment from Hyundai, power generator Alpiq, H2 Energy and Linde Gas.

Why is this significant? Because that hydrogen will be used to power a fleet of 50 Hyundai trucks from 2020 – and trucking, according to Hyundai fuel-cell business chief Dr Sae-Hoon Kim, should prove the irresistible economic force that turns the hydrogen economy viable.

The company is aiming to have 1600 fuel-cell trucks operating in Switzerland by 2025, all of them using hydrogen provided by renewables. Key to the project is ensuring that each of the high-investment hydrogen stations that supplies them is profitable.

But impediments to the roll-out remain, not least the high cost of transporting hydrogen any distance, which typically costs €5 (£4.20) per kilogram per kilometre (the Nexo’s tanks hold 6.3kg), and the cost of cooling it to the -40deg C needed for a fast fill. Which means to be viable, the hydrogen needs to be produced at or very close to the retail pump.

The Nexo, meanwhile, has been a hit for Hyundai. Kim notes that 6000 cars will be sold this year, and more in 2020. By 2021, production will be raised to 40,000 annually from the original 3000.

Hydrogen needs to be kept at -40deg C

VETS IN PRACTICE

The annual London to Brighton Veteran Car Run celebrates the 'Emancipation' of the motor car in 1896. **Colin Goodwin** joins the pioneers for a ride to the south coast

PHOTOGRAPHY MAX EDLESTON

We are surrounded by elegance. Ladies in Edwardian dresses, gentlemen in tweed. Only Duncan Pittaway is letting the side down. Yes, he is wearing a shirt and tie but the man is absolutely filthy. Dirty face, black hands, shirt no longer white. But then he has spent most of the day shovelling coal into the firebox of his 1896 Salvesen steam car. "We have to stop every 12 miles for water," explains Pittaway, "which we pinch from fire hydrants." Which is true because I've seen him watering his machine as we've rumbled past in our 1904 Lanchester.

I can't believe I haven't taken part in the London to Brighton Veteran Car Run before. I haven't even watched the start in Hyde Park or the finish in Brighton. Many friends and colleagues have done so, including our man Cropley. I made the same mistake with strawberries: wouldn't touch the things when I was little, but then discovered in my teens that they're the tastiest things in the world and have consumed great quantities ever since.

What I have done many times (as has Cropley) is ride in the Pioneer Run for old motorcycles. The bikes have to be pre-1915, but these are youngsters compared with the cars' 1904 cut-off date. The other difference is that the bikes start from Epsom rather than central London. Both, however, involve getting up really early.

So at 7.00am, the field is waved off by celebrity gardener Alan Titchmarsh. I've already spotted a few motoring deities, including Prodrive founder David Richards, suitably tweeded-up, and a few friends from the car industry. One is Tim Jackson, who retired as boss of Renault's PR department a few years ago. A total enthusiast, Tim has bought himself a De Dion-Bouton. Mechanical issues have dogged the machine but he's hoping a new gearbox will get him to Brighton this year.

As explained, I am riding on a 1904 Lanchester. I know virtually nothing about veteran cars, not least because they've never interested me much. That is about to change. Our driver is David Manchester, a career man in the motor trade who now runs his own consultancy. In the back we have David Bond, MD of classic car insurer Footman James, and a man from A Lange & Söhne, which is an upmarket timepiece manufacturer and one of the sponsors of the event.

Presumably, Manchester's career has involved making bold decisions without too much thumb twiddling. This ability to make quick judgments is prevalent in his driving. As we head south through Brixton, Streatham and out towards Surrey, we tangle with


Jeans, Goodwin? Really? And no flat cap...

Emancipated! Titchmarsh rips up red flag

They'll beat the rail replacement bus if not a penny-farthing

Barty Pitt on Imperial's James & Browne

Riders like to rock that Edwardian look


It's dirty work... steam power wasn't just for railways

Doug Hill's 1899 Fiat makes it to Madeira Drive in Brighton

early morning traffic, most of which fail to appreciate that we have minimal braking and that the steering is via a tiller, which makes modern EPAS steering feel rather good. I'll quiz Manchester about the controls when he is less busy.

Oh dear, there's my pal Tim on the pavement with various bits of De Dion-Bouton exposed. I think he's about to kick the machine. He's not the only one experiencing difficulties. Since we left Hyde Park, we have seen numerous machines on the side of the road. Our Lanchester is hammering along, its driver showing heroic commitment.

I hadn't realised how big the crowds would be. Out in the open (and not going too fast), you can acknowledge the cheers with a polite good morning and sometimes they'll ask how old your machine is. Once we're on quieter roads in Surrey and Sussex, we see classic cars parked everywhere: a bunch of Lotus Seven owners in a village hall car park, a pride of Moggies outside a pub and random classics parked up on verges. It's just wonderful.

One can converse not only with onlookers but also fellow 'runners'. We're at traffic lights (the arch-enemy of the veteran motorist due to fragile clutches and engines liable to overheat) next to a three-wheeler. It's a 1903 Humber Olympia tandem being driven by Martin Tacon. "My father bought it in 1950," he shouts, "and it's done the run since 1952." Tacon's young son is in the chair in front and no doubt will one day be the Humber's third-generation driver.

Interestingly, the participants in the old bike run tend to be fairly ancient but this event seems to attract a wide range of ages; not just as passengers but as drivers. Both sexes, too. We spot two young men in purple striped blazers wearing top

> "Oh dear, there's my friend Tim. I think he's about to kick the machine"

hats. These turn out to be students from Imperial College, London. Their 1902 James & Browne has been owned by the college since 1934 and each year a team of students prepare it and act as support crew, with one lucky bugger getting to drive. This year it's Barty Pitt's turn: "I did last year but I only got as far as Brixton before the crankcase exploded, so I've been allowed to have another go."

Just outside Brighton, we run through a hailstorm and as Manchester is driving in his usual press-on style, we get a bit of a bead blasting. The traffic in Brighton is terrible and not for the first time we stall. The Lanchester has to be push-started and three of us isn't enough. It's never hard to find volunteers. This time a lady abandons her two kids in their pram and gives us a shove. Thank you, madam.

We roll down Madeira Drive and over the finish line to join a line-up of fabulous cars and equally fabulous people. Pittaway's steamer is still belching and dribbling water. A gauge next to the boiler has its needle past a red line: I presume it is a pressure gauge and that I am about to be blown over to France, but fortunately Pittaway is on the case and lets out some pressure.

Strawberries and the London to Brighton veteran car run. Two of my favourite things. A

OUR LANCHESTER

Our machine is part of the Jaguar Daimler Heritage Trust's collection. Why? Because Lanchester went bust before the first war and then became part of Daimler after a buyout in 1931.

At our stop-off point at Gatwick, JDHT's Eric Baptiste and Scott Barber top up the Lanchester's fuel, oil and water.

"This is an extremely advanced design," says Baptiste. "It has the first engine that featured a pressurised oil system. It runs at 40psi, which is not far off a modern car's pressure. It's a four-cylinder 2.5-litre unit with overhead valves with a camshaft either side of the cylinders. It's a crossflow design."

The next piece of information has my hair standing on end. "It's fast, too," says Baptiste, "We've clocked it at 65mph."

YOU ONLY NEED TO TRY IT ONCE

We've all got bucket-list cars. The Autocar team's suggestions are suitably varied and not always entirely predictable

CHRYSLER IMPERIAL CROWN CONVERTIBLE

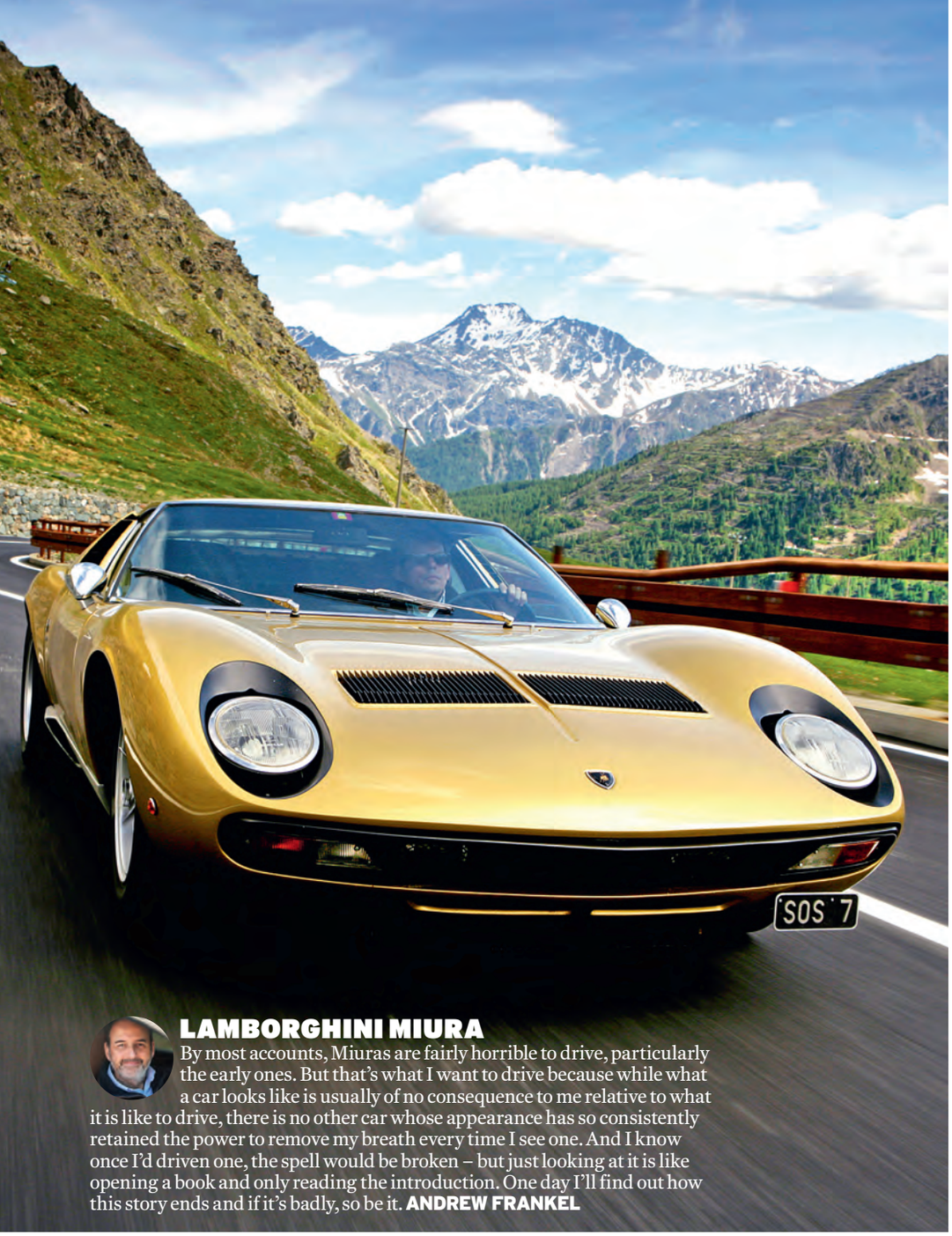
While few people will have the budget, the patience or the sheer quantity of parking to own a slab of classic Americana, everyone should experience a car from the US's 1960s golden era at least once. My personal nomination would be the Chrysler Imperial, both because the ultra-lux model was more technically advanced than contemporary Cadillacs and Lincolns with torsion bar front suspension, and more specifically because my friend Kirk has just purchased a spectacular '65 Imperial Crown Convertible and let me have a go during a recent trip to Michigan. Steering is comically vague, performance is leisurely despite a 7.2-litre V8 under the vast bonnet and handling is relaxed. But nothing has more presence or feels more effortless at a respectful pace. There's just the small matter of 10mpg... **MIKE DUFF**

BUGATTI VEYRON

There are a lot of supercars that I have not driven and, to be honest, I'm not heartbroken about that. I drove McLaren F1s and Ferrari F40s and Jaguar XJ220s when they were new, so perhaps it's the turn of younger scribblers to scare themselves in today's hypercars. But there is one that I haven't driven and which I'd like to just once. It's the Bugatti Veyron. I never got the chance when it was launched and haven't tried hard to get in one since because I didn't think it was my cup of cha. However, so many people whose opinions I respect (including Gordon Murray) have told me that it's a must-do experience that I now desperately want a go in one. **COLIN GOODWIN**

SAAB 9000 TURBO

Saabs rarely made sense to enthusiastic drivers. They were big and, on first acquaintance, often ponderous. But there was a good reason why the Heathrow long-term car park was full of 9000 Turbos in the mid-1990s: there's nothing quite like a Saab for covering long distances effortlessly. A combination of serious shove, a low-mounted driver's seat and a rear beam axle tuned for stability meant that carving up the M1 in hellish weather was almost restful. No need for constant adjustments at the wheel and old Saabs would cut through standing water without a twitch. **HILTON HOLLOWAY**



LAMBORGHINI MIURA

By most accounts, Miuras are fairly horrible to drive, particularly the early ones. But that's what I want to drive because while what a car looks like is usually of no consequence to me relative to what it is like to drive, there is no other car whose appearance has so consistently retained the power to remove my breath every time I see one. And I know once I'd driven one, the spell would be broken – but just looking at it is like opening a book and only reading the introduction. One day I'll find out how this story ends and if it's badly, so be it. **ANDREW FRANKEL**

ALFA ROMEO GIULIA TZ (1963-67)

This Zagato-bodied Alfa is the epitome of the compact, lightweight, race-oriented coupé. Zagato's slinky low-drag spaceframe-hung alloy body carried the 158bhp 1.6 twin-cam, five-speed mechanicals of the Giulia saloon to produce – I imagine – a riotously rapid car of terrific agility, and all within a small, agile and glamorous package. **RICHARD BREMNER**

LAND ROVER DEFENDER

The Land Rover Defender isn't for everyone. Plenty don't warrant a repeat performance, on the road particularly. But if you can spend some time with one, in the company of some experts, in terrain you wouldn't imagine a car can get through (mud that would suck your boots off, water at chest height) and drive, winch and tow your way through it, you'll see the best of it. And have a ball. **MATT PRIOR**

NEW FORD TRANSIT

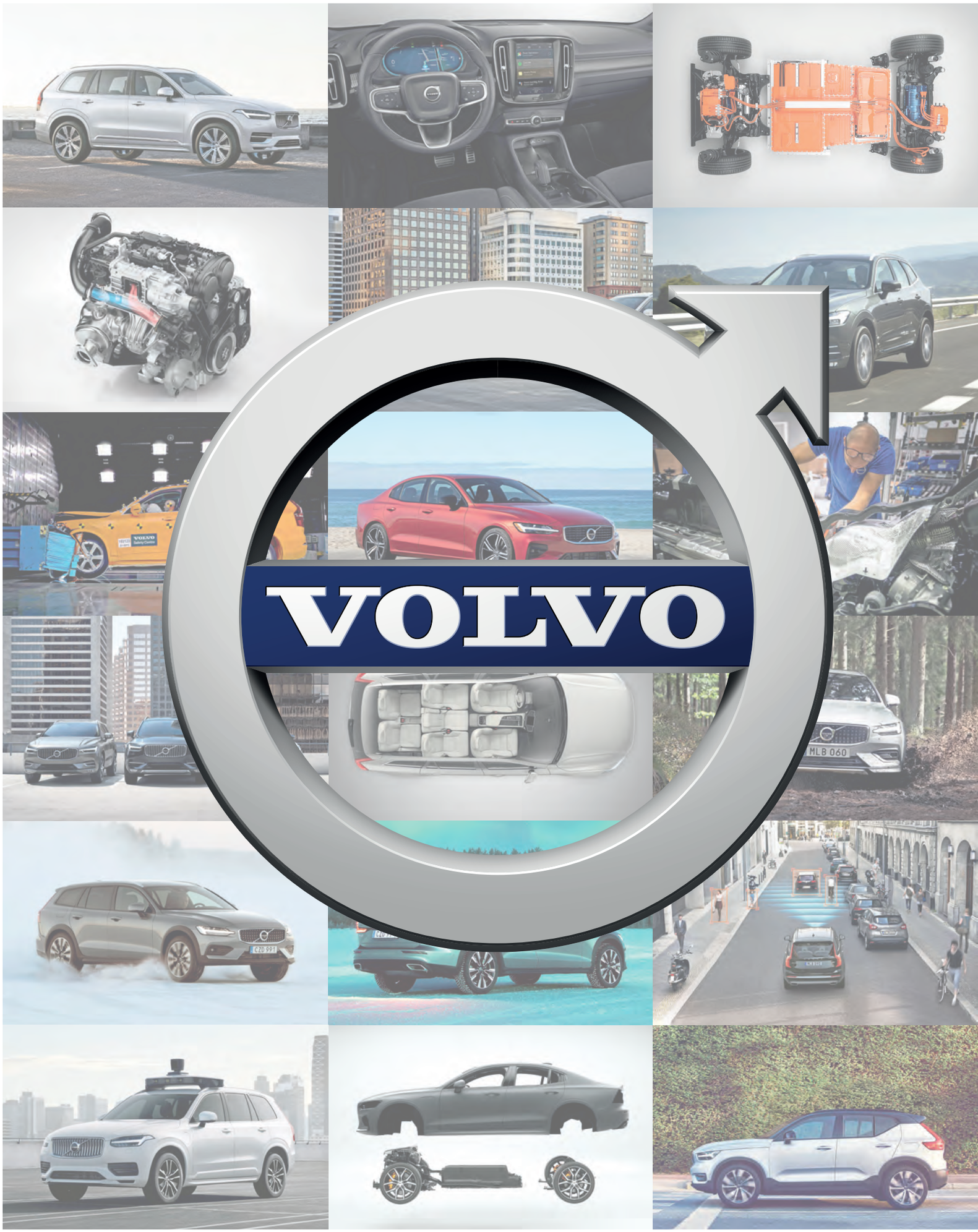
Next time there's a piano to shift, hire a Ford Transit and treat yourself to a great driving experience. Make it a new Tranny, mind. The docile diesel will remind you how tough it's going to be removing such engines from future load luggers. You'll be amazed by the suspension's tall tyres and generous suspension travel – and how it refuses to kick you up the backside over sharp bumps. You'll like the handling, too. Best of all will be the visibility, out-commanding any Range Rover. You'll soon be wishing you drove one of these full time. **STEVE CROPLEY**

ANY THREE-WHEELED RELIANT

This is an easy one. You only need to look at a Reliant three-wheeler to know that it is entirely wrong. However, actually driving one is not only enough to induce terror, you will instantly appreciate the value of having a wheel at each corner. I only drove a Regal once and that was more than enough. It really did feel unsafe at any speed and dangerously unstable when still. Noisy, frightening and hard to handle, but this isn't a stripped-out racing 911SC. Reliants are rubbish. At least this is conclusive proof that Morgan know what they are doing. **JAMES RUPPERT**

AN OLD SAAB

It's been seven years since the plug was pulled on Saab, and perhaps it was for the best. Over the last years of its life, the Swedish firm lost its way – its knack for innovation and idiosyncrasy stamped out by parent company General Motors. Yet drive the early stuff and you're in for a treat. The two-stroke 96, with its rally-bred handling and column gearchange that offered clutchless shifts thanks to a free-wheel device. Then there's the whizz-bang thrill of the 99 Turbo that brought forced induction to the masses. And there's always the novelty of that ignition-between-the-seats layout... **JAMES DISDALE**


VOLVO

No more playing it on the safe side

After nearly a decade of growth under Geely, safety-first Volvo is preparing to gamble it all on motoring's electrified future. **James Attwood** learns why

Volvo is probably the most interesting car company in the world right now. Yes, Volvo – that safe, dependable producer of safe, dependable cars. No more: the Swedish firm has morphed into a dynamic, disruptive force, producing stylish machines while challenging car industry conventions.

Some recent examples. Instead of joining the arms race to make cars faster, Volvo is limiting the top speed of its vehicles – and considered putting sensors in its cars to stop unsafe drivers. And while rivals are struggling to meet tough new emissions targets, Volvo is planning to make its entire operations free of carbon emissions a decade faster than regulators demand.

It has turned its little-known performance arm into a stand-alone premium electric brand, and is spinning off its combustion-engine operations into a separate firm so it can focus on EVs. It has expanded production into the US and offered test drives through Amazon. It believes car subscriptions could replace car buying in the near future, wants the public to decide the future of autonomous cars and appeared at a major car show without any cars on its stand. Volvo has also moved upmarket, reinventing itself as an SUV-led brand that rivals the premium German firms, and nearly doubled its sales to more than 600,000 cars. And, as a next step, Volvo wants half of the cars it sells to be fully battery-electric by the end of 2025, despite the fact that its first electric car won't reach showrooms – real or online – for another year.

That's all happened since 2010, when car giant Ford finalised a deal to sell the then distressed, struggling brand to Geely, at the time an unheralded Chinese firm known best in Europe for producing copycat cars.

Ford bought Volvo for around $6.5 billion in 1999 to add to what was then a growing line of 'prestige' brands. It significantly expanded Volvo's range, but did so through the use of shared Ford platforms, and the resulting cars lost much of the individuality Volvo had traditionally been known for.

Volvo's roadmap to revival was actually laid out late in the Ford era, when it began to push the brand further upmarket and launched the XC60 SUV. But when the 2008 economic crisis hit, Ford put Volvo up for sale. Numerous companies showed interest – reportedly including Volkswagen and BMW – but Geely ultimately won out, paying in the region of $1.15 billion.


Ford signed over Volvo to Geely nine years ago

Given the reputation of Chinese car firms at that time, there were fears Geely's ownership would lead to a further decline in Volvo's standards. Instead, Geely was true to its words of hands-off ownership, giving Volvo the resources it needed, then stepping back and letting the firm get on with it. Essentially, Geely's approach was to let Volvo be Volvo.

A key moment in Volvo's revival was the appointment of former MAN trucks boss Håkan Samuelsson as CEO in 2012. His polite Swedish calm belies his determined, decisive leadership.

His focused strategy stems from Volvo's size: even with Geely's backing, it still can't match the resources of the VW Group. "We have to prioritise," says Samuelsson. "We cannot do everything so have to choose."

He adds: "We like to think we are very good at thinking in an open way. It's not a disadvantage being small. If you are big, there are probably too many experts on board who will tell you everything is important. That means it's not that easy to break out of the old way of thinking."

So far, Samuelsson has chosen right – and with conviction. Volvo worked with Geely to develop the →


Samuelsson has overseen a spike in sales

CREATING A PERFORMANCE BRAND

Volvo's influence within the Geely empire now extends across multiple brands: it has turned its motorsport arm, Polestar, into a stand-alone electric performance car brand, and also shares platforms and technologies with Geely's upmarket new Lynk&Co marque.

Splitting out Polestar – a firm with little name recognition beyond the Swedish Touring Car Championship – seems a bold move, but a deliberately slow and careful brand-building exercise seems to be paying off, with strong early pre-sales for the Polestar 2 (pictured), a hot SUV on the same CMA platform as the XC40.

Doing so also enables Volvo to focus on its core values of safety and sustainability. The two brands will remain closely linked, however, with future Polestar hot EVs set to be followed by similar-size Volvos on the same platform.

←Scalable Product Architecture platform to underpin a new generation of mid-size and larger models, starting with the XC90 SUV in 2016. The first car developed entirely under Geely ownership showed that any fears of a decline in Volvo quality were misplaced.

Volvo has subsequently led the development of the Compact Modular Architecture (CMA) for smaller vehicles, including the XC40 compact SUV. Crucially, it also future-proofed CMA by designing it to house both combustion-engined and electric powertrains. Henrik Green, Volvo's tech boss, says this reflects the fact that Volvo couldn't afford to develop separate platforms for combustion-engined and electric cars, as the VW Group has done with the MEB architecture. So it applied the lessons it learned surviving with far more limited resources. "You get very creative having no money and no time," laughs Green, reflecting on the firm's pre-Geely days.

Volvo is following the same trends – electrification, autonomy, shifting sales patterns – as most major car firms, but is setting itself apart through the decisiveness and speed of its actions. Volvo has turned its relatively small size – traditionally a huge disadvantage in the car industry – into a major strength by acting with the agility and responsiveness of a tech start-up.

Lex Kerssemakers, who has served as Volvo's commercial boss and now heads its new Direct Consumer Business division, says: "We need to act very quickly if we want to play a role in the future and not just become a commodity player, with third parties taking over our business. That sounds a little bit reactive but it's not, it's proactive. We see trends and we want to be part of those trends."

The biggest trend, of course, is electrification. Tough new emissions requirements and greater environmental awareness are pushing every car firm to electrify their range, but Volvo is aiming to do it faster. Every model it launches from now on will feature an electrified powertrain (a hybrid or full EV) with the aim that every Volvo sold by 2025 will be electrified in some form – 50% of those being an EV. By 2040, and preferably sooner, Volvo wants to be an EV-only firm.

There's no hedging here: no concurrent development on hydrogen, no further work on combustion engines, no insistence that diesel still has a role to play.

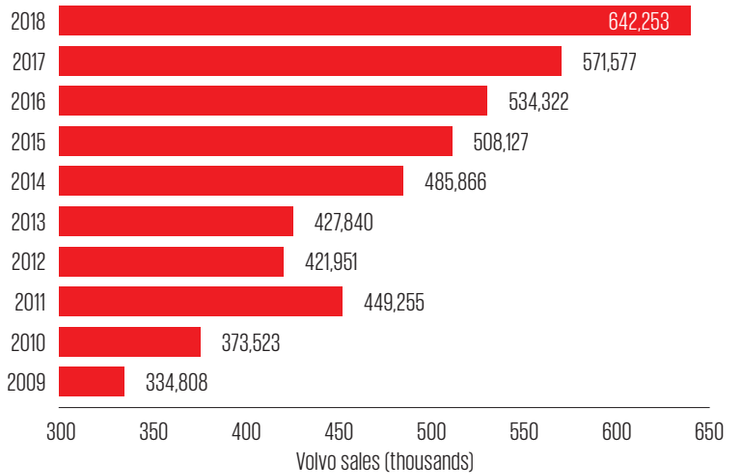
Kerssemakers insists that "the conviction we have as a brand going wholeheartedly into electrification is not because of legislation, but because we believe it's the right type of vehicle for the consumer".

The launch of the XC40 Recharge, Volvo's first EV, coincided with worldwide attention on global warming sparked by Greta Thunberg and other protesters. At the launch event, Samuelsson spoke of how the global community had failed to address the issue, but how he felt the business community could. For him, that means putting sustainability at the core of Volvo's thinking, "not as some add-on, because it's good or expected from us, but because we think it's really good for our business. It's about concrete actions more than symbolic pledges."

Coming from the leader of a company that has long produced polluting machines, it's provocative stuff. But Samuelsson's conviction was such that you believed he was speaking with honesty. He did so when announcing Volvo would limit all its cars to 112mph from 2021 onwards ("We know speed kills, and there is no reason to go beyond 112mph") and when looking at how it could use autonomous technology to aid safety by, for example, limiting speeds outside schools ("Some people could see that as intrusion, so we need to ask how far we should go in limiting choice and freedom").

It's the same with Volvo's approach to sustainability and the environment. Samuelsson is honest: he believes Volvo can help save the environment by going electric, but also thinks it can make money.

VOLVO SALES UNDER GEELY




Volvo's first EV, the XC40 Recharge, will arrive in 2020

Volvos lost their distinctive look (l) under Ford's platform-sharing stewardship (r)


Volvo aims to keep leading the way on safety


By 2025, every new Volvo will be an EV or a battery hybrid

> “Every model Volvo launches from now on will feature an electrified powertrain”

“If you introduce new technology in the first years, it will probably lower your margins, but after some years, you introduce new technology because you believe it will improve your profit,” he says. “That’s experience from the past. If you stay with outdated technology, that’s not a smart way to improve your profits because the margins start to disappear, and you’ll eventually close down.” Samuelsson likens it to Volvo’s long quest for safety: “I imagine when we introduced airbags in our cars, there were some bean counters who said this is not good for profitability.”

That comparison highlights how Volvo’s current disruptive, dynamic approach is actually consistent with its safety-focused history. At its best, the firm has always showed the courage of its convictions, rather than chasing trends. Geely, to its credit, has recognised that, and given Volvo the space and resources to do so. “In the past, we were also potentially a little bit disruptive,” says Kerssemakers. “But now, with our increased size and importance on the market, people start to look at us a little bit more.”

The timing has been fortuitous, too: the disruptive force of electrification has rewarded the quick thinkers. Samuelsson highlights the appearance of traditional-style engine grilles on EVs being launched by some rival firms as an example of how larger companies can become “trapped in a mindset”.

He adds: “We encourage people to think outside the box, and with new technologies the field is levelled. It’s a chance for smaller companies to make a difference. We realised early on that we have the chance of a lifetime to do something with new technologies coming in – and we are eager to be pioneers.” A

CHANGING THE WAY WE BUY CARS

Volvo isn’t just changing the way it makes cars, it’s out to reinvent the way it sells them. It is developing a no-commitment subscription-based model that it hopes can distribute a fifth of its cars within five years.

“The world is changing,” says Lex Kerssemakers, who heads Volvo’s new Direct Consumer Business division. “In the past, you went to a dealer, selected a car and followed the process. Now online sales are rising rapidly and we need to do something.”

Kerssemakers describes it as a “non-paced journey”, with Volvo still working out exactly how online sales and subscription services such as the recently launched Care by Volvo scheme (which is due to launch in the UK within the next year) might evolve.

“We are literally talking about a start-up,” says Kerssemakers. “I’m totally convinced it will work, but if it doesn’t, we’ll find something else.”

Kerssemakers: new subscription model

‘THE TASK NOW IS TO PREPARE FOR NEW THINGS’

CEO Ralf Speth has guided Jaguar Land Rover through public growing pains in the past year but he tells **Steve Cropley** why its future looks bright

PHOTOGRAPHY LUC LACEY

Ralf Speth likes talking about the future. It's no surprise, given the challenges he has faced in the recent past. It can't be much fun for Jaguar Land Rover's CEO to keep raking over the ashes of a recent £3.6 billion financial loss that triggered cuts of 4500 jobs, something he took very personally.

From his early days, looking forward has always been an important part of Speth's make-up. At BMW, where he began a 20-year engineering career in 1980, it was a given among his generation that you embraced new technology and watched it lift the brand image while generating impressive sales. BMW was a very happy place for a young engineer to be.

Let it not be forgotten, either, that for most of his nine years at the top of Jaguar Land Rover (JLR), Speth's penchant for keeping the company focused on growth and constant improvement met unprecedented success: the company remains this nation's largest car maker and biggest spender on research and development.

Still, it is more than a year since Speth first signalled that things were going seriously wrong at JLR. The company was abruptly hit by a perfect storm of difficulties, including a disastrous drop in demand for diesels, rising Brexit fears, a rapid weakening of the Chinese market and a consequent need for a downward revaluation of JLR's entire business. Within months, Speth (now Sir Ralf, in recognition of recent British citizenship and 'confirmation' of a previously awarded honorary KBE) unveiled a £2.5bn plan called 'Charge and Accelerate' aimed at dramatically cutting costs and improving cash flows. Much has been done, but it is still a work in progress.

When I meet Speth at Warwick University's National Automotive Innovation Centre – a magnificent car creation facility mainly established through Speth's own unstinting efforts – the logical first question is to ask exactly how the recovery is proceeding.

"We began our restructuring and transformation earlier than other companies in our kind of business because we are smaller than them," Speth begins carefully, "which meant we struck problems earlier. We don't have banks and insurance companies that let us spread difficulties as others can, so we were criticised early on. But others are now facing the same problems and ours are no longer a surprise.

"Our advantage is we're agile. We are on track to over-deliver on the short-term part of our programme, called Charge, to cut costs and improve cash flow." JLR's second-quarter results showed the truth of this, with a predicted upturn in fortunes – revenue up 8% year on year and a £156 million pre-tax profit – following impressive recent sales improvements, especially in China.

Speth says: "The longer-term part of our plan, called Accelerate, aims to attack systemic issues like improving quality and time to market. That will take longer. We've asked our existing teams to meet and communicate better, and that's also working. And a data analytics team of seasoned, experienced people I set up a couple of years ago has started paying off in a big way.

"We've implemented our toughest decisions first. Do it any other way and you lose momentum..."

Times have been tough, but it's very telling that Speth (who turned 64 last month) continues firmly in the biggest job at JLR, unmolested by rumour mongers and financial denizens who have recently taken to giving other car industry leaders a hard time.

"The task now is to prepare for new things," →

Speth has done much to establish Warwick University's National Automotive Innovation Centre, the Bhattacharyya Building. Within its portals, the future of mobility is being created.


“We plan to expand our range and have some great designs in the drawer”


Speth poses by a Jag word cloud sculpture

New XJ will be electric and twinned with a Land Rover

I-Pace is a recent success. Speth says more hits will follow

says Speth, "to simplify our engine and model ranges as much as possible, and also to prepare some very go-ahead projects we have in the drawer."

"I'm so glad that during restructuring we haven't had to reduce our investment much," he says, reaching instinctively to the future. "I defend our big projects because they define segments and also earn salaries for our next generation. When this disturbance ends, we want to be ready."

Speth doesn't seem to care much about what the car market will be like in a decade's time, except to say that diesel and petrol cars will be around "for a long time". He reckons maintaining a high degree of manufacturing flexibility holds the key – and already sees this policy, steadily maintained at JLR for years, starting to bear fruit.

The centralisation of JLR engine manufacturing – production of modular triples, fours, sixes and EDUs (electric drive units) at the company's Wolverhampton factory – is one huge move towards flexibility, allowing JLR to source conventional, hybrid, plug-in hybrid and full electric powertrains from one site. The same goes for an embryo battery assembly operation at nearby Ham's Hall, where a run of 7500-cell batteries even larger than that of the I-Pace (perhaps for the luxurious XJ saloon and its Land Rover sibling?) will be constructed by an automated process that involves 15,000 welding operations to be completed in just 11 minutes.

However, Speth reserves special pride for the forthcoming Battery Industrialisation Centre (BIC), which is under construction on a huge site near Coventry Airport. There, the capabilities and innovations from universities all over the UK can be brought together in realistic manufacturing conditions – and also tested for re-use and recycling. Speth has long recognised the need for at least one UK battery gigafactory. Success for the BIC could lead directly to this – highly desirable provided the new place embraces next-gen technology and is run on a financially competitive basis. "This could be sensational for the UK," says Speth, "but there's no point in setting up a battery factory just to have one. It has to deliver great products at a competitive price."

15,000
Welding operations are needed in 11 minutes to create every new high-capacity battery due soon to be made in an assembly factory at Ham's Hall.

£2.5bn
Amount by which the recent 'Charge and Accelerate' recovery plan is tipped to boost JLR's coffers. Speth says the plan is working.

1,000,000
Cars a year is the production level Speth would like to reach, to improve economies of scale. However, he's not setting a date.


Speth recently opened a £600m JLR creative HQ

The JLR chief may see his own company selling pure diesel and petrol vehicles for years to come, but his commitment to electrification and zero emissions – along with zero congestion and zero accidents – seems to be total. JLR's factories are already carbon neutral. Speth is scathing about the fact that 1000 coal-fired power stations are currently under construction around the world – and critical of a German process that subsidises coal mining, sends the mined product to Poland for firing, then brings it back as clean fuel. "Does the environment know it's clean?" he asks.

Whatever the future, says the CEO, JLR must grow to be stable and successful. He's optimistic about the prospects: "Of course, it's not manufactured volume that matters: it's cash in the pocket. But economies of scale are vital. To be competitive, you need advanced technologies and they're expensive. If you're VW and can divide your costs by 10 million, that helps. If you're JLR and the figure is 600,000, it's tougher."

I press for the ideal JLR annual production figure, admittedly without much hope. Speth is famous for not revealing targets. But maybe because it's nearly Christmas, he relents. "A million is not out of reach," he murmurs. "We have plans to expand our model range and we have some great designs in the drawer. But we must accompany any expansion with the very best sales and marketing techniques. But I believe we have the substance. Look at our cars in the high street: they are authentic, honest and they all have their own character. I am proud of that."

Speth is late for his next appointment so we really have to stop talking. Trouble is, I always find interviews with Speth turn into uplifting events and so I hang about to the last. This quietly spoken man has rare insight, quiet wit and a powerful ability to fill you with enthusiasm for the future. He is most definitely (we can say this now) a national treasure.

It turns out that Speth likes quotes from great people, an enthusiasm I share, and I'm delighted to find that he recently used a favourite from Abraham Lincoln in a recent speech – as a way of inspiring others. "The best way to predict your future is to create it" was Lincoln's killer line. Here and now in 2019, the person making best use of these words is a slim, moustachioed engineer from Munich, who nowadays lives in Leamington Spa.

See you next month