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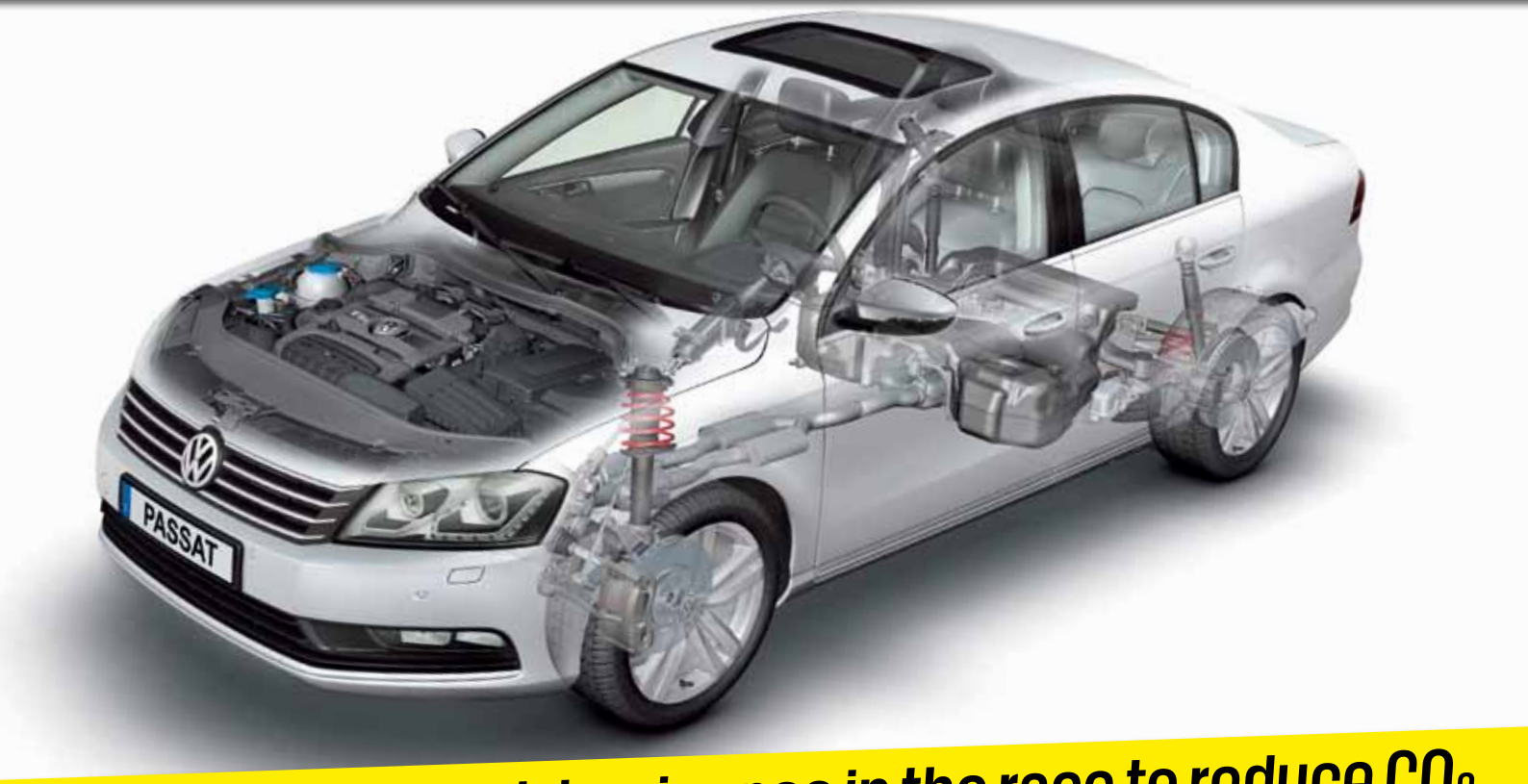
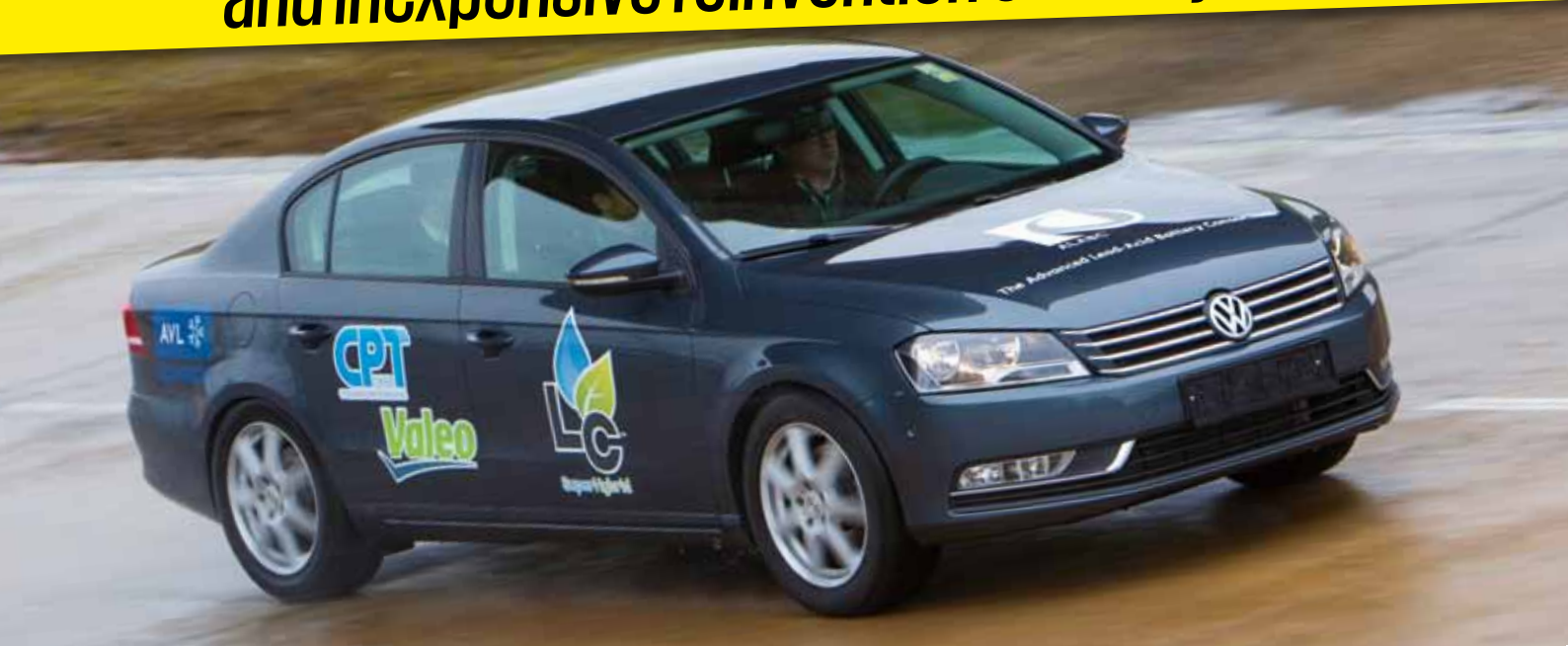
THE ORIGINAL CAR WEEKLY

LC Super Hybrid Passat



'The days of diesel dominance in the race to reduce CO_2 could well be numbered thanks to this clever, simple and inexpensive reinvention of the hybrid.'



SHRINK TO FIT

A new electric supercharger could play a big part in the engine downsizing trend. **Hilton Holloway** investigates

PHOTOGRAPHY STAN PAPIOR

The concept of a hybrid car is a familiar one. In general, it's the use of an electric motor to help get a vehicle rolling before the petrol engine takes over, and using the same petrol engine to generate electricity which can be stored for later use in a battery pack.

One of the downsides of the conventional hybrid is the associated cost of installing an electric motor into a conventional internal combustion drivetrain, as well as fitting a battery pack and the complex and expensive control software. The upshot is that the showroom price of a hybrid is more than that of a typical modern turbodiesel car, which is also likely to return better real-world economy.

But a UK-based engineering conglomerate, commissioned by the Advanced Lead-Acid Battery Consortium (ALABC) at AVL Schrick in Germany via British outfit Control Power Technologies, components giant Valeo, hybrid specialist Provector and component supplier Mubea, has come up with a clever way of integrating an electric motor into a conventional transmission system in order to increase fuel economy.

The principle behind the LC Super Hybrid project is a remarkably simple one. It takes a conventional turbocharged internal combustion engine and transmission and adds a tiny, electrically driven supercharger. This supercharger, driven by two new-generation lead-acid batteries, kicks in the instant the driver demands power and it works in sequence with a conventional (and slower to respond) turbocharger. It's a combination that pretty much eliminates turbo lag.

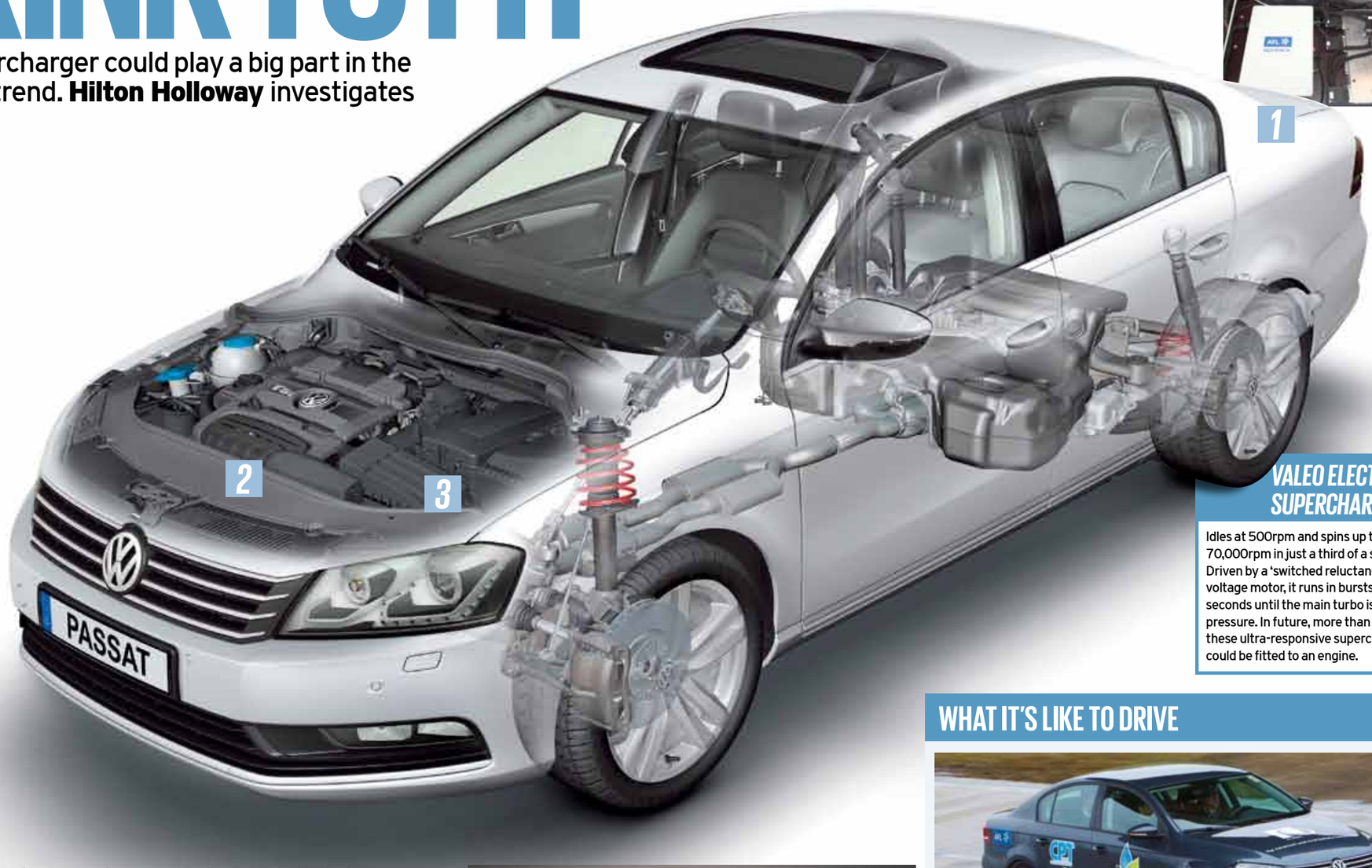
But that's not the primary purpose of the technology. Because the supercharger and turbocharger work in sequence from very low engine revs, it's possible to use the set-up to downsize an engine while boosting power and improving economy.

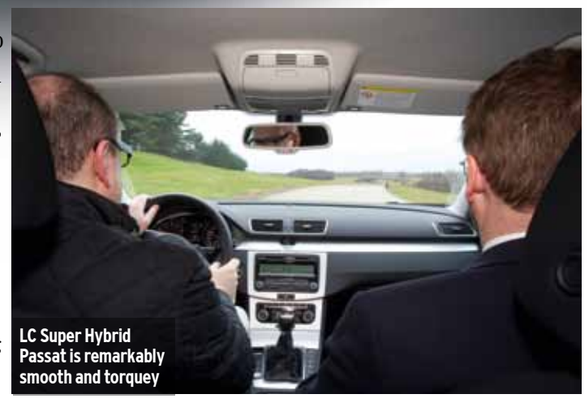
According to the people behind the technology, it is possible to imagine a 1.0-litre, 150bhp petrol-engined Mondeo-sized car with near-diesel economy. Indeed, Nick Pascoe, chief executive of Control Power Technologies, says "extreme downsizing" is made possible by this set-up, with engines as small as 650cc being entirely viable.

And that's another reason why this unusual 'hybrid' powertrain could be adopted by the world's biggest car makers. As EU pollution regulations become more onerous, the cost of building modern diesel engines is rising inexorably. Hybrid costs are also rocketing due to the costs of rare earth materials.

By contrast, the LC set-up consists of relatively simple, robust technology based around a petrol engine, and the factory cost of the components means that an LC-equipped Volkswagen Passat 1.4 TSI, like the demonstrator we drove, could cost as much as £4000 less than a Passat driven by a Euro 6-compliant diesel. The electrically driven supercharger technology itself was bought last year by Valeo, moving the concept a big step nearer to mass production.

Sources suggest that a number of big-league car makers are looking closely at it, particularly the VW Group, which introduced the combination of supercharger (albeit mechanical) and turbocharger a few years ago. Ford is also thought to be experimenting with its new 'Fox' three-cylinder turbo engine.




LC Super Hybrid Passat is remarkably smooth and torquey

1 TWIN EXIDE ORBITAL 50AH LEAD-ACID BATTERIES

The supercharger is powered by a new design of battery with a spiral-wound construction. It's claimed to have a real-use lifespan of 140,000 miles, costs four to five times less than a lithium ion battery and is easily recyclable.

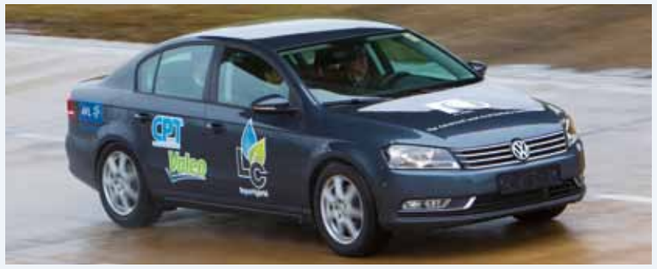
2 CPT BELT-DRIVEN INTEGRATED STARTER/GENERATOR

It not only spins the engine into life seamlessly and ultra-quickly (in just over one-quarter of a second), but it can also be used to recuperate energy and even assist the engine.

3 VALEO ELECTRIC SUPERCHARGER

Idles at 500rpm and spins up to 70,000rpm in just a third of a second. Driven by a 'switched reluctance' low-voltage motor, it runs in bursts of a few seconds until the main turbo is up to pressure. In future, more than one of these ultra-responsive superchargers could be fitted to an engine.

WHAT IT'S LIKE TO DRIVE



According to AVL Schrick's own figures, its LC Super Hybrid Volkswagen Passat delivers 140bhp (up 20bhp on the 1.4 TSI model on which it's based), 203lb ft of torque (up 55lb ft) and a 0-62mph time of 8.7sec (down from 11.1sec), all of which is achieved with longer gearing than standard.

However, the Super Hybrid also returns fuel economy of 50.5mpg on the EU combined cycle, against 45.6mpg for the standard car. Matched up with the next-generation 1.4 TSI engine, that figure should be north of 55mpg.

From a short drive, it's clear that this set-up works remarkably seamlessly. The otherwise standard 1.4 TSI engine felt like a much bigger-capacity unit and has a unique torque delivery that is so extraordinarily consistent that it has more than hint of electric motor or V8 diesel about its performance.

Even turning extra-long gearing, the drivetrain could pull the 1.4-tonne Passat, with four adults aboard, steadily from 1200rpm. Without the electric supercharger, the stock Passat could do the same, but at a more leisurely pace. This system could work even better with a quick-shifting dual-clutch automatic 'box. The belt-driven starter/generator means that this Passat's stop-start system was also far quicker and smoother than virtually any other we've tried.

The LC Super Hybrid is fascinating because of the possibilities it suggests. This battery-backed electric supercharger could be used to spectacular ends in the new generation of three-cylinder engines being used by Ford and Volkswagen in Golf-class cars. A Golf GTI powered by a 1.2-litre, three-pot engine isn't impossible. But clearly, the days of diesel dominance in the race to reduce CO_2 could well be numbered thanks to this clever, simple and inexpensive reinvention of the hybrid.

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