

# Automotive innovations torque up UK manufacturing revival

**The automotive sector is proving to be a power base for the reviving manufacturing economy. Volume car makers have full order books and specialist builders are enjoying record exports. But to maintain this vital economic activity, constant innovation is needed, particularly on reducing vehicles' environmental impact**

For two generations car ownership figures have been an indicator of a nation's wealth. In Europe the 1950s and 60s saw most families get their own car; in the 70s and 80s the two-car family became the norm; the 90s saw children getting their own cars before they left home. Now in the new millennium most people change car regularly, helping keep the manufacturers busy.

And the same development is now being seen in the newly industrialising parts of the parts of the world. Ten years ago the streets of Beijing and Mumbai thronged with bicycles, now car ownership is within the grasp of more and more of these industrious peoples. Last year Audi sold more cars in China than in Germany and Rolls Royce Motors' biggest market was India; Nissan Sunderland sent most of its production overseas and announced ambitious plans for its new electric car, the Leaf. Other manufacturers have similar good news to report, plus the drive for cleaner more fuel efficient cars is driving technical developments.

It has taken time, spiralling costs and considerable legislation, but today's motorists are now keen to ensure that their cars are both clean and economical. And the pressure is on to steadily reduce vehicle emissions over the coming years. Work being done

in universities and research institutes is feeding into manufacturers' own R&D departments and out onto the world's roads at an incredible rate.

To develop new generations of high performance, low emission power plants new high capability test beds that simultaneously monitor multiple parameters have been developed. Tony Ingham of Sensor Technology explains: "An engine's torque is its fundamental characteristic and previous methods of measuring it are not good enough for today's demands. So we at Sensor Technology have developed TorqSense, a non-contact digital technology that can be set up in minutes and feed straight into TorqView software to produce data customised to each job. This allows the automotive engineers to concentrate on their development work rather than having to worry about the mechanical details of running tests."

### Like-for-like comparisons

"There are some really original thinkers working on engine design these days," he continues. "They need like-for-like comparisons of the performance of petrol engines, diesel engines, LPG engines, electric motors, generators and regen units. Quite simply, TorqSense is their favourite way to do this." Typically, a modern test bed needs to be able to monitor all rotating shafts within various hybrid configurations of IC engine and electric machine in moments. Old fashioned belt measurements and strain gauges are difficult to set up and use, whereas TorqSense is a direct in-line mount that gives plug and play levels of ease and efficiency. TorqSense uses

two tiny quartz piezoelectric combs, called Surface Acoustic Wave (SAW) devices, whose resonance frequency changes with torque. This can be measured using a wireless radio frequency coupling and instantly converted into test data

Lotus Engineering has always been at the forefront of automotive developments and has worked with Elektro Magnetix (EMX) of Brighton to develop a new hybrid power plant. Mapping the full performance range was an essential part of the project, but with a tight development timetable, testing had to be simple and effective. Torque profiling can be a very long winded process because of the need to constantly refit and reset fiddly slip rings. Discovering TorqSense was a real boon for the project; EMX could set it up quickly, reset it at will and have half the analytical workload done automatically.

Just down the road from Lotus' Norfolk headquarters, Powertrain Technologies has designed an intelligent engine lubrication system. This incorporates a bank of computers to control oil supply to different parts of the engine. The system can be used on all sorts of engines – big, small, diesel, petrol, high revving or low. But each engine needs to be mapped in considerable detail over its entire performance range and in all climatic conditions. This amount of testing is of course very time consuming, so an efficient test bed design was essential.

Fortunately Powertrain found the experts at Sensor Technology early on in the project and has been able to tap into their considerable experience in the field. Their suggestions for simple in-line test bed geometries and their plug and play TorqSense technology have made a major contribution to time to market objectives.

Safety is another pressing issue for automotive researchers and TorqSense is helping to reduce driver fatigue by improving power steering technologies. It forms the basis of a highly automated test cell at a Tier 1 supplier and checks nearly 200 systems an hour. A robot loads electrohydraulic motors into the test cell and after testing transfer them to either an exit conveyor or, in the event of a failure, to a secure holding area. However, it was realised that with the rapid throughput, losses could build up between the dynamometer and hysteresis brake of the cell and the motor under test. Sensor Technology was approached to see if it could suggest a solution.

Tony again: "The robot's access requirements dictated that more space than normal was needed between the dynamometer and brake, leading to a relatively long connecting shaft and coupling. This was where the losses were going to accrue, so we suggested the elegantly simple solution of fitting a TorqSense in there to regularly and automatically check the torque inherent in the system. We set up the software to compensate the data output for the measured amount of 'offset'. This means a test sequence can be carried out quickly and efficiently. We also separately highlight the offset measurement so that the test engineers can make adjustment before things go out of tolerance."

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