Potential difference

The Aachen Colloquium gave the development chiefs of three of Europe's biggest OEMs a chance to lecture on what is driving their product development. By **Simon Bickerstaffe**

The annual Aachen Colloquium, organised by Aachen University, gives engineers from across the world the chance to discuss the latest in research and development. Clean diesels, downsizing and hybrids naturally featured heavily, but the keynote speakers – the development chiefs of Fiat, GM Europe and Volkswagen – gave presentations not on the challenges of meeting emissions targets, but on the other factors influencing product development within their organisations.

The common thread was software, either as an enabler of in-car technology, a means of differentiating otherwise similar vehicles from different brands, or just as the tools to design and test them. Driver assistance and comfort features are under particular scrutiny at Volkswagen Group. Both contribute to safety and will be of greater importance as urbanisation increases and consumers downsize from larger vehicles.

Systems must be affordable, though, especially as even buyers of A-segment cars will come to expect active headlamps and perhaps even self-parking. VW will develop them, like the vehicles themselves, on a modular basis.

"If and when VW deals with a certain subject, it is about volume production – we put these features into our volume models so large numbers of customers can use the technology," says VW's head of development Dr Ulrich Hackenberg. "But we don't want to develop systems from scratch each time. We have to have kits."

New platforms for transverse and longitudinal layouts cater for all VW Group brands. The former accounts for more than 3.5 million units a year, the latter for 1.5 million. Component kits – including those for infotainment electronics – are split the same way, generating higher volumes and lower costs.

GM Europe's vice-president of engineering Hans Demant

VW's head of development Dr Ulrich Hackenberg

Fiat Group's chief technical officer Harald Wester

Increasing electronic and mechatronic content combined with the growing popularity of small cars mean that technology must be developed so that all customers can afford to pay for it. The Golf's self-parking and adaptive cruise control could be adapted for smaller VWs in future.

The OEM's technology works on a scaleable basis so systems can be used in multiple vehicles even if they are for different segments. Having the right standards in place is critical to this strategy. Software engineers must adhere to design protocols, and not write code in their own style, says Hackenberg.

Packaging the software in small modules makes it more transparent to non-specialists: "Especially important," Hackenberg says, "when the people who developed the software may have left the company and are no longer around to explain it."

Like VW, GM has reduced the number of vehicle architectures it uses too. In 2004 it had six architectures in Europe and the US for its mid-size cars. Nothing was interchangeable. Now one architecture serves seven brands and is managed by Opel in Russelsheim, Germany.

It's important to ensure that the vehicles feel and drive differently when so much of the hardware is common. GM believes software is the answer to managing brand identities. "We want to go away from the mechanical chassis and go over to mechatronics," says GM Europe's vice-president of engineering Hans Demant. "It helps us solve conflicting requirements, optimise characteristics and differentiate vehicles."

Although the same basic layout accommodates multilink or H-arm rear suspension, for example, GM wants greater tuning potential. A Saab isn't meant to feel like a Chevrolet or an Opel. Demant says it doesn't make sense to take one basic set-up and try to generate different price points from it – it won't work: "You need considerable hardware differences to influence the vehicle's basic character but, over and above that, it ought to be driven by electronic architectures," he says.

Controllers in systems such as adaptive damping, ESC, steering, differentials and the powertrain are all networked via CANbus. The algorithms in each can provide different characteristics. So does the number of systems on the bus.

This means that the OEM's mechanical engineers need to develop greater understanding of electronic control. More software specialists are needed too. It needs to develop open systems that can be expanded with additional "plug and play" modules.

Software will solve GM's conflicting chassis requirements and differentiate our brands

Hans Demant, GM Europe

The know-how has to be in-house, not just with suppliers, says Demant: "Software cannot just be bought and applied – it needs to be adjusted to the application and you need to understand it."

Fiat's entire product development process has been overhauled in recent times. A succession of poorly received products such as the Punto and Stilo did nothing for its reputation for quality, style or its bottom line. The firm had to take the situation very seriously.

VW software engineers must adhere to protocols and not write in their own style

Dr Ulrich Hackenberg, VW

It needed much better cars, designed and developed in greatly reduced timescales. Development costs had to come down too. To make money again, Fiat invested heavily in virtual engineering tools and processes.

"The computing power behind our product development is 15 times higher now than it was at the end of 2004," says Harald Wester, chief technical officer at Fiat Group. "It means fewer prototypes and modifications and an increased ability to follow market trends."

Fiat's aim is to work like the aerospace industry, no longer producing prototypes

Harald Wester, Fiat Group

Europe is more fiercely competitive than ever before. Wester illustrates this by saying that a car contains, on average, more than 15,000 parts yet sells at a lower price per kilo than a hamburger.

Switching development into the virtual world has given Fiat desirable products again, such as the 500, and has helped put the firm back in the black: its trading margin improved from zero to 5.5 per cent between 2004 and 2007.

Five years ago the Fiat Stilo took 26 months from styling freeze to commercial launch. The Bravo – its 2007 replacement – took 18 months. The Lancia Delta and Alfa MiTo were put on the market in just 15 months. Fiat has also replaced something most engineers still find extremely useful: 2D data printouts and paper drawings. Wester claims these have all gone, reducing design time in terms of CAD hours per part by 15 per cent.

The trend towards prototype elimination and digital evaluation will continue, says Wester. In 2010 he wants 80 per cent of technical target achievements to be confirmed virtually at the end of the technical concept definition phase.

Although pre-series prototypes are still very much in use at Fiat, this might not be true in the future – more and more verification will be done virtually. "There are no sacred cows," says Wester. "Our vision is that we'll work like the aerospace industry does by no longer producing prototypes."

Not everybody shares this view, however. VW still likes the idea of making things for real. Decision making without hardware is hard for it to accept. "I don't think final decisions on the design, for example, can be done virtually," says Hackenberg. "Maybe it's just me, but I don't know many people who can."

GM isn't likely to go down the same route as Fiat either. Problems are still found at the start of production because the computer models used in development weren't good enough. Moreover, the lessons aren't always applied later on. "During production we don't go back to simulation enough," says Demant. "I see issues that we created by changing the engineering. If we fed our insights back into the simulations, there's a lot we could do to reduce overall costs."