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“Cost-effective, low-emission cars that are fun to drive”

The CO_2 emissions legislation that will introduce a threshold of 95 g CO_2/km for new cars from 2020 onwards is presenting the industry with major challenges. In addition, these low-CO_2 vehicles must exert a certain fascination to ensure that customers buy them. In the ATZ interview, Dr. Peter Schöggl, Vice President Business Field Racing and Vehicle at AVL, explains how we can maintain our control over factors such as the fascination of cars and their development and product costs as the vehicles themselves become increasingly complex.

Dr. Peter Schöggl (born in 1962) took his degree in electrical and mechanical engineering at Graz University of Technology. He also completed his doctorate there. From 1992 to 1996, he was Research Assistant at the Institute for Internal Combustion Engines and Thermodynamics at Graz University of Technology. In 1996, Schöggl joined AVL List GmbH in Graz, Austria, where he worked as Product Manager, Technical Team Leader and Head of Department. Now he is the company’s Vice President Business Field Racing and Vehicle and Head of Department and Managing Director of Österreichische Fahrzeug- und Motor-Akustik Forschungs- und Entwicklungs GmbH.

ATZ _ AVL is the largest engineering service provider in the world and is famous for specialising in engines and powertrains. A year ago, Professor Grebe made it clear in his guest comment column that AVL is entering the automotive engineering market. Why is this?
SCHÖGGL _ AVL has been working in some areas of automotive engineering for decades, for example acoustics, the objectification of driveability and vehicle simulation. The increasingly strict CO_2 limits are the decisive factor behind our current initiative, together with networking and driver assistance systems. We can only comply with these limits by working on both the powertrain and the car itself. Nowadays it is no longer enough for everyone to do a good job independently of everyone else. An interesting example of this is the variable radiator blind, where aerodynamics, cooling, engine emissions and the interior air conditioning system all have to be taken into consideration simultaneously. Only when we have end-to-end networking of our development processes can we achieve the best possible results.

The legislation on CO_2 emissions which will come into effect in 2020 and which involves a limit of 95 g CO_2/km for new cars from then on represents a major challenge for the automotive industry. Will the efforts to meet this new objective have an impact on cars' driving characteristics?
In order for the low-emission (below 95 g/km) cars to be included in large numbers in the calculations, they first have to be sold. Low-emission cars will not necessarily be cheaper, which means that they need to appeal to drivers in other ways. They must exert a certain fascination to ensure that customers buy them. Therefore, manufacturers will have to add special new features to their low-emission cars. The fascination of these cars will lie in attributes such as dynamics, handling, sound, ride comfort and, of course, fuel consumption and emissions. These are the areas that we are looking at very closely.

"Nowadays it is no longer enough for everyone to do a good job independently of everyone else"

Customer expectations vary across the different markets in the world. Does AVL have the necessary knowledge of these markets?
Yes. For three years, we have been running a global vehicle benchmarking programme which analyses every important model that comes onto the market in terms of its functional driving characteristics and its attributes. On average, we evaluate between 100 and 150 vehicles each year. They are generally analysed locally, because AVL has offices in all the major countries including the USA, the United Kingdom, France, Germany, Italy, Russia, India, Korea, China and Japan. On the one hand, we provide our customers with the results from evaluations of these cars as benchmarking data and, on the other hand, we have a technology scouting process in place to find out how much technology is being employed to achieve the objectives. These data are also used to identify the target requirements for future vehicles.

How does AVL configure a successful vehicle for a specific market on the basis of the wide variety of technical options available?
We established our attribute engineering programme for this purpose, which is a combination of high-performance simulation and objective evaluation. Working with the customer's marketing department, we use the benchmarking data to generate the most important driving-related objectives for the customer's product. These involve not only costs and CO_2, but also performance, dynamics, handling, ride comfort and emissions. Then we create thousands of virtual prototypes of the different variants. Many of our customers are still relying heavily on test vehicles to enhance the brand-specific character of their cars. The attribute engineering process allows us to move these activities into earlier, virtual phases, which means that we can identify very early in the development process whether the measures that are being taken are constructive or whether a specific variant will have an NVH problem, for example. The result is that OEM customers no longer need to build a large number of costly and complex prototypes. By taking a joint approach to all the target criteria, we also achieve better overall results, including driving pleasure and costs. This means that we can design cost-effective, low-emission vehicles that are fun to drive in the very early phases of the process.

Driving pleasure is a highly subjective concept. What approach should we take to this? How can an engineer turn an adjuster screw at later date?
We need to distinguish between customers and experts. Customers consciously give the car one of three ratings: I like it, I don't notice it or it annoys me. The subconscious rating scale is more detailed, because it identifies differences. Highly experienced test drivers differentiate much more precisely between the different categories and generally have a scale from one to ten with increments of 0.5. The experts use this to evaluate hundreds of criteria. The process begins with start-

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"The attribute engineering process allows us to move these activities into earlier, virtual phases", explains Schöggl in conversation with ATZ

ing the engine: How long does it take? What is the idling speed? How does the engine sound? What about the warm-up time? and so on. The simple process of starting the engine once can be broken down into a large number of individual elements. We have analysed the methods used by hundreds of experts like this and we have transformed what they say into computer programmes. The evaluation can now be used either together with a real vehicle, for example in the benchmarking programme, or with a simulation. This allows us to carry out an objective assessment of a simulated vehicle.

"Reducing costs by between 10 and 30 % means saving a lot of money"

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"The fascination of low-emission cars will lie in attributes such as dynamics, handling, sound, ride comfort and, of course, fuel consumption and emissions", says Schöggl

You are putting the focus on virtual development. Is there a rough formula to indicate what computer simulations cost in comparison with testing on a test bench?
Each hardware prototype of a car costs between 50,000 and 1 million euros, depending on the development phase and whether it is a model upgrade or a completely new model. The cost of a virtual prototype is around one thousandth of that. Using the attribute engineering process, we can create 15,000 virtual prototypes and in 24 hours run virtual tests on them against all the emission cycles and driving cycles. If we use cloud computing, we can drive three million km in 24 h. The key factor is the virtual assessment with our objective procedure which reduces the work and the cost involved. But it is important not to see this in black and white. In other words, we cannot drive everything in the virtual world. We still need prototypes, but reducing costs by between 10 and 30 % means saving a lot of money.

You are a member of the advisory board for the ATZ driver assistance systems conference. Alongside CO_2 emissions, these systems represent one of the key topics in the automotive industry. What do you think their impact will be on world markets?
The largest proportion of development costs is currently being spent on reducing CO_2 emissions. But driver assistance systems are in second place. There will be a huge amount of growth in this area in the near future. For example, Mercedes-Benz has announced that there will be no more fatalities in its S-Class model from 2020. The pressure on the other premium manufacturers is growing. Everyone has to invest in this area, because it is all about safety. In addition, driver assistance systems are used to reduce emissions and make cars more fun to drive.

So your benchmarking tests also cover highly subjective topics such as driver assistance systems?
Yes, definitely. We evaluate these systems in every car that we benchmark, if they are installed. We look at how end customers see these systems and that brings us back to the three ratings: I like it, I don't notice it or it annoys me. The experts take a much more precise approach: Is the car snaking slightly? Does the distance between this car and the one in front vary? Do I ever reach the point where I feel unsafe as a passenger? These are the subjects that we are considering so that we can provide support for the development processes of our OEM customers and help improve cars' behaviour.

Another question that takes us back to the beginning: We said that AVL's history is in powertrain development. How are you able to make use of your huge amount of powertrain knowledge when you are working on a complete vehicle?
We have resolved this by creating a structure where we can bring together all our knowledge of powertrains and use it to reduce vehicle CO_2 emissions. We have experts from a wide variety of different areas working together in a team. They combine possible measures relating to the powertrain with possible measures relating to the chassis, aerodynamics, thermal management and air conditioning. All of these individual measures are linked together in an organisational structure which involves all the experts sitting together and working on joint projects.

Dr. Schöggl, thank you very much for talking to us.

INTERVIEW: Dr. Johannes Liebl and Michael Reichenbach

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