

Driver, passenger, side and leg - the varieties of airbag are rapidly growing. Thanks to microelectronics, these passive safety systems are also getting smarter. At the "Airbag 2000+" conference, experts discussed the latest trends in safety applications for the car.

**The buzzwords** at this regular international conference have changed little over recent years - "intelligent airbags", "smart systems", "seat-occupancy recognition" - but this only confirms how swiftly technical visions can become everyday reality. Two years ago, debate focused on systems capable of recognizing whether a passenger or a briefcase was sitting alongside the driver; four years ago, the key issue was whether several airbags deployed at various positions should be used to provide protection in a crash. Most of these innovations are now available in new cars of certain price categories. At the latest "Airbag 2000+" conference, hosted once again by the Fraunhofer Institute for Chemical Technology ICT in Karlsruhe, many new ideas were put forward, some of which surely appeared utopian to the layman, including electronically controlled safety systems capable of "foreseeing" an impending collision and acting so as to prevent it - "collision avoidance".

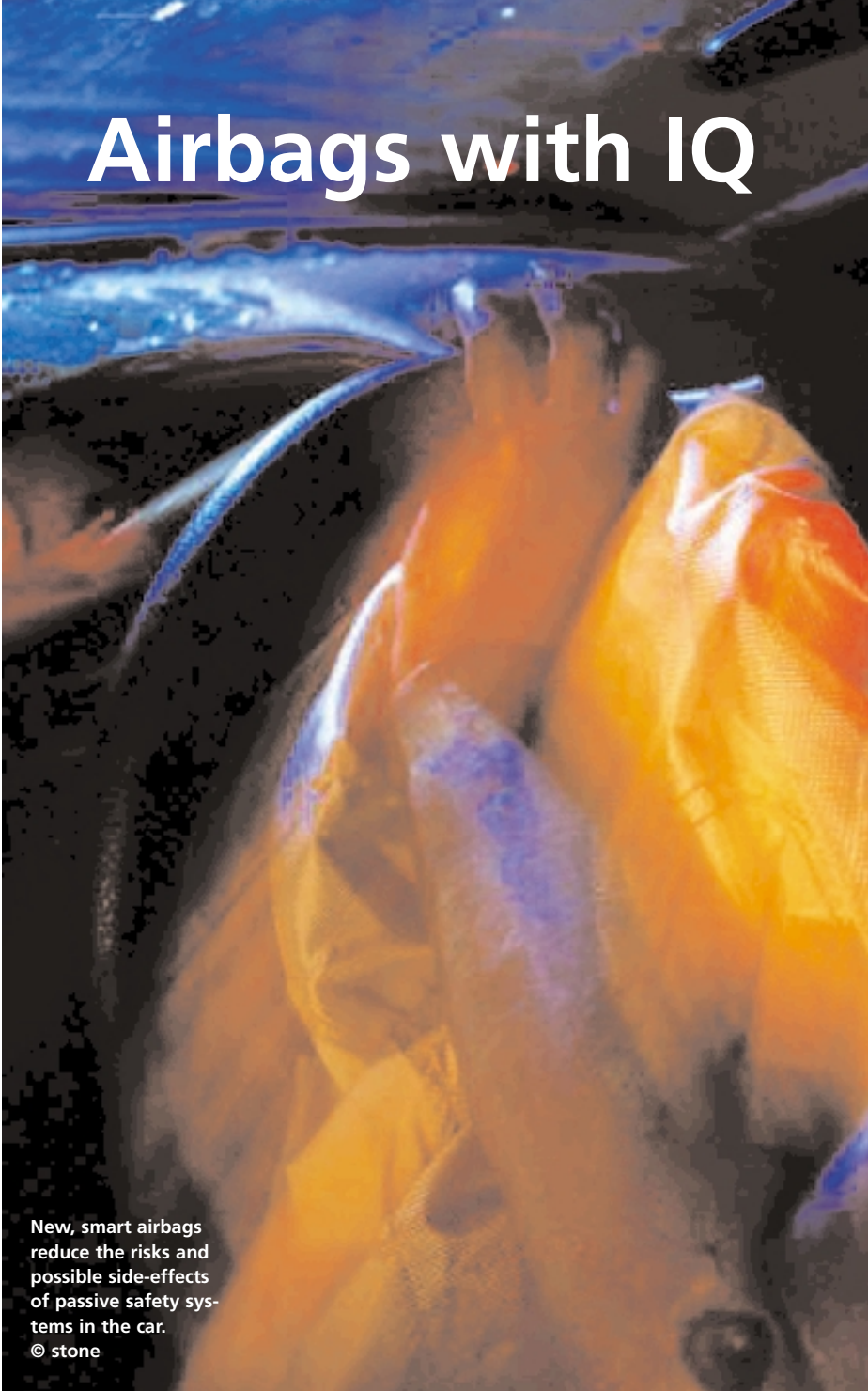
"Whereas in earlier years," comments Dr Karl-Friedrich Ziegahn of the ICT, "questions of airbag technology and design were at the forefront of attention, at this most recent conference it was information and communications technology. More and more, the car is becoming a computer on wheels - and reliable data transfer within a fraction of a second will be crucial for the next generation of safety systems." The objective here is to provide the driver with support in critical situations. Radar, infrared and optical systems will monitor the road - and they can see both farther ahead and more precisely than the human eye. They will also register the driver's condition, and warn him, for example, if he appears in

danger of falling asleep at the wheel. Such dangerous situations can be identified and evaluated extremely quickly and reliably. In a crisis, the computer will intervene in the steering process so as to avoid the impending crash or - at least - attempt the greatest-possible damage containment, and immediately trigger an alarm to rescue services. The electronics should not distract the driver or lull him into a false sense of security; the computer is only allowed to take over the functions of steering or braking in a genuine emergency.

Another vision comes from the Swedish

carmaker Volvo. Stefan Nilson, responsible for innovations in vehicle safety at Volvo for many years, presented a new and integral concept of accident evaluation: "As a departure from the 'long-suffering' crash-test dummy, many test collisions will in future be simulated on the computer - 'virtual testing', as we call it. The capabilities of today's computers allow us to model and analyze the behavior of the human body in a wide variety of collision and skid situations." The data acquired in this way are far more comprehensive and genuinely revealing than tests using dummies. Furthermore, this method cuts down the number

# Airbags with IQ



**New, smart airbags reduce the risks and possible side-effects of passive safety systems in the car.**  
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## Safety technology



market - where airbag configurations can vary considerably from those standard in Europe. Not without reason, of course: Although the wearing of seat belts is compulsory in the USA, the majority of drivers simply don't. Consequently, airbags are designed to inflate faster and to a greater volume.

Intelligent airbag systems able to adapt to the driver's physiognomy and behavior can, naturally, be of great advantage. Sensor systems, for example, can identify how far forward the seat has been moved toward the steering wheel; they can also register the weight and height of the driver and regulate the ideal volume of the inflated airbag correspondingly. "This is no vision of the future," confirms Ziegahn. "Today we already have two- or multi-stage airbag systems which inflate according to the relative impact and type of collision." Such a smart airbag system was developed jointly by car manufacturers, suppliers and specialists from the Fraunhofer ICT in a project funded by the European Union.

One of the key components of an airbag is the gas generator. The Fraunhofer scientists have now developed a new variant for the intelligent airbag system. It consists of a casing, an ignition element and a solid propellant in tablet form. "In a crash," explains Dr Norbert Eisenreich of the ICT, "these tablets can produce up to 100 liters of gas within 40 milliseconds. Each discharge has a greater force than the punch of a professional boxer. To prevent a driver, who is sitting too close to the steering wheel, from

receiving its full force and possibly sustaining a severe injury, sensors identify the driver's exact position and induce a time delay in the flow of gas. A special chemical composition enabled the researchers to fulfill several requirements at a stroke: effectiveness, cost and environmental compatibility. Moreover, in comparison to airbags standard today, the gas is generated at relatively low combustion temperatures; at the same time, the gas generator is entirely safe and impervious to external influences.

The Fraunhofer experts supplied their tailor-made gas-generator casing as a part of the new package. The new gas generator responds at a lower pressure than hitherto the norm. This allows for simpler casing design with lower requirements in terms of mechanical durability. This in turn substantially lowers the production costs for the "airbags with IQ".

Dr Ziegahn comments on a further problem. "Many emergency paramedics are concerned that an airbag that has not inflated could suddenly be triggered when a casualty is being rescued - and injure one of the rescuers. The danger here is negligible, exaggerated through unfamiliarity with the technology. In order to dispel such fears and obtain factual data, we collaborate closely with the fire departments on practical trials to ensure the safety of rescue services."

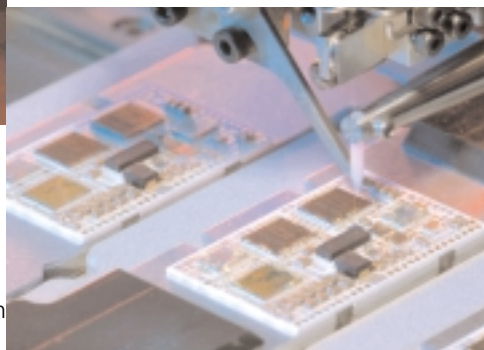
According to the car manufacturers, the useful life of airbags and gas generators extends to a maximum of 15 years. After that - as stated in the manufacturers' instructions - the systems must be exchanged in order for their guarantee of reliability to be upheld. At the end of a car's service life within the European Union, current regulations require its components to be disassembled and appropriately recycled or disposed of. Airbags, too, thus need to be optimized with regard to their suitability for recycling.

The substantial successes achieved to date in enhancing safety in the car became clearly evident at the airbag conference. The next "Airbag 2000+" symposium in Karlsruhe in December 2002 will show how far the vision of the intelligent, autonomous car has proceeded on its way to becoming reality.

**Beate Koch**

of expensive cars wrecked for purposes of testing.

These virtual tests could perhaps also be of benefit to sections of the driving population that have not been properly considered in the past - shorter people, for example. As was shown in a study published in the United States, earlier types of airbag can actually be dangerous for this category of driver. Shorter people sit closer to the steering wheel - out of which the airbag explodes in the case of a collision. Such findings are of particular relevance to manufacturers who also sell their cars in the North American



**Collision avoidance:  
Electronics help to  
prevent accidents.**

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