

Bertrandt*magazine*

No. 6 • September 2005

Volkswagen Passat – Development Support

Ford Mondeo – Bumper Development Facelift Show Car

Renault-Concept-Car Zoé – Glass Roof Element Development

Opel Astra – Luggage Compartment Development

Bertrandt Engineering Network – Supporting Services



4 Redefining Customers' Wishes



8 A Fresh New Look on Europe's Roads



10 Under a Starry Sky



22 Flexible Luggage Compartment



16 | 30 Welcome to the Bertrandt Engineering Network

4 **Projects**

Volkswagen Passat Development Support • Ford Mondeo Bumper Development Facelift • Renault-Concept-Car Zoé Glass Roof Element Development • BMW 3 Series Airbag Tests Air Conveyance Development • Opel Astra Luggage Compartment Development • Karin Sander Aluminium Memorial

16 **Bertrandt Engineering Network**

Supporting Services

26 **Range of Services**

Occupant Sensing

30 **Bertrandt Internal**

Bertrandt at the IAA 2005 • Supplier's Day in Munich • Customer's Day in Wolfsburg • Bertrandt in Brief • Corporate Calendar • Portrait • Bertrandt Subsidiaries • Masthead



Editorial

For more than 30 years, we have taken great care to listen closely to our customers as they express their needs. Addressing the challenges facing our customers and responding to the demands of the market have turned us into a development partner with complete vehicle expertise and have enabled us to extend our range of services along the entire automotive value added chain.

This includes Supporting Services. For about ten years now, our specialists for process engineering have been coordinating and controlling cross-cutting, interdisciplinary functions. With these experts at hand, the Supporting Services Competence Centre occupies the niches outside purely design-based development and production activities. We are active in the most varied interfaces – from the initial idea right through to series production support – in order to serve our customers rapidly and flexibly within their own environments. I would like to invite you to see just how much our Supporting Services Competence Centre has to offer. You will find a detailed report in the middle section of this edition of *Bertrandtmagazine*. Our specialists will be more than happy to assist you on-site with whatever challenges you may face.

Three decades of Bertrandt is quite an occasion to present our own development from an engineering consultant into a partner for the automotive industry at this year's IAA International Motor Show in Frankfurt. Under the heading "Foresight", we will present future-oriented topics that demonstrates today how we can be your farsighted partner tomorrow. Pay us a visit at Stand A05 in Hall 3.1. You will be sure to find a warm welcome, a relaxed atmosphere and a chance to exchange ideas and information.

Dietmar Bichler

The New Volkswagen Passat



At the beginning of February, the first pictures of the new Passat were given an enthusiastic reception in the automotive world. As from March 2005, the best seller has been out on Europe's roads. Bertrandt Wolfsburg played a role in the development of "the most comfortable Passat of all times". The Bertrandt team collaborated on projects with the Volkswagen development department and with a range of system partners. Services from Bertrandt's extensive range were tailor-made to ensure that they met the individual requirements of each customer optimally.

Bertrandt Wolfsburg Supports New Passat Development

► Carefully designed electronics

The vehicle had to accommodate more than 3.5 km of cable to ensure the correct functioning of the electrical system. A number of new electronic features presented a challenge for Bertrandt. These included the new "coming home" and "leaving home" functions, which offer the driver the safety of additional lights at the push of a button when getting into or out of the vehicle in the dark. The electronic handbrake, which is also operated at the push of a button, is another sixth-generation innovation.

Space had to be found for the numerous cables, connectors and protectors. Bertrandt had been working with the main system supplier in this area for more than five years, before starting the joint project for the new Passat. The technical CAD support provided

by the Bertrandt team for this project was another collaborative milestone. The tasks included creating wiring diagrams, developing a wiring kit package and investigating the available installation space, to ensure that everything run smoothly right through to the start of production.

► Bumpers developed to improve pedestrian safety

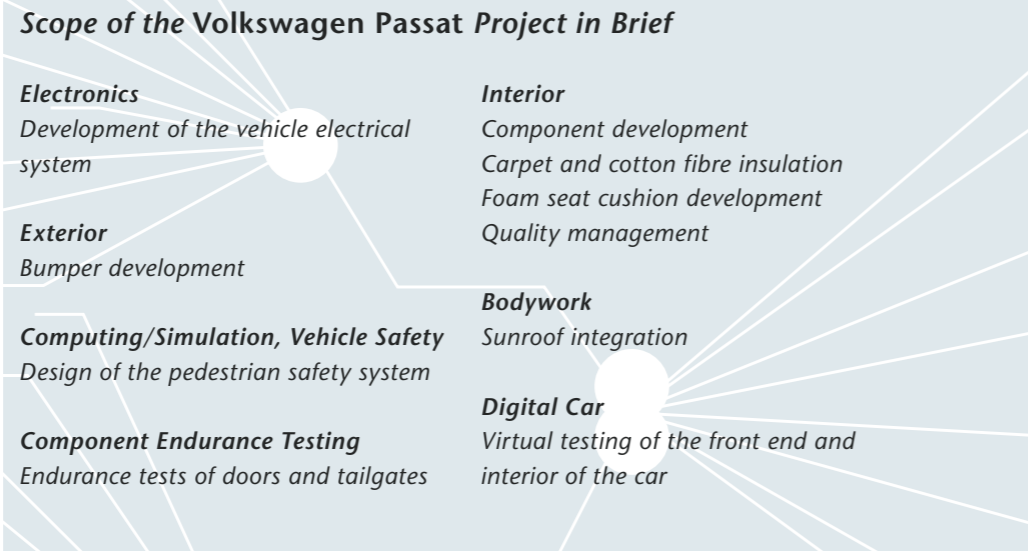
The Bertrandt team was responsible for developing the bumpers for the variant and saloon models right through to planning release. For the next stage of development until the start of production, Bertrandt was chosen as partner by the system suppliers Rehau and Peguform.

The exploded diagram of the front bumper shows all the components that Bertrandt helped to develop, with the exception of the electrics.



With the input of extensive expertise and innovative ideas, a bumper system was produced that met the design and technology requirements. The close proximity of the developers had a positive impact; during the one-year development period, Rehau moved into Bertrandt's premises. As part of the joint project with Volkswagen's technical development team, the latest European pedestrian safety guidelines, which are coming into effect as from October 2005, were taken into account. In future, new models in crash tests must demonstrate that pedestrians are better protected in the event of an impact. The Bertrandt vehicle safety team provided additional support by designing the head impact areas on the vehicle bonnet. The EEVC WG17 and Japanese NCAP guidelines were taken into account for the head, lower leg and upper leg impact areas.

► **Interior developed in collaboration with system suppliers**
Bertrandt actively worked together with system partners on developing the seats, including, for example, the drawer and storage compartments under the seat and the fire extinguisher mounting. Bertrandt engineers carried out package tests of the seat air conditioning and monitored the quality requirements. The foam seat cushions for the front and rear seats were also produced by Bertrandt. The team developed all the design variants for the Trendline, Comfortline, Comfortline Leather, Highline and Sportline models from the concept phase right through to production. The thermoplastic carpet, which acts as sound insulation, combines environmental awareness with the quality standards of cars from the upper mid-sized sector. The carpet, which has cotton fibre padding, has excellent sound insulation properties and is made mainly of



recycled materials. The Bertrandt team was responsible for designing the shape of this acoustic component, taking into account all model variants, including right-hand drive versions.

► **Component endurance testing**
Another part of the project involved testing the doors and tailgates using Bertrandt's own testing equipment, which is certified by Volkswagen. The endurance tests of the doors and tailgates consisted of more than 100 000 load-cycle changes under different climatic conditions. The equipment and

electronics/electrics were included in the same test process. Bertrandt also met the challenge of incorporating and coordinating the tests of the "door assembly" departments in order to save costs.

► **Virtual testing of the front end and interior of the car**
The virtual car is playing an ever more important role in the development process. During the development of the new Passat, the Wolfsburg team, together with the type approval managers from Volkswagen, provided virtual testing for the virtual front end of the car

Volkswagen Passat



► **Redefining customers' wishes**
The new Passat is Volkswagen's answer to the question of how driving can be made even more enjoyable. With its many comfortable features, the Passat sets new standards in its class. With equipment levels aimed at the demanding customer, Volkswagen's claim that the new Passat has redefined customers' wishes is no empty promise.

Successful project: (from the right) Klaus Landrock, authorised Project Leader for the automotive industry from Rehau AG+Co, with Bertrandt Team Leader for Vehicle Exteriors, Thomas Klingner.



The seats are characteristic of the overall high ergonomic standard of the Passat.



with all its assemblies and drive components. The team was also responsible for testing the function, the installation space and the wide range of variants of the entire interior in the virtual car.

► **Integrating the sunroof**
Bertrandt Wolfsburg was also given the assignment of integrating the Volkswagen sunroof into the new model range. The assignment included positioning and designing the roof cutout and the gutter and the concept development and design of the sunroof reinforcement frame. ■

Heidi Wolfarth, Wolfsburg



Ford Mondeo Facelift

Bertrandt Cologne
Bertrandt Dunton
Bertrandt Wolfsburg

► Project scope

Acting as engineering service provider for Ford and various system suppliers, it took Bertrandt in Cologne only six months to transform the required modifications into CAD data. The project included the front bumper and bumper grille, the radiator grille and frame, the side indicators, the rear lights for the saloon model and the rear bumper for the saloon and Turnier estate models.

Bertrandt Wolfsburg carried out thorough tests of the bumper components.

► New clay bumpers form the basis for design freshening

By means of the CAS (computer-aided styling) data for the new bumper provided by Ford, Bertrandt in Ehningen milled a full-size clay model of the existing bumper. The responsible Ford bumper stylist then worked together on a daily basis with the design modelling team members at Bertrandt in Cologne to refine the bumper shape and to incorporate any necessary technical changes to its shape.

► Model approval ensures early "styling freeze"

During this phase, a Bertrandt development team working in parallel pressed ahead with the process of testing the model for technical feasibility and adherence to legal requirements. The styling freeze milestone was reached only two months after the start of the project.

► Network develops exterior shape

Subsequently, the Bertrandt surface design teams in Cologne and Dunton began working in ICEM-Surf. Using virtual reality techniques, Bertrandt was able to demonstrate the progress made on the surface design every week to the Mondeo team on the power wall at the Ford Design Centre in Cologne. After a further two months, the milestone for the completion of the exterior shape was reached.

► Component development and testing for system suppliers

During this development phase, Bertrandt in Cologne was commissioned by the system suppliers to develop a range of components. As a result, it was possible to incorporate the specific tool requirements into a development process for the exterior shape without data being lost or time being wasted. The CAD models of the components already produced by the associated teams were adapted on the basis of the completed surface design data by Bertrandt Cologne's exterior team

using the CAD system I-DEAS. By the end of October 2004 they were ready for delivery to the tool manufacturers.

In February 2005, the first components produced in one step were ready and therefore the testing phase could start. Bertrandt was also responsible for testing various components.

For example, all the bumpers and grilles were subjected to comprehensive environment simulations by Bertrandt in Wolfsburg. This involved constructing special testing and assembly equipment that allowed the bumpers to be placed in the mounted position shown in the drawings. The assembled parts were then measured in their mounted position using 3D measurement technology, and the results were documented. Selective checks of the components using pho-



A Fresh New Look on Europe's Roads



Ford is giving the Mondeo a facelift in order to cash in on the success of last year's Titanium special edition, which was a sell-out. The new-look Mondeo hit the streets right on schedule in the summer of 2005.



Scope of the Ford Mondeo Saloon and Turnier Project in Brief

Construction of Design Models

Clay modelling

Show Car

Surface Design

Development of the exterior bumper shape

Exterior

Front bumper

Radiator grille and frame

Front bumper grille

Side indicators

Rear lights (saloon only)

Rear bumper

Component Testing

Environment simulation of the exterior components with infrared radiation

togrammatic measurement techniques were carried out before, during and after the tests. The option of carrying out a spatial scan of the entire surface of all the components and then representing them using colour flow diagrams was also available.

► Project ending with show car

The project ended with the construction of a show car for Ford, which was completed within a deadline of two weeks. Once again, the different service areas of the Bertrandt Engineering Network were involved.

Bertrandt Cologne is proud to have contributed to another chapter in the Mondeo success story. ■

Frank Beifuß, Cologne

Under a Starry Sky...



Renault chose the 2005 Geneva Motor Show to unveil its latest concept car, called "Zoé". The small upper-range urban vehicle is designed to provide genuine motoring pleasure. Visitors to the show were presented with a compact, attractive and dynamic model: Zoé features clear-cut lines and rounded forms as well as a luxurious, functional and asymmetrically designed interior that offers three full-size seats and a voluminous boot. Glass roof panels inlaid with LEDs bring plenty of light into the interior. A further interesting new development is a memory stick that enables drivers to personalise their car: one click will automatically adjust the music, settings and interior ambience to match the taste of the individual driver.

Bertrandt France Develops the Glass Roof Elements for Renault's Concept Car "Zoé"

The Art of Combining Design and Technology



Photos: Renault Design

Renault-Concept-Car „Zoé“

► A project from A to Z(oé)

Renault entrusted the electronics department of Bertrandt France with designing and producing the glass elements that light up like a starry sky, as well as the corresponding control electronics. The entire development was determined by the innovative interior. The originality of the concept enriched this exciting project and inspired all those involved to come up with numerous new ideas. The glass elements consist of laminated glass panels that integrate a polyester film with LEDs and four layers of coloured PVB (polyvinyl butyral). The laminated glass is heated in an autoclave for eight hours at 130 °C and under pressure of 15 bar. During this process, the PVB melts and forms a homogeneous combination of the different elements.

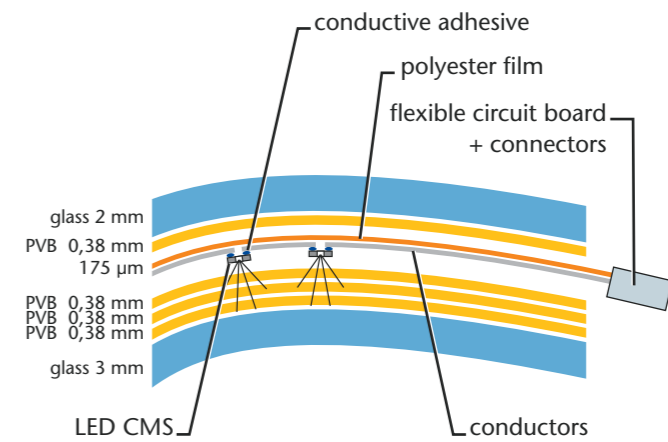
This process is made more complex by the fact that all the elements are applied under limited conditions in terms of their usability. For this reason, the development and execution of this cutting-edge technology represented a major challenge.

► A poetic touch from Renault's design department

A control system allows all the parameters for switching the LEDs on and off to be regulated. The two glass panels can be controlled independently of one another and the time delay before they reach their maximum light intensity can be set individually or can be configured via an Ethernet connection in the vehicle.

The system calibration software, which was developed by Bertrandt France, allows the different parameters to be adapted to the surroundings. For example, it makes it possible to pre-define several configurations that offer the user a selection of different lighting sequences.

The system also offers interaction between the user and the lighting ambience in the interior. For example, it can create a link between the light intensity and the speed of the car or allow the lighting of the glass panels to be automatically activated by external parameters.



Schematic diagram: Structure of the glass elements.

► Future perspectives

The positive response from the media encouraged the Renault design team to consider developing transparent conductors to the LEDs. The engineers are currently working on this idea and the results of their work may well be seen in one of the next concept cars from Renault. ■

Cédric Damiot, Yohann Desiles, David Boismaigre, Agnès Vogt, Paris

Scope of the Renault Zoé Project in Brief

Project Management

Module Development: Roof Systems
Design, development and component verification for glass panels
Manufacture of the roof and side windows

Electronics
Control electronics: software and hardware

Supply Chain Management

Increased Safety



© BMW AG

BMW 3 Series

The development and testing of the individual components ran smoothly, and the first project milestones, such as connecting the airbag cover to the dashboard insert, were soon achieved. In various additional stages, the Bertrandt engineers were able to test the functioning and positioning of components such as the cup holder, covers and fresh air inlets. The companies that supplied the individual system components were on site for the testing so that any necessary changes could be implemented quickly.

► New unfolding sequences based on out-of-position tests

By means of the latest high-speed video technology, the project then focused on the unfolding sequence of the airbag and on the times of opening. At speeds of up to 9000 frames per second, even the fastest events, which are not perceptible to the human eye, can be clearly displayed and carefully analysed. The conclusion drawn from out-of-position tests carried out by the airbag manufacturer was that a change in the way the airbag material was folded could give a passenger sitting in an unfavourable position a far greater level of protection. For this reason, the airbag manufacturer provided a range of differ-

ent airbag folding sequences for the test. This enabled the possibility to identify the sequence that met the demands for airbag integrity and the requirements of the out-of-position tests. After a successful release test was carried out for the relevant BMW department, the project was completed.

► Together on the move in future

This project has given the airbag laboratory's Vehicle Safety Competence Centre additional experience in functional development. BMW and Bertrandt are already cooperating on new products in the vehicle safety field in which the out-of-position concept plays a more important role. ■

Andreas Gräfnitz, München

An airbag cover with an invisible split line opening in the new BMW 3 Series (high-speed video recording at 9000 frames/second).



Bertrandt Integrates Passenger Airbag into the Dashboard of the New BMW 3 Series

The first airbag tests in the new BMW 3 Series were carried out in Munich at the beginning of 2003. The objective was to integrate the passenger airbag module into the dashboard. BMW chose the airbag laboratory at Bertrandt's subsidiary in Munich to run the tests. The laboratory has already carried out airbag tests on a wide variety of cars.

► Prototype components enable testing at an early stage

Bertrandt was first contacted by BMW with regards to the 3 Series passenger airbag project in 2002. At that time, BMW requested pressure tests data for a previous model. BMW incorporated the data into the calculation and simulation processes as part of the functional development process. This resulted in the production of prototype components that enabled for initial tests to be carried out in spring 2003. The results of these tests were

incorporated into the development process that speeded up the process of integrating the airbag module into the dashboard.

► Integrating all partners makes for faster progress

The BMW 3 Series dashboard is not produced by a supplier but by the BMW factory in Landshut on the basis of the work of the research centre. Only the components, for example the airbag module, covers and air vents, are third-party products.

Improved Performance

Air Induction System for the New BMW 3 Series 6-Cylinder Engine

► Concept

The initial investigations into the system of the new BMW 3 Series began in October 2001 on the basis of the previous model. During the unfiltered air intake, air is induced by twin inlets above the BMW double-kidney grille and subsequently transported towards the air filter. Studies were carried out and designs produced for the required components, the demoulding concepts, the mounting concept and the seal between the air induction and the engine compartment, to prevent hot

air from being induced. In collaboration with Mahle, several variants were developed and evaluated.

Another important issue was the connection between the engine compartment and the front bulkhead. The initial assumption was that the route to the engine compartment would go across the bulkhead. The subsequent evolution stages of the bulkhead resulted in the creation of an interface. This meant that the air induction had to consist of at least two components.

Improved Performance



Complete scope of air induction system: unfiltered air induction, air filter and filtered air convoluted rubber gaiter.

A convoluted rubber gaiter was utilised as decoupling module between the unfiltered air induction and the air filter. As both the air conveyance and the filter are mounted onto the bodywork, there was no need to balance out their movements relative to one another. The convoluted rubber gaiter makes assembly easier and is used to compensate for tolerances. In the original design, the convoluted rubber gaiter was attached to the plastic components using latches. However, after the trial phase, Mahle decided to weld the convoluted rubber gaiter to the air conveyance, which eliminated one of the interfaces.

Mahle had been responsible for the unfiltered air induction and air filter of the previous model and was able to work from the basis of its existing concept. This resulted, for example, in a round

filter element being used instead of the normal disk-shaped design. The round filter enables the maximum filter surface area in the smallest space, which results in long filter change intervals. The initial task was to position the filter element designed by Mahle in the package. In addition, Bertrandt had to develop a sealing concept and a secure mounting concept for the filter element.

The convoluted rubber gaiter for filtered air forms the connection between the air filter and the throttle valve and is the last component in the air induction system. In addition to transporting the air, its main task is to accommodate the relative movements of the engine (throttle valve) and the air filter. As a result of its complex shape the convoluted rubber gaiter for filtered air is also blow-moulded.

The Development Process

► Air induction system

Under the guidance of the Mahle computing department, several proposals for the flow geometry of the air induction system were produced. In addition, the cross-sections of the system were optimised to prevent a break-up of the airflow. The aim of these measures was to reduce the pressure loss as much as possible throughout the air induction system, as this has a direct impact on engine performance. After the airflow had been redesigned, Bertrandt, together with specialists from Mahle, focused on the demoulding of the components. At the back, the air induction system had to be divided into an upper and lower part, which were joined together using vibration welding. As the air induction system is highly visible in the engine compartment, it is important that the welded joints are as inconspicuous as possible.

► Casing and lid

The primary consideration in the design of the air filter casing and lid was to achieve as much volume as possible in the specified environment. Another important factor was the structure-borne noise. Bertrandt worked closely with the Mahle computing department in this area. This enabled noise reduction measures to be incorporated into the models at an early stage, including ribbing and embossing of smooth surfaces. However, this remained a critical issue right through to the start of production. In particular in the case of components where the design is critical, the appearance and the function must be in harmony. This resulted in the lid of the casing being reinforced in order to prevent the gleaming through of the ribbing due to sink marks.

BMW 3 Series

► Convoluted rubber gaiter for filtered air

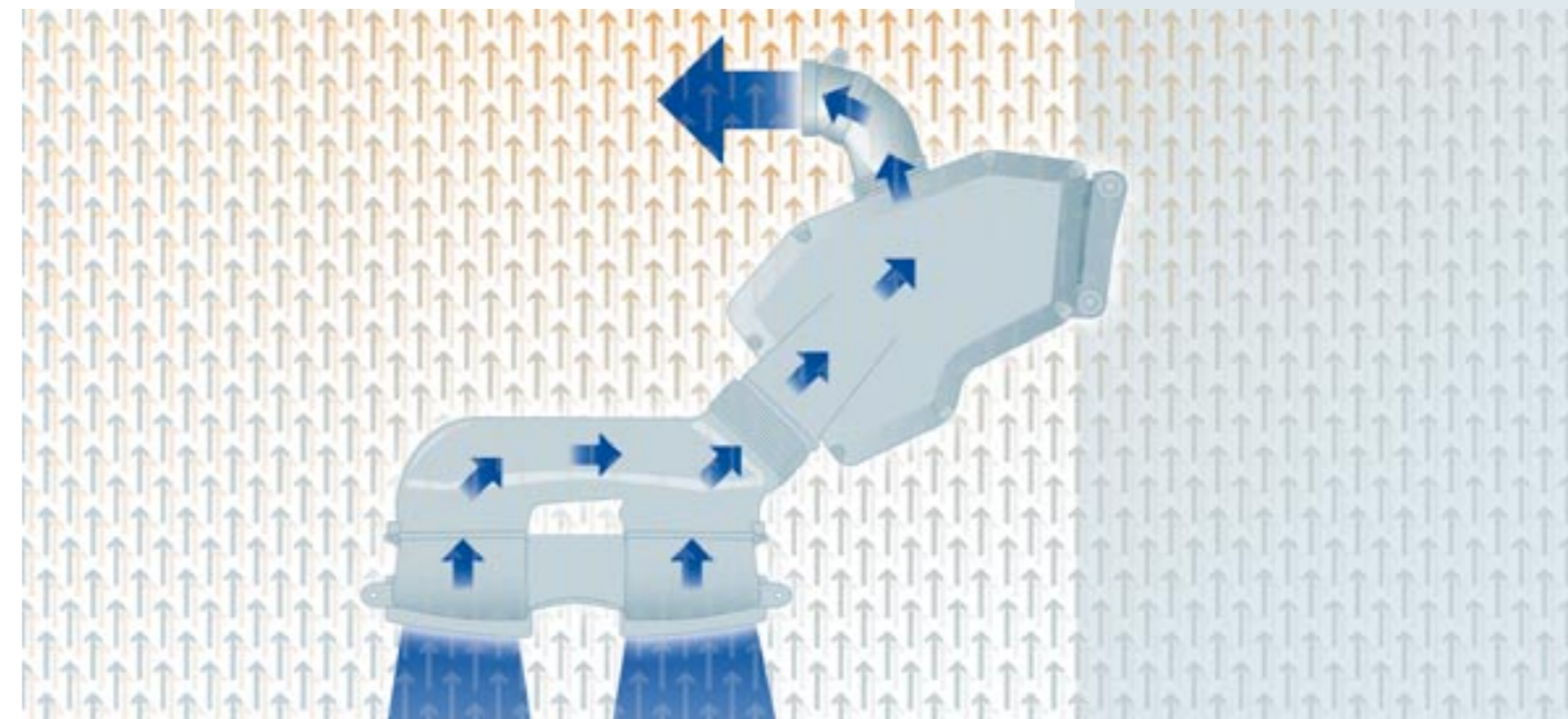
One might think that this convoluted rubber gaiter would be the simplest component to develop, but this is not entirely the case. Because of the constantly changing environment, a new route for the convoluted rubber gaiter was needed. For this reason, the position of the convolutions had to be changed. In order to ensure the required level of flexibility (20 mm in both directions), a minimum number of convolutions were required. The convoluted rubber gaiter is mounted on the throttle valve in advance. This means that it is already fitted when the engine is mounted in the bodywork and is therefore "in the way". For this reason, the convoluted rubber gaiter is divided in two. The shorter, more rigid part is mounted onto the throttle valve and the flexible part is then fitted onto the air filter. Acoustic factors also

played a part here. The convoluted rubber gaiter for filtered air is the ideal component to accommodate resonators that filter out unwanted frequencies in the air induction system. A resonator is used in the new BMW 3 Series that was developed in collaboration with Mahle's acoustics engineers.

► Conclusion

One of the main features of the project was the mutual trust and openness displayed by both partners. This formed the basis for the successful collaboration between the two companies. The creation of the 3D data for the production tools in spring 2004 marked the end of a very interesting and wide-ranging project for Bertrandt. However, Mahle and Bertrandt also worked together on another 3 Series project: the parallel development of an air filter for the US market. Other versions of the engine will follow in future. ■

Detlev Hruschka, Ehningen



Scope of the BMW 3 Series Project in Brief

Component Testing
Airbag tests

Powertrain: Engine

Concept design and development

Front air flow routing

Rear air flow routing: Assembly of air

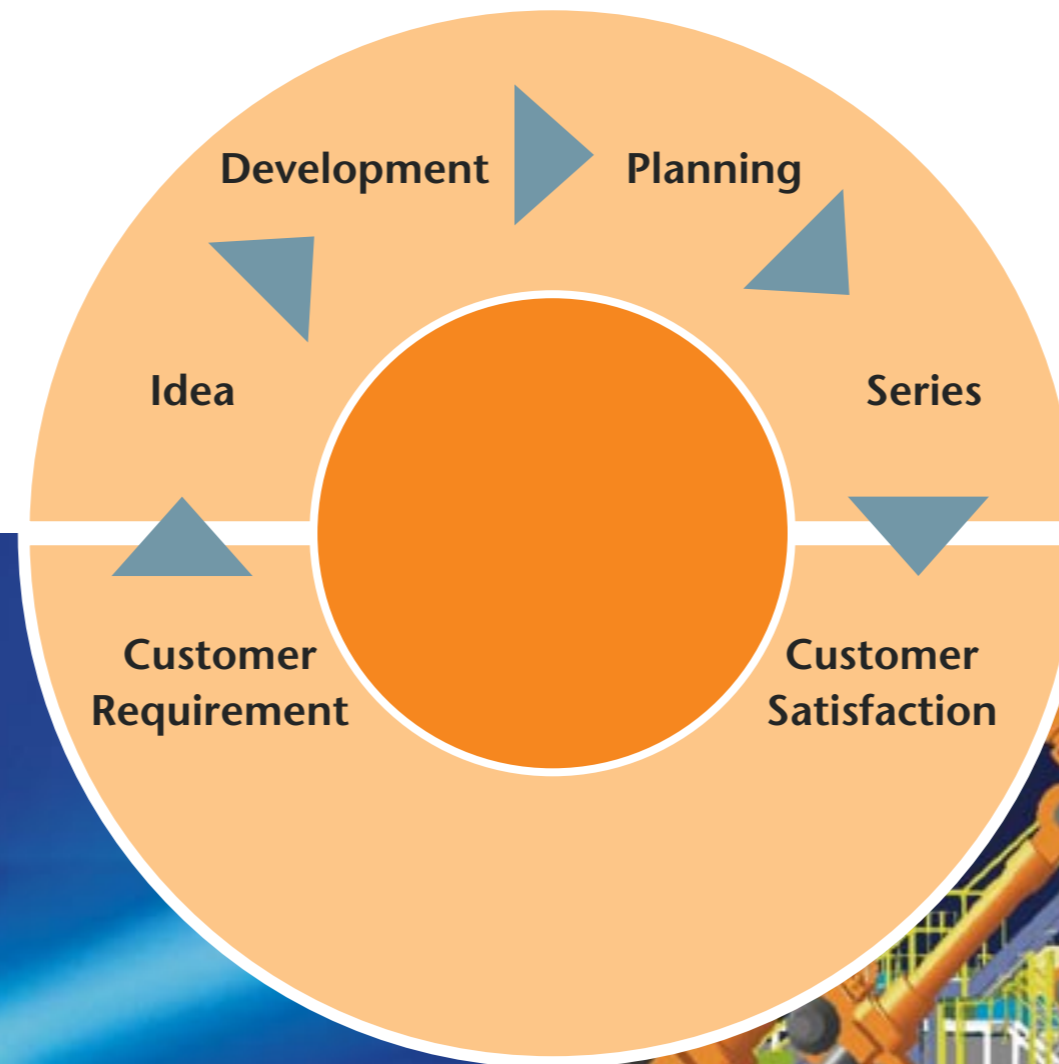
conveyance, upper part, bottom part

and unfiltered air channel

Air filter: Casing and lid

Filtered air channel

Supporting Services



Stricter quality demands and an increase in process reliability will continue to characterise the automotive and aviation industries in years to come. An important role will be played by "Supporting Services" (EDL), in which external partners provide support for the interfaces of automotive manufacturers and suppliers outside the mere development process. Bertrandt's Supporting Services Competence Centre, with its broad range of services and a team of highly qualified experts, is ideally equipped to provide optimum support to its customers in managing their processes.

At Home in All Interfaces

With its Supporting Services, the engineering partner Bertrandt provides support to the automotive, aviation and supply industries in inter-disciplinary functions of the development and production process. These customer-based services within the product development process range from project and quality management and digital verification of products to series production launch support.

The main advantage for customers is that their processes are coordinated and managed, making optimum use of their development resources. Customers can benefit from more than 30 years of Bertrandt-expertise along the entire automotive development process chain.



Managing, supporting, monitoring and optimising – eloquent complete vehicle specialists ensure that the process of finding a solution runs smoothly.

Supporting Services

Product Development Process



Product Development Process

Three Questions for Jörn Beier, Managing Director: Supporting Services Competence Centre

Bm: Mr Beier, around 350 specialists are working in eight subject areas in the Supporting Services Competence Centre. Where do you see the strengths of this competence centre?

Jörn Beier: The range of supporting services that we offer enables us to react quickly and expertly to the market's growing quality and flexibility demands. We actively approach our customers and are able to provide optimum support for them in their environment and according to their own ideas. Our task is to manage the interfaces in the product development process as a project manager and act as a kind of "troubleshooter". What is very important is: Our approach not only entails the problem-finding, but especially the problem-solving!

Bm: Could you give us an example from your day-to-day work that demonstrates your reaction to customers' needs?

Jörn Beier: Firstly, we optimise the processes between system suppliers and the production plant within the framework of supply chain management and logistics. We examine the manufacturing workflows, analyse them and develop solutions, for example in order to improve the working processes of the employees at the machines, against the background of schedules and costs. But we can also intervene at an earlier stage: within the context Manufacturing Engineering, we can implement turnkey solutions in automation technology. Before the machines are built, we can perform digital verification, even including such specifications as where a steel sheet has to be placed or where the spot welds are to be located.

Bm: What trends reinforce you in extending your range of supporting services?

Jörn Beier: Digital process verification and the optimisation of production processes will be a dominant issue in the future. Furthermore, the market will be characterised by increasing quality requirements. This is precisely where our services are aimed. With our specialists, we act as a consultant for the customer, combining the factors of quality, flexibility, speed and expert knowledge that are so vital for success. ■

"The expertise of our staff can be described as process-supporting engineering in complete vehicle development."



Opel Astra

Believe two interior specialists: The Astra's luggage compartment is really worth opening! The interior design team at Bertrandt Rüsselsheim provided support for the development of a flexible luggage compartment concept for the Astra family for Opel and Johnson Controls. The new Opel Astra combines an emotive design with modern functionality, which is reflected in the flexible rear design of the GTC, saloon and estate models.

► Frontloading optimises interior panel trim components

Opel implemented its new supplier integration strategy in full for the first time in the development of the new Astra. By choosing its external partners at an early stage, the company aimed to ensure that even during the development of the design surfaces the requirements of production were taken into account. An additional objective was to ensure that the use of the best possible surface design and of appropriate materials in the luggage compartment area would make a high quality impression without sacrificing storage space. This in particular applied to the Caravan estate model, with its newly developed easy opening system for the luggage compartment cover, in which a version of the FlexOrganizer system from the Vectra was used.

Rüsselsheim are short and the teams have been working together for years. The close cooperation between Opel design and development enabled the package to be exploited to the full, in spite of tight deadlines.

► Integration of RZM, easy opening concept and sliding seat

During the project phase, weekly coordination meetings were held at Bertrandt, which were attended by the relevant project engineers from Opel, Johnson Controls, suppliers, subcontractors and the Opel designers. The panel trims of the rear zone module (RZM) posed a particular challenge for all three models.

The RZM is an electronics module that contains a large number of fuses. As a result, the side trim panels had to meet two criteria:

neers developed a variety of concepts and variants for this system.

- Robust trim panels and mountings for the FlexOrganizer system, which divides up the luggage compartment area and ensures that smaller items can be transported securely.
- The incorporation of a sliding seat that gives rear passengers plenty of legroom or, when pushed forward, makes the luggage compartment area correspondingly large. Because of the choice of component separators and joints, only two additional trim panels are needed on each side.

► Development of the "Feature Box" storage facility

Other trim panel components were developed for the optional storage compartment under the luggage compartment floor area. Bertrandt also provided support for the development



The luggage compartment cover in the Astra estate with easy opening concept.



Easily accessible: the luggage compartment area in the 3- and 5-door models.

The most important factor in the design and development of the estate load surface was to take into account the different seat concepts, in order to ensure that the best possible utilisation was made of the luggage area. An additional consideration was to keep the parts costs low and the quality high, and to ensure that the manufacturing tools were cost-effective.

► Innovative storage concept

The Opel Astra offers carefully designed solutions for people on the move. With its special storage box, FlexOrganizer system and sliding seat, the Astra luggage compartment area fulfils all the requirements of a modern storage system. ■

Michael Kaiser, Stefan Neuhäuser, Rüsselsheim

Flexible Luggage Compartment



Scope of the 3- and 5-door Opel Astra Project in Brief

Interior

- Tailgate panel
- Luggage compartment cover
- Console
- Side trim panel
- Rear cover
- "Feature Box"
- Floor covering
- Extension of entry cover (5-door model only)
- Reinforced load surface

Scope of the Opel Astra estate Project in Brief

Interior

- Tailgate panel
- Luggage compartment cover
- Console with integrated easy opening rail
- Side lining for basic and sliding seat
- Extension of entry cover for basic and sliding seat
- Rear cover
- Integration of the FlexOrganizer system
- Reinforced load surface for basic and sliding seat

► Surface development in the luggage compartment area

Opel chose Bertrandt as its development partner for the surface design. This meant that the engineering of the luggage compartment area components for Johnson Controls and the surface development were both handled by one service provider. Bertrandt was able to apply its extensive experience for the customer's benefit. The internal cooperation between engineering and surface development went very smoothly. Communication routes in

- The trim panels had to have a large opening so that the module is easily accessible.

- The trim panels had to be sufficiently robust to protect the RZM from being damaged by items shifting in the boot area.

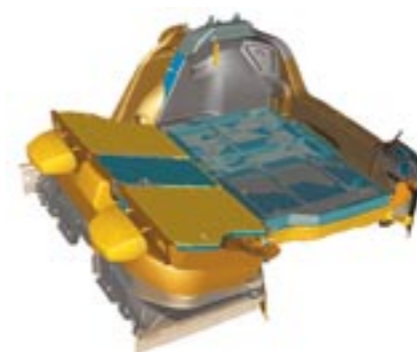
Three additional factors had to be taken into account for the Astra estate model:

- The development and integration of an easy opening system that retracts the luggage compartment cover at the push of a button. The Bertrandt engi-

of the entire luggage compartment area, including the "Feature Box" special storage container, for the five-door and GTC models and the load surface of the Caravan model.

The challenge was to ensure the best possible utilisation of space in the smallest possible design envelope. By working closely with Opel and its suppliers, the engineers were able to implement a special storage box for the 5-door and GTC models that contains several compartments and can also be used to store the hook for the tow bar.

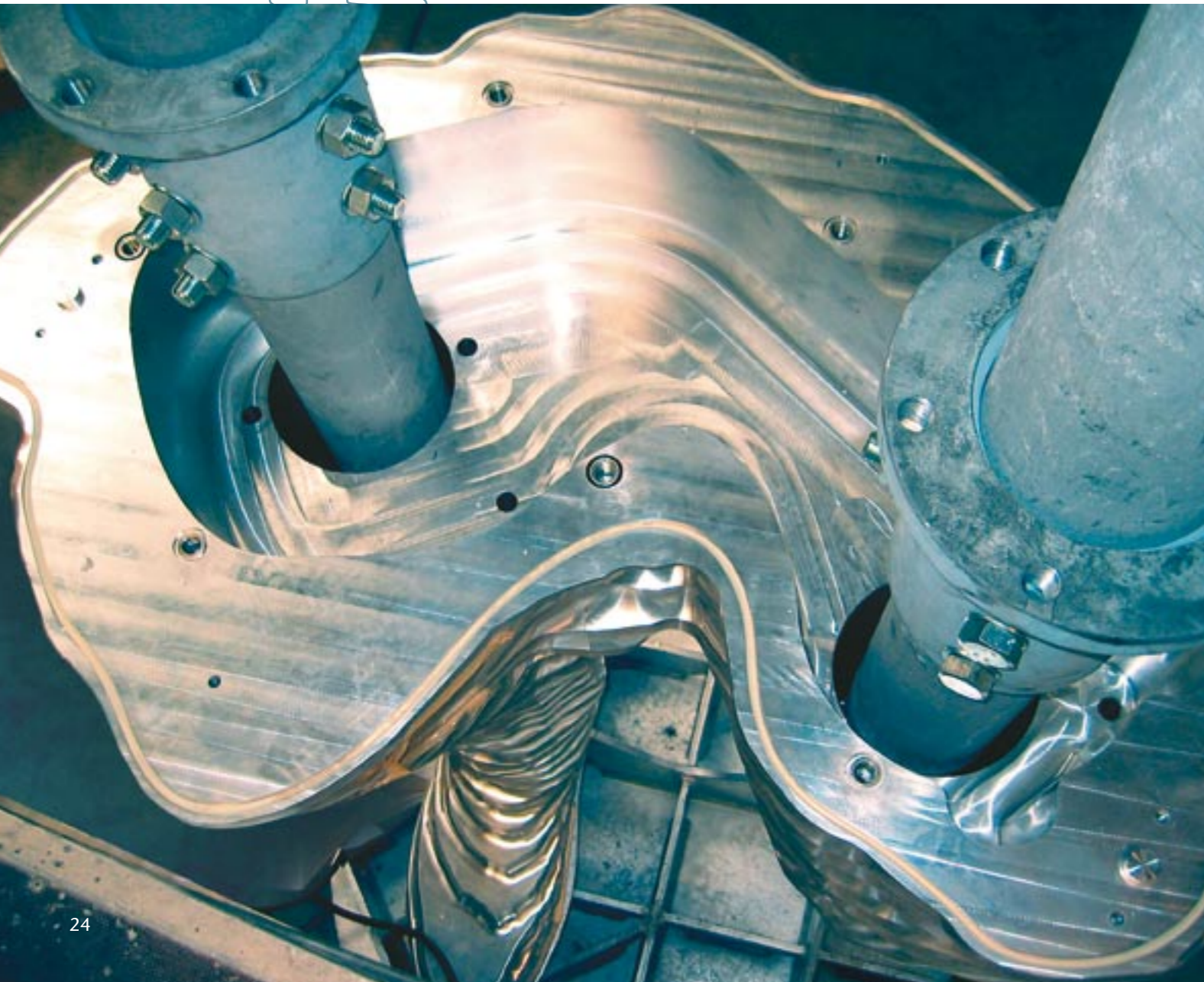
Rear seat folded down with "Feature Box".



Milling a Work of Art

Creation of a Six-metre High Aluminium Memorial for Karin Sander

Bertrandt Technikum GmbH in Ehningen and Bretzfeld worked together with the artist Karin Sander to mill an aluminium sculpture. The memorial to the former Bavarian Prime Minister Count Maximilian Joseph von Montgelas, which is six metres high and weighs 9.5 tonnes, was erected on the Promenadenplatz in Munich on 25 April 2005.



Karin Sander

Karin Sander was born in 1957 in the town of Bensberg in North Rhine-Westphalia in northern Germany. She now lives and works in Berlin and Stuttgart. In recent years, her work has been on show in a number of solo exhibitions at international museums (www.karinsander.de).

The computer-generated portrait reconstruction of the Bavarian Prime Minister Count Maximilian Joseph von Montgelas uses a combination of modern rapid prototyping and development processes at the level of both materials and technology to highlight the important role played by the enlightened reformer.



Karin Sander chose Bertrandt to support with the design and practical implementation of her concept for an aluminium statue. On the basis of an existing data structure, the engineers worked closely with the artist to optimise the exterior shell and to develop the supporting steel frame of the statue, which is made up of 15 separate segments. After this, the individual aluminium blanks, which weighed a total of 30 tonnes, were milled on 5-axis high-speed mills in Ehningen and Bretzfeld.



The finished memorial is 6.20 metres high, weighs 8 tonnes and is supported by a steel framework weighing 1.5 tonnes. One of the main challenges for the engineers and model builders was to create a uniform milled surface with invisible joins. A special insulation and sealing concept has been used to prevent the aluminium components from corroding. Karin Sander's design was the winner of a competition held by the German state of Bavaria. ■

Anja Schausser, Ehningen



Occupant Sensing



Seat positions of passengers in different sizes at a glance. Child seat recognition, oop-recognition and seat belt use recognition (from left) are used as test procedures.

Improved Airbag Systems with Occupant Sensing

In recent years, airbags have made car travel much safer. In the event of a crash, the airbag cushions inflate in a split second, but in extreme situations this can also involve risks. Bertrandt is working on new occupant recognition systems for a number of manufacturers and suppliers that will help to ensure vehicle safety even in the event of constellations deviating from the norm.

► New US guidelines

Airbags can seriously injure or even kill small children. For this reason, the US National Highway Traffic Safety Administration (NHTSA) has issued guidelines that set high standards for the electronic systems that activate airbags. For example, in future a front passenger seat occupant recognition system must be able to distinguish whether a child sitting in a child safety seat or a lightweight adult is occupying the seat.

The focus is currently on a number of systems that Bertrandt has supported to develop, test and certify for a range of OEMs and suppliers:

- Weight-based systems that adapt their performance to the passengers' biomechanical impact limit.
- Pattern detection systems that analyse the pressure profile on the seat cushion.
- Optical systems that recognize passengers using either ultrasound or infrared.
- Capacity systems that measure the strength between the seat and the vehicle body.
- Combinations of the aforementioned systems.

Occupant recognition systems can be classified into the following sub-systems.

Testing and Trials Competence Centre

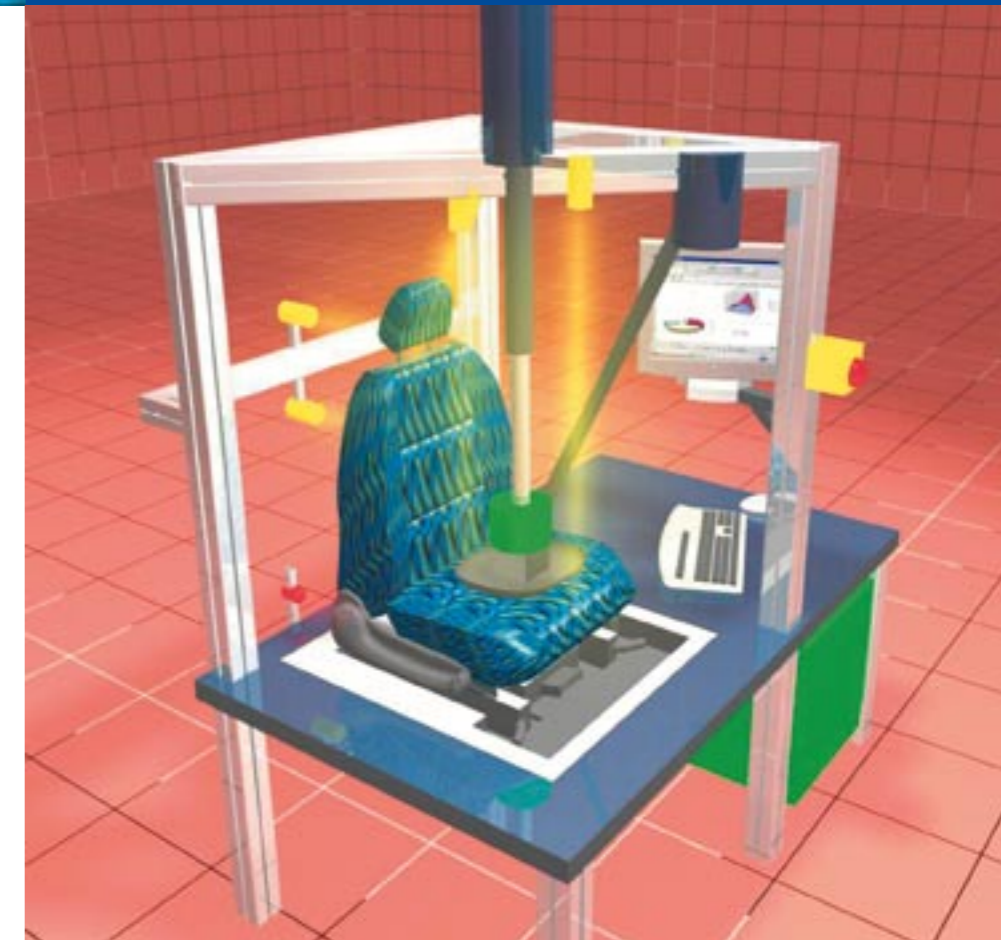
Test of child seat recognition system with a forward-facing seat. Does the system recognise the child seat?



► Out-of-position recognition
“Out-of-position” recognition aims to reduce the risk of injury to passengers sitting in unfavourable positions in relation to airbags. The system must be able to determine whether a passenger is too close to the airbag, for example when bending forward. Technical solutions using ultrasound, infrared or 3D camera systems are costly and time-consuming. In addition, the requirements to be fulfilled by these systems are highly complex, which means that reliability is demanded. An alternative approach is to reduce the out-of-position risk by modifying the

► Occupant classification

Occupant classification enables the airbag deployment to be adapted to biomechanical impact limits, as smaller passengers are at a greater risk of injury at a specific impact level. The recognition component of the system is difficult to implement, because the wide variety of human body shapes would require a large number of different sensor systems. Restricting the system to identifying only the passenger weight has limited benefits and is also difficult to put into practice, as depending on the passenger's sitting position, only an unspecified part of the body weight is absorbed by the seat cushion. Bertrandt is currently working with a number of suppliers on new approaches to classify different body sizes. One of these is a combination of weight and pattern detection. The aim is for one system to extend another that has reached its limits.



Schematic diagram of a seat test.

Occupant Sensing

airbag module itself. The idea behind this approach is to minimise the risk of injury by adapting the aggressiveness of airbags to individual passengers. Airbags that have been adapted to accommodate out-of-position passengers could help to reduce the demands on an out-of-position recognition system and therefore make it easier to implement.

Bertrandt's vehicle safety engineers are working on a solution of this type using modern measurement technology, the latest high-speed cameras and their years of experience in airbag development. As from 2005, all the FMVSS208 variants of the oop-tests carried out in

Munich and Ingolstadt will use dummies representing three-year-old and six-year old children, and the results will be carefully analysed. Bertrandt's fast response time and close proximity to the OEMs represent a major benefit in this respect.



Rear-facing child seat mounted on the passenger seat. In the USA the automatic airbag deactivation must be warranted in future.

► Child seat recognition

Child seat recognition systems are used to activate or deactivate passenger airbag modules automatically. For a rear-facing child seat mounted on the passenger seat, an active passenger airbag module would be very dangerous and for a forward-facing child seat at the very least critical. In Europe, it is allowed to manually disable passenger airbags, but in the USA human failure must be excluded. The NHTSA's requirement that child seats for small children mounted on the passenger seat must be automatically detected and the airbag disabled at the same time is very difficult to implement because of the wide variety of child seats on the market. However, as from September 2006, all new vehicles in the USA must be equipped with a system of this kind. Bertrandt, in its role as a development service provider, is about to complete a successful development and testing process involving the testing and certification of models from a number of different vehicle manufacturers for the US market.

Testing and Trials Competence Centre

► Seat belt use recognition

Systems that recognise seat belt use have not been widely used in Europe until recently, as in most European countries seat belt use is required by law. Vehicle manufacturers base their airbag system designs on the assumption that passengers are wearing seat belts. Restraint systems consisting of a combination of seat belts and airbags offer the highest possible safety levels.

However, for passengers not wearing seat belts, the restraint requirements are quite different, which means that the design of the airbag system must also be modified. In North America, as



Test bench for series monitoring in the Bertrandt seat laboratory.

well as in some Arab states and Australia, the recognition of seat belt use on the driver's seat is required by law. In the USA, where seat belts are worn less frequently than in Europe, legislation requires specific crash tests to be carried out, including those with dummies not wearing seat belts. In order to guarantee the safety of car passengers, additional measures such as knee supports and airbags that are activated at low speeds are essential. In addition, the airbags are designed to be "harder", to provide the full restraint that would otherwise come from the safety belt. This in its turn makes oop-difficulties more problematic to resolve because the airbag is activated earlier and more aggressively.

Bertrandt has undertaken to solve the seat belt use recognition problem and has developed seat belt lock endurance tests together with an OEM. The function of the sensors in the seat belt lock is regularly evaluated and break-off measures are taken in the case of failure in real-life situations.

Child seat with dummy representing one year old on the seat test bench.



► Conclusion

Occupant recognition systems and subsystems all have one factor in common: all the measurements and signals from the sensors are fed into the airbag control system and have an influence on the accident severity and the airbag performance function. Multi-stage gas generators are responsible for activating and deactivating the airbags and for determining the volume of gas released.

As an independent development service provider, Bertrandt has the necessary specialist knowledge of all the current system types as well as their strengths and weaknesses. As a result, the company has the experience and skills needed to test newly developed and modified passive safety components. Developing new components and modifying existing ones is currently focused on. These include adaptive restraint systems, optical occupant recognition systems and pre-crash sensors. The latter ensures that the different safety systems are activated in good time without direct intervention of the driver. All these systems are based on a combination of electronics, sensors and software. ■

Werner Rasch, Ingolstadt



Demonstrating Foresight

Bertrandt's presence at the world's largest car show conveys a feeling of continuity. For years the company's customer-oriented approach has been reinforced by its decentralised organisation and the close relationships to customers. It is therefore no surprise that the company's stand, in line with its strategy of maintaining close customer relationships, can be found amongst those of the manufacturers in Hall 3.1.

Welcome to the Bertrandt Engineering Network

► Bertrandt Stand A05 in Hall 3.1

► Putting a customer-oriented approach into practice

The exhibition stand is designed to facilitate communication. Visitors overwhelmed by the broad spectrum of new impressions from the show will find peace and quiet, an opportunity to relax and take things at a slower pace and time to talk. The Bertrandt stand has been based on this same concept for years.

Inside the stand, the display focuses on three themes: pedestrian safety, supporting services and 30 years Bertrandt.

► Far-sighted approach gives Bertrandt a head start

By constantly monitoring developments on the market, Bertrandt became actively involved with pedestrian safety at an early stage. The company's engineers developed virtual and real test procedures that nowadays are based on national requirements. Japanese test processes are designed for the Japanese market and the "standard American" differs from the "standard European". Bertrandt is currently one of the largest service providers in this field.

► Different tasks – different specialists

A supporting service is an interface function that is playing an increasingly important role in managing processes between OEMs and suppliers. Bertrandt engineers supervise customers' interfaces throughout the entire automotive value chain, right through to the start of production and beyond. Sometimes, the task force is called on to carry out unusual assignments and must be prepared to get on a plane at a few hours' notice. As soon as they have organised the necessary visas and special tools, the teams are ready for the journey. For example, during vehicle transfers on sea, the teams utilise the time on board ship for vehicle conversions in order to meet the customer's special requirements.

► Far-sighted continuity

Over the 30 years that Bertrandt has been in business, its vision has hardly changed. The company sees itself as a development service provider for mobility solutions. However, these solutions take a wide range of different forms. Bertrandt's automotive industry customers have been joined by new clients from the world of aviation and the company's mechanical engineering skills have been complemented by an in-depth knowledge of electronics.

In 2004, the company set up competence centres in order to provide its customers with a more individual service. One of these competence centres handles electrical and electronic systems. A pool of our competency is formed by

cash flow as well as expenditures and revenues. A further building block for reliable project execution.

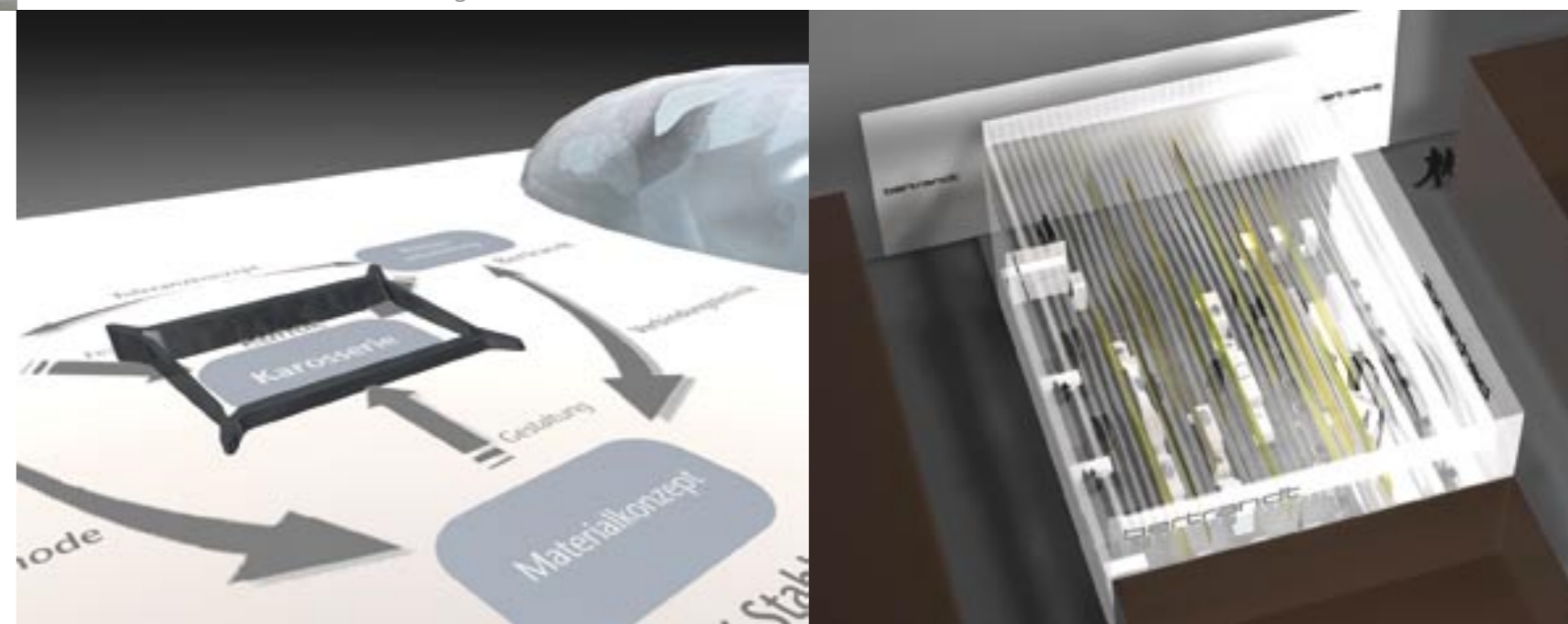
► A sense of well-being

It goes without saying that entertainment is provided for trade fair visitors. At this year's show the Swabian celebrity chef Jörg Mink delights with his trademark "Maultaschen" (Swabian ravioli). Alongside the traditional filling, he is also offering a home-made salmon version for additional variety.

Foresight: Together with its customers, Bertrandt is looking into the future at the IAA and discussing developments over the years to come. Welcome to Bertrandt's stand at the IAA. ■

Florian Gerlach

The exhibition stand is designed to facilitate communication.



our competence centres specializing in powertrain, testing and trials, supporting services, computing and simulation, body-in-white, interior and aviation. A further example of close customer relationships being put into practice is financial engineering. Thereunto, Bertrandt has joined forces with three leading banks in the "aucip. – automotive cluster investment platform GmbH & Co KG". This enables automotive manufacturers and their suppliers to synchronize



Supplier's Day in Munich ...

10 Years of Reliable Development Work

Bertrandt started out with 14 employees at each subsidiary in Munich and Wolfsburg in June 1995. The continuous business relationship building with the main local customers BMW and Volkswagen has been successful until today. An occasion to look back on: ten years together with customers and business partners.

► **Munich: Future-oriented mobility development**
Board Chairman, Dietmar Bichler welcomed numerous partners from BMW on a Supplier's Day. Exhibits and expert presentations represented Bertrandt's extensive services ranging from the development of passenger vehicles and motorcycles, model and prototype building, as well as testing services up to complete vehicle testing. Bichler

stressed that the maximum customer benefit is the focus of all activities and Bertrandt Munich will also operate as a foresighted and competent partner with its employees in future. He cited the BMW X5 Security as an example of successful project work for which the teams of both enterprises developed the safety system inter alia.

► **Wolfsburg: Bertrandt is a strong partner**

At a Customer's Day in Wolfsburg, 300 guests could be welcomed at the subsidiary. In his welcoming speech Bichler gave a short overview of the subsidiary's development. He stressed that approximately 300 employees develop innovative and individual solutions as "idea architects" on most diverse planning and development levels today. He referred to the joint development work with Volkswagen, on the VW T5 Multivan inter alia, VW Touareg and the Bentley Continental GT. Erwin Pape, Head of Product Development for VW commercial motor vehicles, praised the development of Wolfsburg from developing from being a small engineer's office to a competent development partner possessing complete vehicle competency. ■

Imre Szerdahelyi, Ehningen



... and Customer's Day in Wolfsburg.

Corporate Calendar

12.-25.09.2005	International Motor Show, Frankfurt am Main
20.-21.09.2005	Presentation: Integrated Variant Management, Düsseldorf
29.09.2005	HVB Investors Conference, Munich
06.-07.10.2005	The Role of Electronics in the Automobile, Böblingen
19.10.2005	University Contact Event: Career Day: Ulm University of Applied Sciences (FH Ulm)
25.10.2005	University Contact Event: meet@fh-darmstadt
02.11.2005	University Contact Event: HOKO: Munich University of Applied Sciences (FH München)
03.11.2005	University Contact Event: ZWIK, Westsächsische Hochschule Zwickau (FH)
03.11.2005	University Contact Event: meet@fh-wiesbaden, Rüsselsheim
05.-06.12.2005	University Contact Event: bonding-Messe Aachen (bonding fair)
15.12.2005	Annual Press Conference, Stuttgart
19.01.2006	Analysts Conference, Frankfurt am Main
14.02.2006	Report on the First Quarter of the Financial Year 2005/06
15.02.2006	Bertrandt AG Annual General Meeting, Sindelfingen

[Bertrandt in Brief]

+++ **Plastics Expertise:**

Bertrandt presented exhibits from the Rapid-Tooling range on the VDI conference on "The role of plastics in automotive manufacture" in Mannheim. A SLS smart crossblade model with the actual sizes of 1:4 as well as the sandwich side panel of the Binz funeral car. +++

+++ **Bertrandt in Sweden:**

On 9 May 2005 the subsidiary Bertrandt Sweden AB in Trollhättan celebrated its 5 year anniversary. As an engineering partner, Bertrandt offers among other things services within the range of

interior, prototype building and production related services. +++

+++ **Certification 2005:**

The certification company BVQi successfully examined the established management systems DIN EN ISO 9001:2000 as well as VDA 6.2. Also audited, was the environmental management system according to the new DIN EN ISO 14001:2005. +++

+++ **Career Platform:**

Bertrandt representatives from the ranges electric/electronics and testing provided information to students

studying engineering sciences, graduates from this field of study and professionally experienced engineers on "careers4engineers automotive" in Stuttgart and were subsequently available to give answers on questions. +++

+++ **Bertrandt Football Tournament:**

For the sixth time the internal football tournament for the Bertrandt trophy hosted by the company took place. The Holding Team won the final with 2:0 against their French colleagues J'TE KIFFE. +++

+++ **Fairs and Exhibitions:**

Bertrandt represented its service capability of its competence centres to customers and interested parties on numerous fairs and exhibitions. The company was thus present inter alia in the past months on the "Control in Sinsheim", the automobile forum and the Automotive Testing Expo in Stuttgart as well as at the automobile congress "Thuringia is worth it" in Erfurt. +++

+++ **High-ranking Visitors:**

At the Bertrandt stand Audi Board Chairman, Dr. Martin Winterkorn explained the current law regulation on pedes-

trian safety to the Bavarian Minister of Economics Dr. Otto Wiesheu on a tour through the supplier fair "Bavaria Innovativ". +++

+++ **Anniversaries and New Operating Site:**

As from 1 May 2005 Bertrandt opened a new operating site in Bremen, in order to actively support regional manufacturers and system suppliers from the automobile and aircraft industry. With the further adjustment on aviation the successful development in this specialist area is to be continued. Thus the subsidiary in Hamburg celebrates its 5th

anniversary on 1 October 2005. Today with approximately 80 employees, customers is offered a service range within development and design. +++



Portrait Roland Kirsch

This successful growth was due to the acquisition of in-depth development expertise and the constant expansion of the range of services on offer throughout the entire automotive development process chain, in accordance with the requirements of the main customer Volkswagen.

Kirsch is a team player who is very much achievement-oriented. His technical expertise and his extensive customer experience allow him to customise the services offered by the Bertrandt network to meet customers' requirements. In his role as a decision-maker, he feels that he can work with motivation and enthusiasm to ensure that he and his team achieve their shared objectives. The main secrets of his success include genuine work enjoyment and a positive approach. ■

Heidi Wolfarth, Wolfsburg

Working with Motivation and Enthusiasm towards a Common Goal!

Roland Kirsch, Technical Manager of the Bertrandt subsidiary in Wolfsburg (Tappenbeck) since 1997, joined the Bertrandt group in 1989. Under his management and with the support of his strong team, the subsidiary has grown from 30 to 300 employees.

This genuine Rhinelander was born in Rengsdorf. Having completed his training as a car mechanic, gave him a solid foundation for his future career. He has always been interested in motor sport and during his apprenticeship he often spent his free time at the Nürburgring and other racetracks working as a mechanic in the service team for a group 2 BMW 2002 TI. He was also part of a racing team for the first Renault R5 cup, which was the training ground for a number of successful racing drivers.

After years of hard work in the world of motor sport, Kirsch decided to continue his training as a bodywork and vehicle construction engineer at the car construction college in Kaiserslautern. A position at Happich Fahrzeug- und Industrieteile GmbH in Wuppertal developing cockpit modules was the start of his career in the automotive industry. After this, Kirsch worked as a technical project manager for Audi, Volvo, Ford and

DaimlerChrysler. His technical and communications skills helped to ensure the success of the projects he managed.

A project involving the development of an airbag control panel for Audi led to established contacts at Bertrandt in Ingolstadt. In 1989, Roland Kirsch joined Bertrandt as a manager. He was responsible for the development of the bodywork and interior of the Audi A4 Avant, amongst other things. Kirsch made



a significant contribution to the development of the Ingolstadt site.

In 1997, Kirsch, who has the unusual hobby of breeding sheep, moved from Bavaria to Tappenbeck in northern Germany, close to the Volkswagen headquarters in Wolfsburg. Here he made a major contribution to the growth of the site and in eight years his team grew in size from 30 people to 300.

Learn to drive ideas at Bertrandt
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Publisher:

Bertrandtmagazine is published by Bertrandt AG
Birkensee 1
D-71139 Ehningen
Phone +49 7034 656-0
Fax +49 7034 656-4100
Internet: www.bertrandt.com
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Schönaich

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