Bertrandt*magazine*

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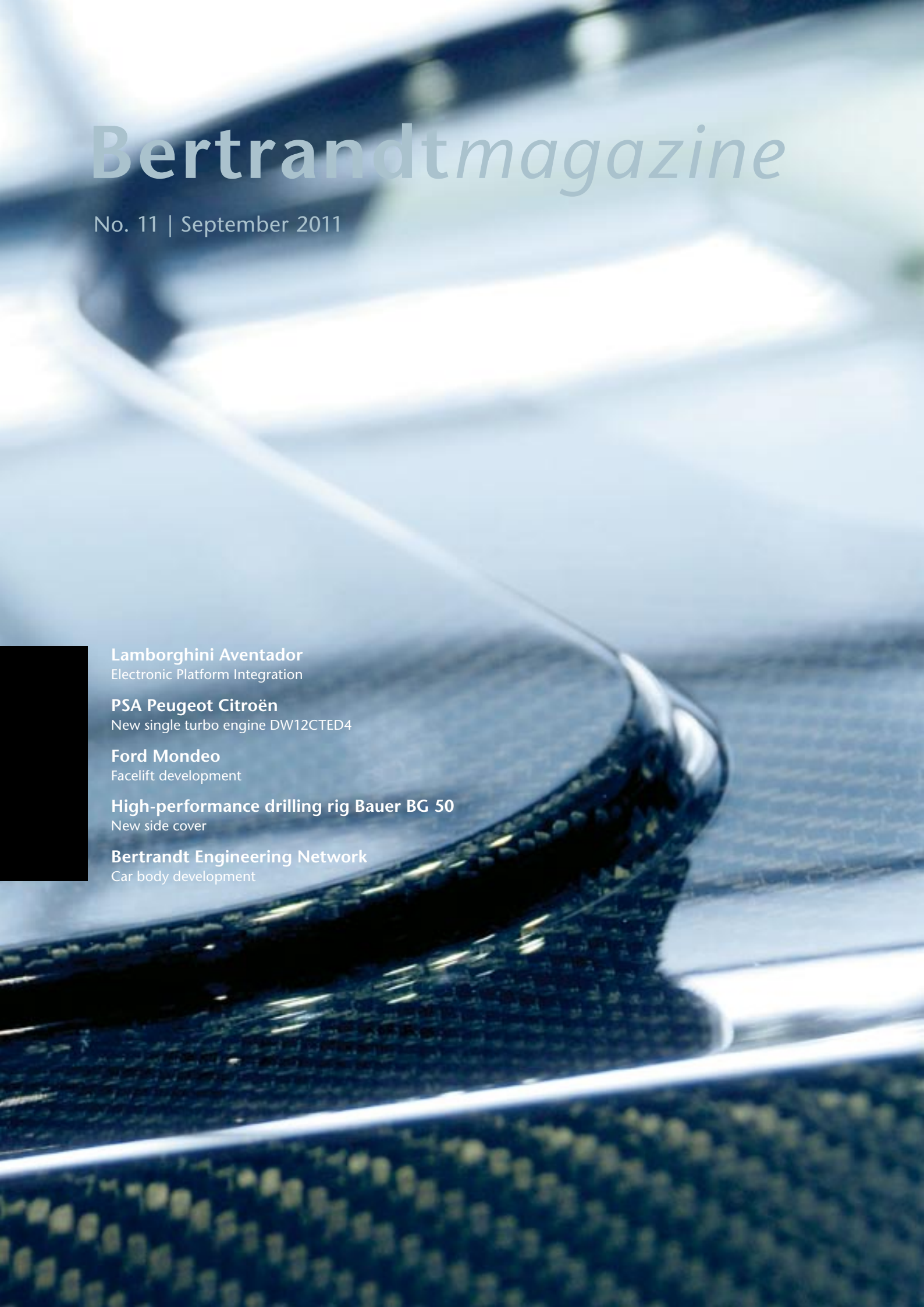

Lamborghini Aventador
Electronic Platform Integration

PSA Peugeot Citroën
New single turbo engine DW12CTED4

Ford Mondeo
Facelift development

High-performance drilling rig Bauer BG 50
New side cover

Bertrandt Engineering Network
Car body development

Masthead

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Bertrandt AG
Birkensee 1
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Phone +49 7034 656-0
Fax +49 7034 656-4100
Internet: www.bertrandt.com
E-Mail: info@bertrandt.com

Editorial Responsibility:
Anja Schauser

Editorial of this Issue:
Christine Barth, Sandra Fischer, Ute Frieß, Petra Haas, Vera Lamprecht, Elisabeth Medele, Hartmut Mezger, Angel Moran, Gudrun Remmlinger, Pascal Weiss.

Layout:
Hartmut Mezger
Bertrandt Technikum GmbH

Editorial Office:
Bertrandt AG
Anja Schauser
Phone +49 7034 656-4037
Fax +49 7034 656-4090
E-Mail: anja.schauser@de.bertrandt.com

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Editorial

The car industry is going through a period of dynamic growth, with the main market players producing a range of highly innovative and appealing new models. A total of 125 years' experience of every aspect of vehicle manufacturing is represented by a forward-looking approach to safety, comfort and environmentally friendly transport, together with an impressive selection of new vehicles.

These current industry trends are giving rise to additional requirements for development services that end-to-end service providers like Bertrandt are ideally positioned to meet. One good example of this is in the field of environmentally friendly mobility, which requires solutions that cross system and component boundaries and which will have a major influence on the overall design of future vehicles. For this reason, it will be even more important to introduce sustainable development practices across entire systems. This will make it necessary to link together specialist expertise from every area of vehicle design and its environment.

In this issue, we are offering you an insight into the comprehensive range of ongoing activities at Bertrandt using the example of our car body development Competence Center. This brings together the three main cornerstones of vehicle development: body-in-white, exterior and interior. These are complemented by light and visibility services. The department's engineers and technical specialists are responsible for identifying new ideas, creating solutions and implementing them during the process of developing the cars and aircraft of the future. Their work also involves incorporating the latest trends, such as lightweight design and new materials. Our new battery test centre will allow us to further extend our expertise in electromobility and the Bertrandt networking test centre is responsible for ensuring that electronic systems can communicate with one another. In the engineering services department, the focus is on functional safety and lean management. Bertrandt Services highlights its development activities in the field of medical technology.

With our extensive knowledge of the entire development process, we have been providing our services to manufacturers and their suppliers for many years. New requirements are opening up the opportunity for us to apply our established engineering expertise to the latest product solutions, above and beyond the development services we already offer. Bertrandt is prepared for the future and we will be continuing to offer services ranging from developing individual components to managing complex integration solutions in our body-in-white/car body, powertrain, interior and electronics departments, with support in the form of simulation, testing and prototype construction. With more than 8,000 highly qualified and motivated employees, we are looking forward to providing you, our customers, with individual services and demonstrating our competence as an engineering service provider.

Dietmar Bichler

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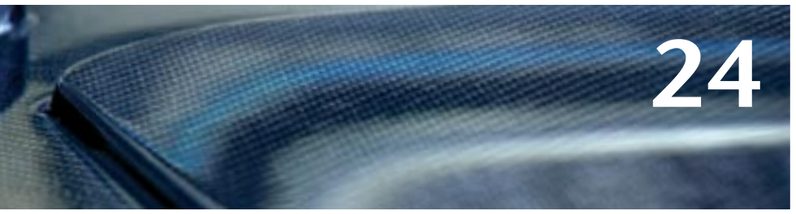

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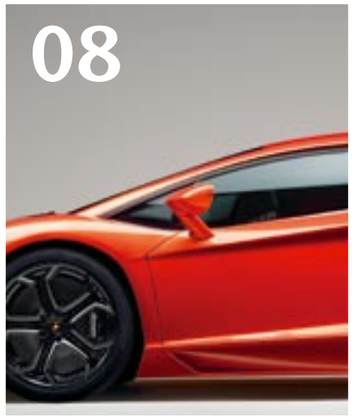
Solutions across system and component boundaries

A jump of two generations



A new single turbo engine

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Spotlight

Bertrandt Ingolstadt

FlexPLI – a new addition to testing services in pedestrian protection

Bertrandt in Gaimersheim is the first engineering service provider on the European market to install the new Flexible Pedestrian Legform Impactor or FlexPLI from Japan. The new legform impactor will be used in pedestrian protection tests to meet the future technical requirements of Global Technical Regulation (GTR) no. 9. As well as being based on the average dimensions of a human leg, the impactor is much closer to the original: wide at the top and narrow at the bottom. In addition, it has increased biofidelity, which allows a broad range of realistic accident scenarios to be recreated. Individual segments reproduce the flexibility of the bones in the upper and lower leg. Spring tensioned wires are used to model the cruciate and medial collateral ligaments in the knee joint. Because the FlexPLI has a very large number of measuring points, it enables sequences of movements during a crash to be analysed more effectively. The information can then be used in developing vehicle front ends. The test system installed at Bertrandt has seven extra measurement channels in addition to the twelve standard ones. ■

Bertrandt Wolfsburg

New painting facility and light tunnel installed in test building

The new painting facility consists of a preparation room, a painting and drying booth and a finishing room. Tasks such as grinding and filling take place in the preparation room. An extraction unit removes grinding dust from the workplace and keeps the room at low pressure. The employees access the painting and finishing areas via an airlock. Components and vehicles are painted in the painting and drying booth, which is 8.50 m long and 4.50 m wide, and then undergo the finishing process. After this, the quality of the paint is evaluated in the light tunnel. An automatic light temperature setting unit creates the perfect conditions for analysing the paint quality. ■

Bertrandt Technikum, Ehningen

Multichannel test bench systems for complex component and system testing

A hexapod test bench manufactured by Moog Inc. was acquired by the testing department in August 2010. The new test system allows rotational and translational movements to be evaluated in three-dimensional space. A modular climate chamber can also be fitted to the hydraulic simulation platform. The result is that components up to a total weight of 680 kg can be tested under climate controlled conditions in a frequency range from 1 Hz to 80 Hz. ■

Bertrandt Neckarsulm and Ingolstadt

New real-time visualisation software extends the range of 3D services

Since May 2011, the car body development department at Bertrandt has been using the VRED package developed by PI-VR for 3D real-time visualisation. VRED is a professional tool which allows high-quality illustrations to be created from CAD models quickly and realistically. Together with PI-VR, the Ingolstadt and Neckarsulm sites have established a project and training model to develop their employees' expertise. As a result, Bertrandt has been awarded recognised trainer status for VRED and can provide customers from the automotive industry and from other sectors with appropriate training and project support. ■

Bertrandt Cologne

New test chamber with additional vibration testing functions

Bertrandt has invested in a new test chamber at its Cologne site. Over an area of around 800 m², engineers and technical specialists are developing solutions for customers in the fields of environmental simulation, climate-controlled vibration testing, functional endurance tests and vehicle conversions. One particularly important new feature is the electrodynamic shaker that can be combined with a climate chamber. This is one of the most powerful of its size in Cologne and the surrounding area. The testing department now has test facilities covering a floor space of around 40,000 m² across several Bertrandt sites. ■

Hannover Messe 2011
Positive response on both exhibition stands: Electronics exhibits at the Bertrandt stand, information about future prospects at the Bertrandt Services stand.

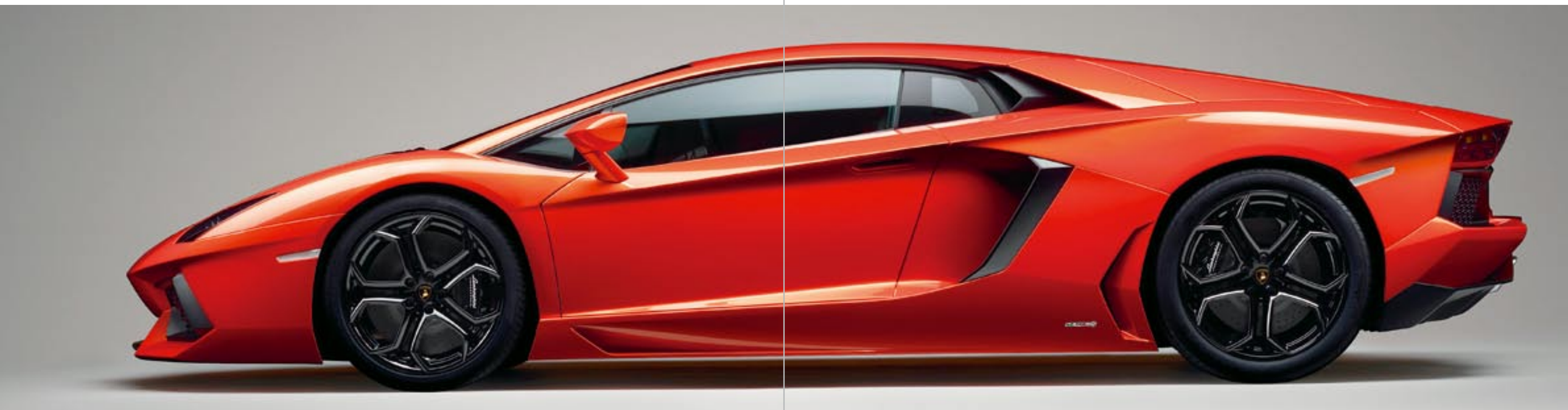
VDI congress: Plastics in Automotive Engineering
The VDI congress gave Bertrandt the chance to take part in expert discussions about the latest developments and prospects for the future. Visitors to the comprehensive exhibition were able to find out more about current trends and developments in the world of plastics.

Aircraft Interiors Expo 2011
Bertrandt took the opportunity to establish an even stronger presence in the aerospace world and to make numerous contacts at the world's leading trade fair for aircraft interior design.

BAIKA 2011
The eye-catching feature of the Bertrandt stand at the 13th BAIKA trade fair was the interior of the Audi A7, which resulted in a large number of customer contacts.

Continental award
Bertrandt was the only engineering service provider to receive the Continental Supplier Award 2010, as a result of its high level of technical competence and decentralised structure.

Lamborghini Aventador – a jump of two generations



Electronic Platform Integration

1 March 2011. The world premiere of the new Lamborghini Aventador LP 700-4. A carbon-fibre monocoque chassis, a 6.5 litre engine, 515 kw (700 hp), engine speeds of up to 8,000 rpm, 0 to 100 km/h in 2.9 seconds. Stephan Winkelmann, President and CEO of Automobili Lamborghini S. p. A., unveiled the new model at the 2011 Geneva Motor Show, describing it as "a jump of two generations in terms of design and technology". Bertrandt Ingolstadt was on board as a development partner to support the platform integration of the new supercar.

Background

A little over two-and-a-half years ago, Lamborghini commissioned Bertrandt Ingolstadt with the "LB83x Electronic Platform Integration" project. Engine size? Acceleration figures? A jump of two generations? It was an exciting project, still at a high level of abstraction, with freshly sketched ideas and initial proposals for modifying the existing electronics architecture.

Scope of the project

Bertrandt engineers were given the support for integration and validation of 40 ECUs, including the electronic peripherals. Just under half of the control units were so-called "carryover parts". At first, that may sound like a manageable amount of time and effort. But even for these parts, the modifications for a super sports car needed to be evaluated, carried out and then tested. About 30 percent of the ECUs required far-reaching modification. 20 percent were developed completely from scratch. The implementation period for the electronics was a challenging 26 months – a fairly standard development cycle in this vehicle segment.

Technical consulting

The first third of the project period focused on collecting, compressing and coordinating the technical framework conditions and the scope of the modifications required. In accordance with the idea of frontloading, it was important to support the concept development at an early stage. This enabled Bertrandt to provide rapid support for the customer in the evaluation of modification influences in functional implementation by providing reliability and risk analyses. In the further course of the project, so-called Delta performance specifications were generated. Focusing purely on the scope of the modifications required – including the necessary interface considerations – made it possible to comply with the tight schedule specified by the test management.

Test management

On the basis of the generated Delta performance specifications, the Bertrandt engineers developed the corresponding ECU test specifications. At the same time, the test strategy was also developed. The aim was to resolve issues such as

- Which testing equipment is basically available at the customer or his system suppliers?
- What test coverage is offered by the available equipment?
- How can gaps be closed?
- What testing depth does each ECU require?

Lamborghini Aventador – a jump of two generations

In brief

Electronic Platform
Integration
Lamborghini Aventador

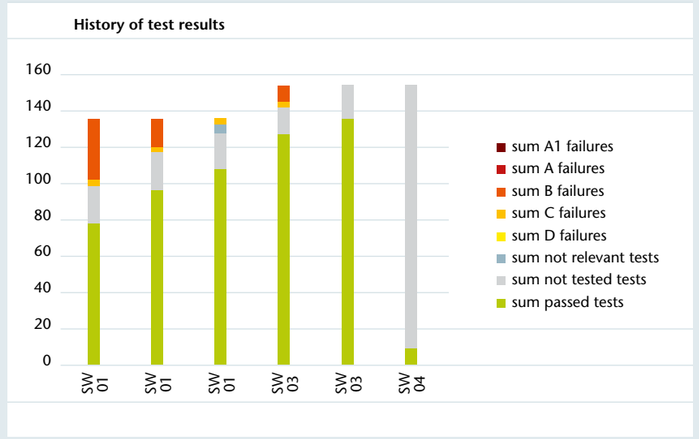
Integration management

- *ECU integration*

Function development

40 ECUs:

- *New development*
- *Adaptation*
- *Validation*



History of the test results according to different software versions.

Efficient project management as a success factor in complex projects.

Each of these questions has two dimensions. Firstly, the aim is to achieve optimum fulfilment of the technical requirements. Secondly, organisational and budgetary issues need to be resolved. Which availability periods are appropriate for which software delivery? What does a test cycle with the corresponding testing depth cost? Finally, the project team generated a decision matrix that took both dimensions into consideration and which served as a decision-making basis for the customer.

Operative testing

While it was largely possible to use various, already available testing equipment for carryover parts and control units that required a deep modification intervention, the new control units required completely different solutions. Bertrandt was therefore asked to develop a modular, future-proof test stand and to carry out the networking tests required.

The test stand was built within a period of 16 weeks and was designed for sequential testing. The networking tests were carried out on the basis of an operator model. Initialised by the integration project, this test stand now provides an additional testing facility for Audi.

External success factors

Since Bertrandt is deeply rooted in the customer's development landscape, the team was able to install a special communication structure for the Aventador project, which it called the Bertrandt Expert Network. One of the advantages was that almost 80 employees were involved in the project-relevant architecture. More than three quarters of all technical challenges were directly resolved by Bertrandt.

Internal success factors

The last Bertrandt*magazine* already reported in detail on the comprehensive internal project management and process know-how, such as the project management toolbox or the web-based LOP system (LOP = list of all open points). In cooperation with Bertrandt Projektgesellschaft, Bertrandt Ingolstadt already established a suitable process framework in the initialisation phase. This enabled the team to concentrate very quickly on its core technical tasks. Supported by a project-internal Continuous Improvement Process (CIP) and Lessons Learned workshops on the various phase completions, the customer was presented with high process quality at all times.

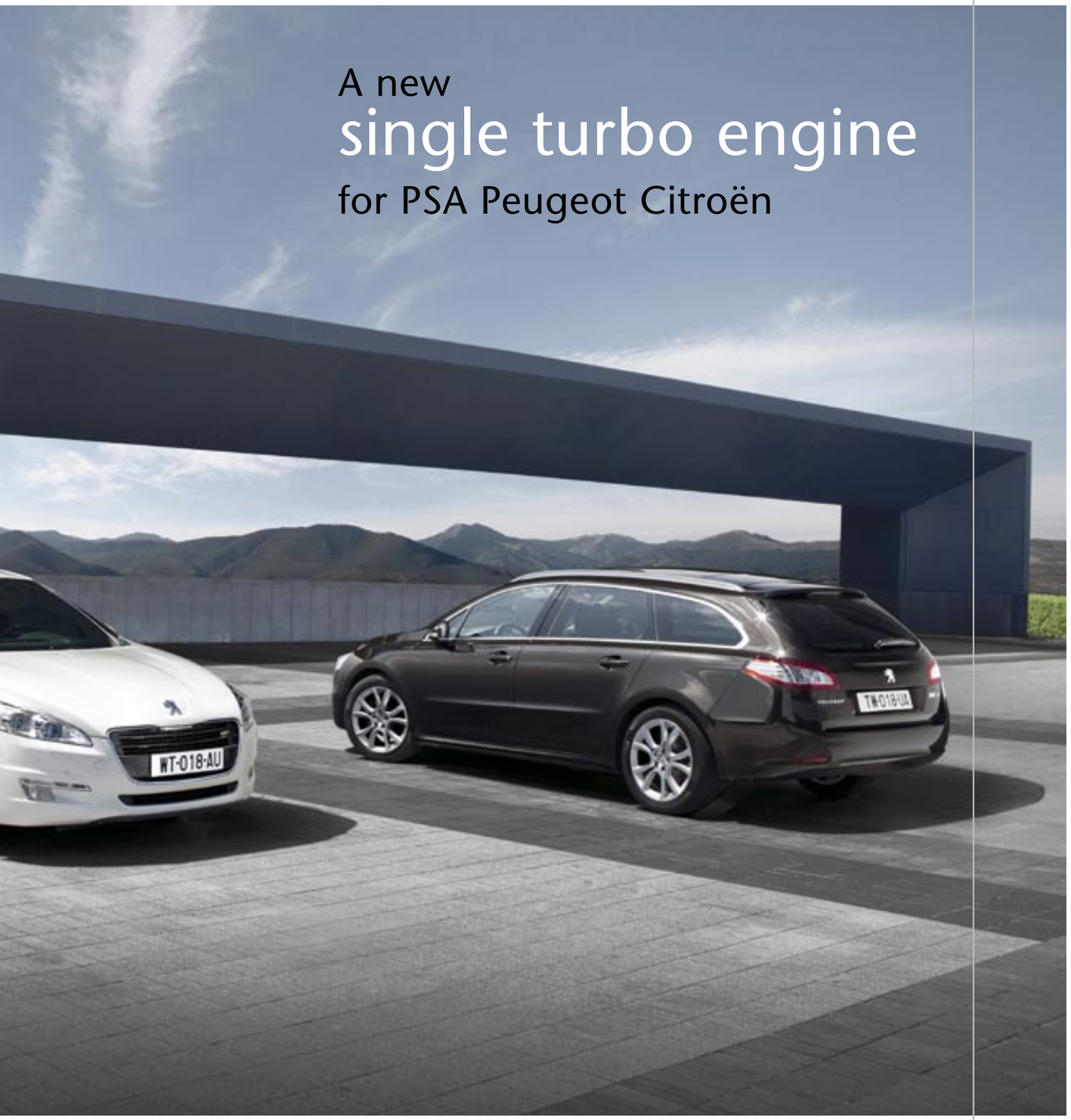
Joint RASID forms the basis for follow-up project

Following on from the internal Lessons Learned, three workshops were carried out jointly with Lamborghini at the end of the project. The project team considered the different project phases with regard to technology transparency, communication and process structures. This workshop resulted in a so-called RASID (R=Responsible, A=Approval, S=Support, I=Information, D=Doing), a defined performance agreement for future cooperation between Lamborghini and development partners.

On the basis of this RASID, Bertrandt was awarded another very interesting electronic integration project. The successful cooperation can be continued, and the mutual trust, the joint product and process understanding and the various success factors can be taken over into future project work. ■

Michael Jarnik, Ingolstadt

A new single turbo engine for PSA Peugeot Citroën



PSA Peugeot Citroën commissioned Bertrandt in France to develop all the mechanical components for its new DW12CTED4 engine. This 2.2 litre HDI engine with a single turbocharger produces 200 bhp, which makes it one of the manufacturer's top-of-the-range models. At the same time, it meets the new Euro 5 emissions standard. We look back over all the stages of this exciting project.

How it all began

Right from the very beginning, it was clear that this project represented something completely new. For the first time, PSA Peugeot Citroën had decided to outsource the entire development and design process for the mechanical components of its new DW12CTED4 engine. The company chose Bertrandt to take responsibility for these challenging tasks. The goals of the project were ambitious: to design a single turbo engine, based on the twin turbo DW12BTED4, with improved performance and reduced fuel consumption that complies with the Euro 5 standard. PSA Peugeot Citroën plans to use the new engine in the 508 GT and the C5, but also in the Land Rover Freelander and the Jaguar XF250. For this reason, it had to produce 200 bhp. In addition, three variants of the engine had to be developed to meet the specific requirements of the four different brands: Peugeot, Citroën, Land Rover and Jaguar.

Complete component development

The team of Bertrandt component specialists and design engineers worked on the project from May 2007 to the end of June 2010. On the basis of PSA Peugeot Citroën's functional concepts, they designed and developed the mechanical components of the engine which was to be the successor to the now discontinued DW12BTED4. The component specialists were responsible for the entire process of developing the parts: architecture, simulation, testing, costing and quality management. In addition, they had to meet all the specified criteria and ensure that the components reached production readiness on schedule. Furthermore, the components had to be designed for ease of assembly and manufacture. Other tasks which the design engineers took responsibility for included the design itself, the 3D plans, the calculation of the chain dimensioning and support for subcontractors who provided feedback on the parts.

The DW12CTED4

A single turbo engine with the performance of a twin turbo

The Bertrandt engineers fitted the new water-cooled engine with a single lightweight turbocharger to ensure that its performance was equivalent to that of the DW12BTED4 twin turbo model. Subsequently, the exhaust manifold and turbo mountings were also redesigned to give the DW12CTED4 a new generation exhaust manifold. In order to avoid modifying the exhaust system as a whole, all the interfaces to the system were retained. After the design process had been completed, the package was created to enable the turbo to be fitted into the vehicle. As a result, the surrounding components, which included the turbo shield, the oil inlet and outlet pipes, the water feed, the coolant hoses and the manifold gasket, had to be modified for all three engine variants.

EGR module: highly efficient cooling

The combustion mechanisms were improved in order to ensure that the exhaust gas treatment process was as efficient as possible. The team at Bertrandt France focused closely on all the elements of the exhaust system, including the exhaust valves, the manifold and the exhaust turbo itself.

The exhaust gas recirculation (EGR) module captures and cools a part of the exhaust gas and returns it to the combustion chamber. This is an essential element in the process of reducing the engine's raw emissions. In collaboration with specialists from PSA Peugeot Citroën and the subcontractor, the Bertrandt team designed a highly efficient cooling system. A great deal of work was put into implementing the system. First of all, the components of the exhaust gas supply, recirculation and cooling systems were designed, together with the mountings. Defining the architecture of the modules and choosing between a U-shaped or an I-shaped exhaust gas circuit in the heat exchanger presented further challenges. Ultimately, the U-shaped circuit was chosen, because it was the only solution that complied with all the functional and dimensional criteria. This design process took around six months. Finally, two EGR models based on two completely different concepts were designed to meet the differing requirements of the various vehicles: one for PSA Peugeot Citroën and Ford and another for Jaguar and Land Rover.

Crankshaft drive system: reducing energy losses and noise

The crankshaft, con rods and pistons are moving parts which make up the crankshaft drive system. The addition of a more powerful turbocharger necessitated the expectation of higher stresses being imposed on this system. With the aim of cutting CO_2 emissions and fuel consumption, the component segmenting was improved in order to reduce the mechanical friction losses in the crankshaft drive system.

The torsional vibration damper was used to compensate for the changes in the inertial forces on the shaft assembly. The damper functions as an adjuster for the active inertial forces. Noise was transmitted through the end of the crankshaft in the previous version of the engine. Because the new engine is a premium model, the engineers at Bertrandt France decided to develop a special acoustic damping plug to resolve this problem. Incorporating the additional damping component presented challenges with regard to the process flow, because it was essential that it could be fitted easily.

Acoustic gains in the control system

As part of the process of developing the engine, the Bertrandt team also focused heavily on reducing the noise produced by the drive elements in the control units and the oil pump. The Bertrandt engineers were able to make use of the experience that they had gained from a previous engine and transfer it to the DWC12CTED4. In order to reduce the noise created by the belt drive, the design of the housing and the seals in the system were improved. In addition, the position of the oil pump was changed to make more space available for the cam chain. ■

Patrick Facelina, Pierre Lecat, Angel Moran, Bièvres

In brief

Development of the DWC12CTED4 engine

Drive system

Entire development for the mechanical components:

- *Injection*
- *Exhaust system*
- *Emissions*
- *Crankshaft drive*
- *Control system*

Supporting Services

- *Quality Management*
- *Supply Chain Management*

The new Ford Mondeo – modern, progressive design

Ford has given its flagship model, the Mondeo, a facelift that includes attractive new styling, a redesigned interior, new high-performance engines and a variety of innovative comfort and driver assistance systems. Bertrandt Cologne provided a wide range of development services for the new version of the Mondeo.

Bertrandt Cologne supports the Mondeo facelift project

Development partner with comprehensive expertise

The Bertrandt site in Cologne developed several components for the European and Asian markets as part of the Ford Mondeo facelift project. The focus was on the car body development department (exterior, interior, doors and closures) and the electronics development department.
The services provided by Bertrandt included design modelling, creating external surfaces, virtual CAD development of components and accompanying simulations, together with documentation, electrical testing and preproduction car conversions. In addition, Bertrandt engineers were responsible for the project management and supplier coordination. This is where the close partnership and cooperation with the technical departments at Ford really paid off. Another advantage was the proximity of Bertrandt Cologne to the Ford development site, which enabled the team to meet the customer's requirements quickly and efficiently.

Product development in Bertrandt's technical departments

Exterior/Doors and closures

The Ford kinetic Design is highlighted by the elegant styling of the front and rear of the car and, in particular, by the new lower radiator grille with a trapezoid shape, a delicately structured air inlet on the upper radiator grille and a revised bonnet profile. The new front apron with integral LED daytime running lights completes the picture. A variable cold air inlet controls the flow of air through the radiator to the engine electronically, in order to shorten the engine's warm-up period.
At the rear of the car, the apron, LED rear lights and boot lid have also been redesigned. Chrome side window surrounds underline the new Mondeo's high-quality finish.

Interior

The eye-catching features of the new interior include a modified instrument panel and centre console. The satin chrome surrounds of the air vents and the new interior door panels enhance the avant-garde interior styling. The overhead console has been subtly modified and includes an integral ambient LED lighting fixture. The seat upholstery has been redesigned to match the new interior colour schemes and complement the premium appearance of the new model. New LED interior lights add the finishing touches.

Electronics

The purpose of the Mondeo's innovative driver assistance systems is to improve safety levels for the vehicle occupants. They include a lane departure warning with driver alert system to protect drowsy drivers and a high-beam assistant which consists of a highly sensitive camera mounted on the windscreen. Additional safety features developed by the Bertrandt engineers in collaboration with systems suppliers are a blind spot assistant, speed limiter, electric child safety locks and on-glass antenna.

Project management and supplier coordination

The job of the Bertrandt project management team included managing and coordinating the system suppliers and reporting on project progress to the customer. The team was also responsible for adhering to the schedule and meeting the quality requirements in the customer's development plan.

Summary

Around 70 Bertrandt engineers responsible for development, data management, quality management, approvals, change management and testing brought the project to a successful conclusion. It was another important milestone for Bertrandt in Cologne which covered the entire portfolio of development services. We are encouraged by the positive feedback from the customer and proud to have contributed to Ford's European flagship model. ■

Kay Schrader, Cologne

In brief

Ford Mondeo facelift

Exterior
- *Developing front and rear apron, upper and lower radiator grille, daytime running lights, variable cold air inlet, chrome window surrounds*

Doors and closures
- *Developing the bonnet and boot lid*

Interior
- *Developing the modified instrument panel and centre console, roof liner, B-pillar trims, overhead console, interior lights, interior door panels, seat upholstery*

Electronics
- *Integrating the lane departure warning system, high-beam assistant, blind spot assist, speed limiter, electric child safety locks, on-glass antenna*

Prototype construction
- *Converting preproduction cars*

Ford Econo Check

Using an OBD data logger, known as the Ford Econo Stick, it is possible to analyse a customer's driving style and provide tips on fuel-efficient driving. Bertrandt Cologne supported Ford during the entire planning and development phase and the production process. The engineers' objectives were to provide quality assurance services and to reduce the impact of car travel on the environment.

From the concept through to the finished product

Driving style can be measured

Bertrandt's services covered the entire process chain from the concept through to the finished manufactured product, including related functions, for the Ford Econo Stick, a mobile data logger. Using the Econo Stick, Ford's Econo Check program can analyse a customer's driving style over a period of a week via the OBD2 interface. Information such as the vehicle speed, the engine speed and other relevant vehicle data is recorded. Subsequently the driver is sent a report by e-mail which lists his or her positive and negative driving behaviours in an easy-to-understand form. In addition, the report gives helpful tips on fuel-efficient driving which are directly related to the driver's driving style and the potential annual savings in litres of fuel, euros and kilos of CO_2. The aim of the Econo Check program is to explain to the driver about his or her driving style, to encourage fuel-efficient driving and, therefore, to make a significant contribution to reducing the car's environmental impact. In addition, the statistical evaluation of all the driving data provides information for the quality assurance, development and marketing departments, which results in added value for all car buyers.

Development and production services from one provider

The interdisciplinary expertise of the Bertrandt engineers proved to be a valuable resource during the entire planning, development and production phase. The process chain was coordinated by Bertrandt project managers. The hardware and software was developed by electronics specialists at Bertrand Cologne, while the ergonomic housing was designed by the design engineering department. Bertrandt also took responsibility for manufacturing individual components in collaboration with its established partners. The Bertrandt team remained in constant contact with the customer and with the other suppliers in order to ensure that the project ran as smoothly as possible and to keep everyone up-to-date on the latest progress.

On the basis of the V model, Bertrandt Cologne developed a rough concept during the system specification phase which was fine-tuned following the subsequent feasibility study and marketing analysis. The requirements analysts investigated 40 vehicle models with a wide range of different engines in order to identify their special features. On-site specialists were responsible for handling risk management, legal issues and patent research.

After this the specifications for the technical aspects of the system were drawn up and converted by systems architects into an overall structure. Both the hardware and software aspects of the project went through the specification, architecture and implementation phases. During the software integration and hardware installation stages, the engineers brought the two strands of development together. The software and hardware were tested separately and as a complete system. One important feature was the successfully completed certification process, together with CE and E13 approval and the temperature, drop and vibration tests based on standards procedures.

Bertrandt also took responsibility for coordinating the production of several thousand units on the basis of the customer's requirements. These were delivered on time throughout Europe. During and after the production process, the Bertrandt developers provided support for the customer on all the technical and organisational issues. In addition, constructive feedback from field trials was incorporated into subsequent software releases.

Identifying further potential savings

On the basis of the successful collaboration, Bertrandt was awarded additional projects to extend the Econo Check concept. Additions were made to the original range of functions of the Econo Stick and to the analysis algorithms needed for the evaluation. In addition, further applications for the Econo Stick were identified. For example, Bertrandt Cologne developed the next stage of the product, which will offer additional features, as part of an innovation project. ■

Robert Rembold, Cologne

In brief

Ford Econo Check

Electronics
- *Rough concept*
- *Feasibility study including market analysis*
- *Hardware and software development*
- *Integration into the overall architecture*
- *Testing*

Engineering Services
- *Project management*
- *Preparation for and implementation of the certification process*
- *Production together with partners*

Find out how easy it can be to reduce fuel consumption with the new Ford Econo Check. An animated film shows car drivers how they can change their driving style to achieve the best possible fuel economy. On the basis of a thorough analysis of the driver's style using the Ford Econo Stick, Ford produces a personal Ford Econo Check report.

Pandora

With the new automotive version of the Pandora® app, MINI drivers in the US can now enjoy having their personal DJ with them in their car, without the need for a distracting tangle of cables. A member of the Bertrandt team in the US provided support for BMW North America during the process of testing the smart phone app.

Bertrandt US supports the testing of the personalised radio app

Safe and easy to use

The web-based smart phone app can now broadcast personalised "radio stations" via the existing infotainment system in vehicles equipped with MINI Connected. The app can be operated centrally using the vehicle's joystick and high-resolution display, so there is no need to touch the phone once the app is running. This allows new radio stations to be "created" at the press of a button, without drivers needing to take their eyes off the road.

MINI Connected technology

A fundamental requirement for the implementation of the smart phone app is MINI Connected technology, which enables apps to be developed for the Apple iPhone that can be seamlessly integrated into the vehicle's infotainment system. The major benefits of this are the further development options that it makes available. Until now, it has been difficult to install additional software functions in the infotainment system after the car has been delivered to the customer. The new technology allows the content and functions of any MINI Connected Approved iPhone app to be displayed and used on the infotainment system.

Prospects for the future

Tim Westergren, creator of the Pandora® personalised radio, is predicting a bright future for his music software. In 2010, Pandora acquired 35 million additional listeners as a result of the iPhone app, which is now the second most popular download. Incorporating the software into the MINI's existing menu structure makes the app safer and easier to use.

Bertrandt US at the cutting edge

Bertrandt US was responsible for coordinating the testing of the software with MINI plants, function managers and test sites throughout the world. The collaboration between all these organisations helped to ensure the high quality of the app. From January 2011 onwards, MINI customers in the US who have MINI Connected can listen free of charge to personalised radio stations designed to suit their individual taste. ■

Christine Barth, Detroit

In brief

BMW MINI

Supporting Services

- *Launch Support*
- *Quality Management*

From the concept to the trade fair

The closures team at the Technikum in Ehningen became involved in the exciting world of construction machinery. On behalf of one of the world leaders in specialist foundation engineering machinery, the Bauer Maschinen group, the Bertrandt engineers developed a side cover for one of the company's flagship products: the BG 50, a rotary drilling rig which produces around 500 kNm of torque.

High-performance drilling rig with a new side cover

New safety requirements

The project was launched at a joint kick-off meeting in Schrobenhausen in November 2009 during which the main content of the project was defined. A new design for the side cover was needed because of the stricter safety regulations for construction machinery which require a gangway with a railing. For this reason, the existing top-mounted side cover could no longer be used. The new concept also had to fit into the very restricted space available. Furthermore, the BG 50 with the new side cover was to be the highlight of Bauer's presence at the "bauma 2010" exhibition.

Design and solution

Firstly a range of different opening systems was developed in order to ensure that the side cover could be opened easily and ergonomically without obstructing the narrow gangway during maintenance. With the support of the technical product designers, twelve different opening mechanisms were created and visualised. Three solutions were then selected on the basis of the predefined evaluation criteria. Rough concepts for these three solutions were produced during the next phase of the project and, at the same time, important information for the evaluation process was gathered, including cost estimates, operating force and ergonomic design. The resulting data enabled Bauer Maschinen GmbH to make the final choice of the new concept just before Christmas. The concept selected was the foldable sliding door.

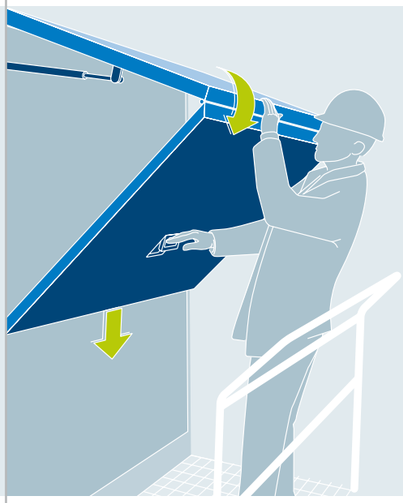
As well as the design activities, the project also involved simulating different load cases. As part of the function development process and with the help of the simulation department, the gas springs needed to open and close the cover, the hinges and the seals were designed. The results of the static load cases were incorporated into the existing data and used to fine-tune the design. In addition, tests were carried out to ensure that maintenance work could be completed with the cover open at wind speeds of up to 100 km/h.

The Bertrandt engineers also produced and tested a partial structure made from wood to validate the ergonomic design and the functionality of the concept in practice. As part of this process, the team identified the lock position which would make the cover easy to open. The last design task involved adapting the concept to the module manufacturer's production line, taking into account the assembly sequence.

Prototype presentation

After the first side cover had been manufactured and installed in the side frame, it was taken to the plant. The need for one further improvement was identified in order to prevent the user's fingers from becoming trapped between the two halves of the cover when opening and closing it. Finally, the new fully functioning cover was fitted to the exhibition rig and prepared for transport to the exhibition.

Four weeks later, the Bertrandt team visited "bauma 2010" to see the side cover in action. After being unlocked, the cover opened automatically as intended and could be closed using relatively little force.



In brief

BG 50 side cover development

Development of closures
- *Concept creation*
- *Functional development of gas springs, hinges and seals*

Simulation
- *Simulation of different load cases*

Component testing
- *Testing the functionality of the partial wooden structure*

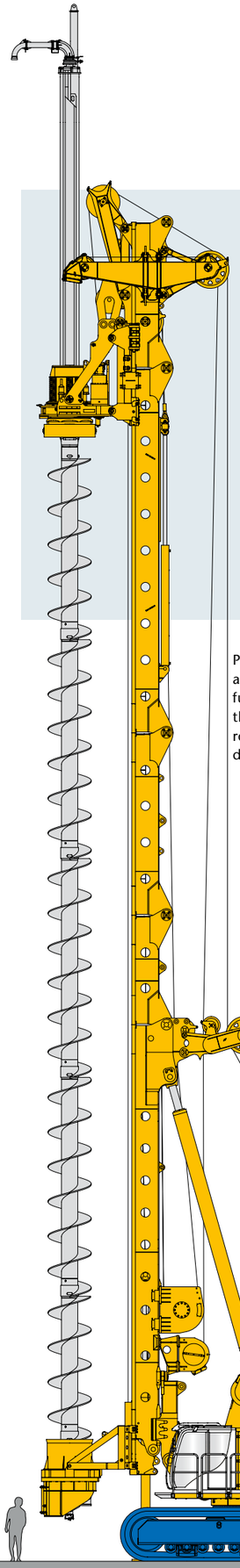
Production planning
- *Coordinating the assembly sequence*

Summary

The project was very interesting, but also presented a major challenge, as the cover had to be developed in a very short time, from the concept stage right through to its presentation at the exhibition. Incorporating all the customer's requirements while taking into consideration the small installation space and the tight deadlines was a particularly demanding task. The success of the project was due in part to very close coordination with the customer.

The construction machinery industry represents an interesting business area for the development services department which offers further potential for growth. The requirements specified for the development process relate not only to the functionality of the machine, but also to the ease of use and design of the component, which play an important role. It is essential to take into account the fact that, in contrast to the automotive industry, the development process is much shorter and that many decisions must be taken on a practical basis. ■

Miriam Hoffmann, Daniel Nunes, Ehningen

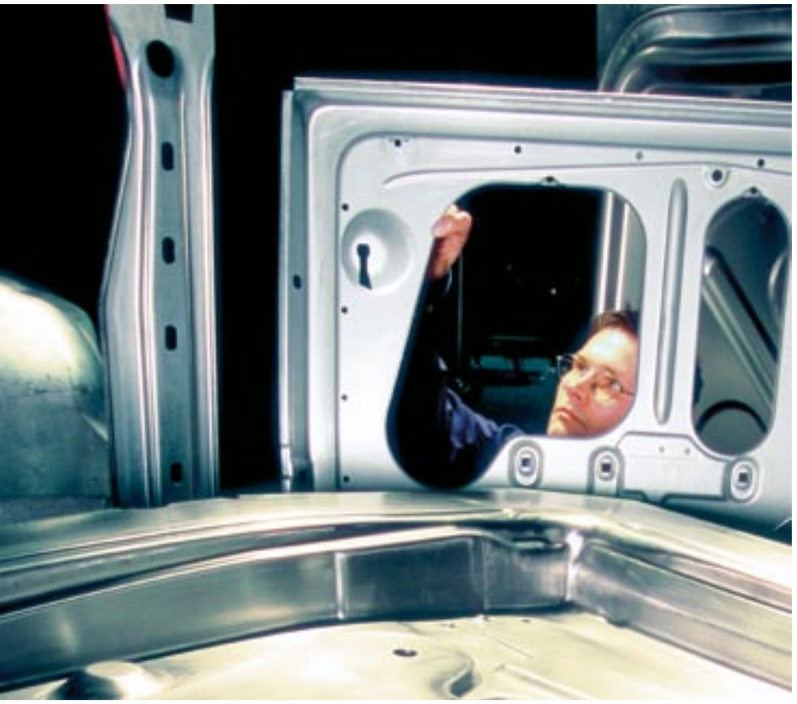


Powerful and multi-functional: the BG 50 rotary drilling rig.

Car body development

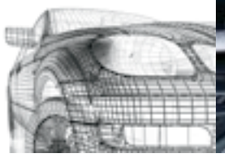
Solutions across system and component boundaries

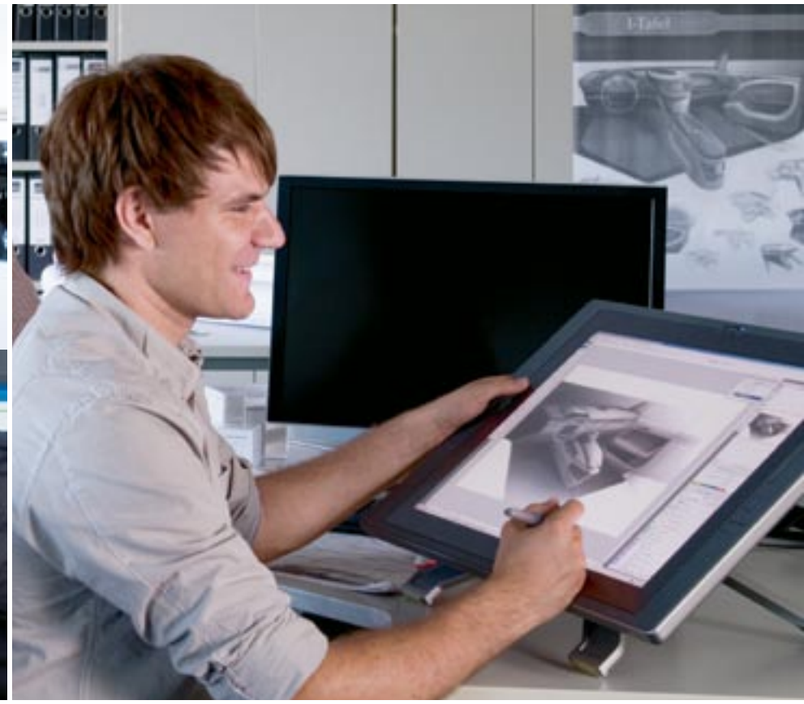
The roots of Bertrandt's car body development Competence Center lie in the classic body-in-white development process. The Competence Center's broad and in-depth range of services is based on the three main cornerstones of vehicle development: body-in-white, exterior and interior. It provides the ideal support for customers by offering expert solutions at an early stage in the process in areas such as future CO_2 emission limits, weight savings in modern cars or aircraft, materials, including fibre composites, high-strength steels and aluminium, and the latest developments in lighting and visibility.



Service portfolio of the car body development Competence Center

There is close collaboration in the body department, with effective networking between the body-in-white, exterior and interior teams. Special teams bring together experience and knowledge to develop new technologies with a customer focus.





Networking for future development

Networking represents an important success factor in modern automotive and aerospace development, where manufacturers and service providers have to come to terms quickly and efficiently with new subject areas. Bertrandt's decentralised structure offers many opportunities to share knowledge about new areas relating to bodywork and interior development and to develop solutions that cross system and component boundaries.

Body-in-white

The engineers and technical specialists are involved in projects to develop components such as front-end and rear-end structures, cabs and ladder frames. Bertrandt has many years' experience of the body-in-white development process from design through to volume production for all types of vehicles, including commercial vehicles, saloons, sports cars, SUVs and special vehicles with armour.

Doors and closures

This team works in areas such as door shells, shells for closures and lids, seal systems, kinematics and pedestrian protection. The teams' approach to the complexities of doors involves close interaction between structural design, simulation and testing. Experience of a variety of materials, kinematic requirements, integrating systems suppliers and managing the interfaces to simulation and testing enables the team to develop functions which meet customers' specifications.

Exterior

The focus is on front-end and rear-end structures, underfloor applications and systems integration. Bertrandt acts as an efficient development partner and systems integrator by coordinating systems suppliers and managing processes in such a way that all the necessary functions are provided, for example in the development and integration of front and rear modules. Supplier and interface management, together with comprehensive resources in the fields of simulation and testing, are an integral part of the services available.

Light and visibility

The important thing is to see and be seen! In the fields of windows, trim, light simulation and concept development, Bertrandt develops cost-effective, design-oriented solutions for exteriors and interiors which comply with the relevant legislation, meet demanding lighting standards and incorporate the latest technologies. Challenging lighting simulations represent only one facet of the team's work.

Dimensional management

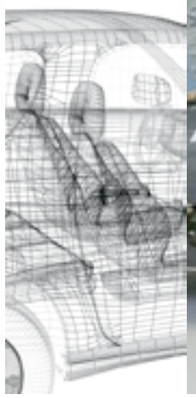
Tolerance management involves optimising the development process in terms of both production costs and quality and includes geometric dimensioning and tolerancing, fixtures concepts, operational dimensions, tolerance chains and 3D simulation. The earlier in the development process the team begins its work, the greater the potential benefits for the customer.

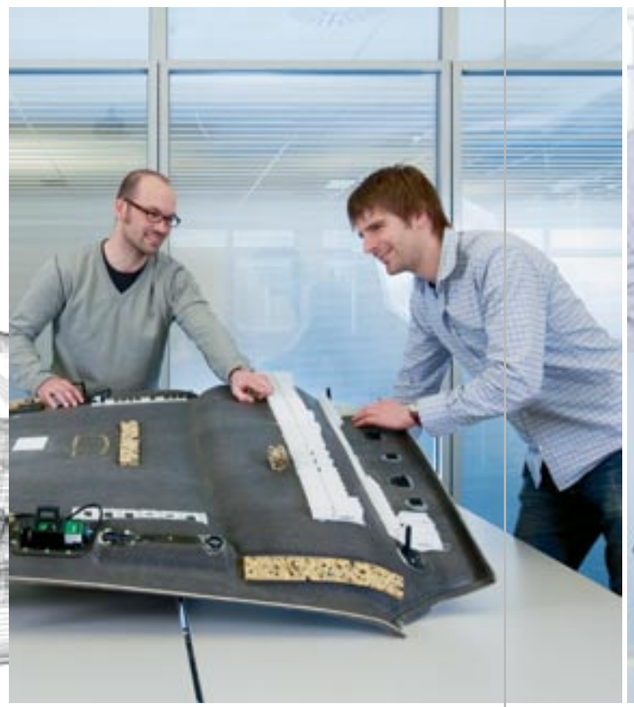
Design services

A successful design represents the emotional connection between form and function. The members of the design services team provide support for customers right at the start of the product development process during the design identification stage using various virtuel tools. A variety of working methods and materials are used in design development to produce tangible, 3D versions of ideas.

Interior

The design of vehicle interiors has an increasing influence on end customers' buying decisions and their expectations of comfort levels are constantly growing. As a result, car manufacturers are using design elements and surface textures as important differentiating features in vehicle interiors. In the aircraft industry each individual plane may have its own cabin design. The focus in interior design is on ergonomics, comfort and functionality. Complex components and modules, such as the dashboard or seat units, are developed and thoroughly tested by the engineering functions within Bertrandt. In the interior, design is based on the interaction of form, safety, ergonomics and functionality and drivers' and passengers' requirements and expectations in these areas are becoming increasingly complex. For example, the seat of the future must be suitable for all global markets and accommodate people of different sizes, without significant changes being needed to the seat structure. The focus in this area will be on a modular approach, cost and weight. As long ago as 2003, the Bertrandt Ergoseat family with its concepts and features highlighted solutions that would meet future seat requirements. By constantly developing their expertise in the field of seats, the Bertrandt engineers and technical specialists will remain on an equal footing with systems suppliers and OEMs – for example with the latest member of the Ergoseat family "Ergoseat Evolution".





New FRP training course

There is a long history of fibre-reinforced plastic (FRP) design at Bertrandt which has its roots in aircraft development. For some years Bertrandt engineers have been using their expertise in this area in the automotive world and developing it further. As part of a network with aircraft specialists from the Hamburg site, the engineers have already completed the first projects for customers from the international car industry. Because of the growing demand for expertise in this area, the car body development department has produced its own training course entitled “FRP for the automotive industry” which has proved to be a great success with customers and employees. The first two days of the course involve studying sample designs and acquiring knowledge of processes and materials from the cooperation with system suppliers. On the third day, course participants create a component themselves. The training course is an important building block for the future progress of lightweight design projects.

For further information please contact Michael Hage.

Complete seat

Working on customer projects, these teams introduce continuous improvements to design, comfort, ergonomics, functionality and active and passive safety. During the process, they often have to develop completely new working methods and approaches, as in the case of the in-house Ergoseat concept. The engineers have comprehensive experience of individual areas, such as seat structure and mechanics, foam, panels, components, upholstery and restraint systems, as well as of overall function and module development.

Cockpit

The cockpit presents a variety of challenges for developers, including functionality, manufacturing feasibility, ergonomics and safety. As it is always essential to make the best possible use of the available installation space, digital and physical mock-ups and prototyping are important components of the development process. The engineers and technical specialists work together with manufacturers and suppliers to plan the interaction of the components in the assembly process and to ensure that repairs can be easily carried out and functionality is optimised.

Trim

In interior development, passenger safety and the interfaces to the bodywork are important factors with regard to compliance with FMVSS. At the interface between design, safety and functionality, Bertrandt acts as system integrator for the entire greenhouse concept, for example. Bertrandt specialises in designing, engineering and integrating all the components of a vehicle interior. ■

Lightweight structures

Lightweight and composite designs have become an essential part of vehicle bodies. Steel is increasingly being replaced with lightweight materials, such as aluminium, magnesium and fibre-reinforced plastics. Multi-material design enables hybrid materials to be used in bodywork. It is the technology of the future which will allow lightweight bodies to be produced cost-effectively on a large scale. Multi-material design involves selecting lightweight materials which meet the requirements of each individual component of the body. The selection process is determined by the specific needs of the vehicle in question, such as styling, safety, customer value and functional integration, and by production requirements, such as manufacturing feasibility and cost. This cost will depend on the material which is chosen, the process used to manufacture the vehicle body and the investments in new production facilities. Experts estimate that weight savings of up to 30 percent are possible in current production models. The focus here is also on the interior and all its functional systems. Potential starting points include the dashboard, trim components and seats.

Ideas, solutions and implementation

Interview with Michael Hage, head of the car body development Competence Center

Bertrandt*magazin*: Michael Hage, what in your opinion makes the car body development Competence Center stand out from the crowd? What particular benefits does it offer to customers?

Michael Hage: Exchanging ideas and experiences within a network is unusual in our industry and we are very good at putting this into effect at Bertrandt. This connection enables the interior, body and exterior teams to interact from a development perspective, so that we can offer our customers solutions that cross system and component boundaries. For example, we not only develop door trims for our customers, we also focus on the entire door module with all its components, in order to provide the best possible solution for the complete system with regard to weight, functionality, cost and safety, without having to stop at component boundaries. This is because it is precisely at these boundaries where a big potential of this connection between the three areas lies.

> "There is a big potential for connecting at component boundaries."

Bm: How has the Competence Center developed over the last few years?

Michael Hage: On the basis of our customers' requirements and our own drive to succeed, we have developed a great deal of new expertise in recent years. This includes, for example, areas relating to structures and materials and also joining systems. Our customers are currently particularly interested in lightweight design solutions for vehicle exteriors and interiors. Our proximity to our customers has enabled us to take on board the changing requirements for vehicle design, cost, performance, production processes and production sites over the last few years and to work together with our customers to develop new solutions.

Bm: Interior development is becoming increasingly complex and the requirements for systems expertise and occupant safety are growing. What approach do you take to this?

Michael Hage: The requirements for systems expertise and occupant safety have for many years been part of the development process in the department. The most recent example is the support for systems development of the greenhouse for the Porsche Panamera. In close cooperation with Porsche-Experts, the focus was on designing the components, but also on simulation and test validation, in order to meet the head impact safety requirements of FMVSS 201U. This project brought together the interior development, testing and CAE simulation teams at the Ehningen site, which with their links with other technical departments were able to provide the necessary systems expertise. In addition, our employees together with Porsche were responsible for managing the systems supplier, all of which resulted in a successful conclusion to the project.

Bm: You often highlight the importance of involving other departments in development projects at an early stage. Which processes are used to support this approach?

Michael Hage: The first stage in the process of involving other departments in the development of a project is to evaluate the customer's request jointly with all the disciplines involved. On large-scale projects the Bertrandt Projektgesellschaft (BPG) takes responsibility for integration as early as the quotation process. Progress reports are made at the weekly function meetings on interdisciplinary projects of this kind. Representatives of the design, simulation, testing and project management teams from one site or from throughout the network take part in these meetings, which are used to identify the progress of the development activities and to determine the measures needed during the remainder of the project.

> "OEMs now expect us to look at the big picture."

Bm: You start with an idea and develop it to meet customer requirements. What is an ordinary day like in the car body department?

Michael Hage: It varies as development service providers have to perform a wide range of tasks. Bertrandt can take full responsibility for the entire development process chain. Or we may only be asked to become involved at a specific point. It is this flexibility which our customers value. They can call on our development experience at every milestone in the process and incorporate it into their projects. Nowadays more and more customers want to see networking within a project, in other words, they require a cross-disciplinary approach. This applies in particular to simulations and links with testing. OEMs now expect us to look at the big picture in order to help ensure the success of the development process in future. This represents our main competitive advantage, as we can cover the entire process chain and we also offer production start-up management and other development support services.

Bm: If we take a look into the future, what is likely to change?

Michael Hage: The way in which the department develops will be determined by market requirements and our customer focus. Our job is to identify these requirements at an early stage and make the necessary preparations. For some years we have been working with our customers to introduce changes in the structure of bodywork, as an increasing number of OEMs are moving to a platform strategy or introducing more modularisation. In addition, attempts to identify potential weight savings will have a major influence on what we do. Electric drive systems will continue to affect the structure of vehicles, including the interiors, and this will open up new opportunities for us.

Bm: How would you describe your department?

Michael Hage: In a nutshell, we have many years' experience of the entire bodywork development process. When this is combined with new technologies, we can offer our customers the necessary expertise for state-of-the-art body-in-white, exterior and interior development. We provide ideas, solutions and implementation services.

Bm: Michael Hage, thank you very much.

The Bertrandt networking test centre

Testing services for vehicle networks

One essential element of the function and vehicle development process is the communication between electronic systems. Data which is generated in one location as a result of incoming signals from actuators or sensors is made available elsewhere in the form of signals. The aim of this is to avoid redundant communications or unnecessary installation processes, in order to produce solutions that make sense in business terms. In the Bertrandt networking test centre in Ingolstadt, engineers can validate the communication behaviour of electronic control units (ECUs) at an early stage in the development process using specially designed test environments.

CAN network	FlexRay network	Gateway routing
		
CAN network tester ▪ Test follows VW80118, VW80119 ▪ High test coverage ▪ 100 % VAG test macros ▪ TBAD process	**FlexRay network tester** ▪ Test follows VAG FlexRay spec. ▪ 100 % test coverage ▪ EXAM test automation	**Multibus test bench** ▪ Test follows Audi GW spec. ▪ 100 % test coverage ▪ EXAM test automation ▪ MOST150 MIB test suite

Figure 1 shows all the testing facilities available at Bertrandt Ingolstadt. These have been specially designed to cover the VW80118 and VW80119 test standards, the VAG FlexRay specification and the Audi Gateway test specification and have each been individually calibrated to the appropriate standard or specification.

The background: guaranteeing interface compatibility

The fundamental rules of electronic data transmission, such as chronological sequences and electronic parameters, are laid down using communication protocols, also known as bus systems. The compatibility of the interfaces between semiconductor manufacturers' systems guarantees that the rules are correctly applied, which simplifies cross-platform use. The following bus systems are currently used by leading car manufacturers in volume production models: CAN (Controller Area Network), LIN (Local Interconnect Network), MOST (Media Oriented Systems Transport) and FlexRay (FLEXible Time ArRAY).
During the process of designing a new ECU and of providing development support throughout the entire product lifecycle, it is necessary to test the functionality of the communication interfaces and to ensure correct operation across the entire operational voltage range. The networking test process is an important means of validating communications and, therefore, of guaranteeing the quality of the ECU. In order to be able to provide these protocol-based test methods, Bertrandt has developed specialist test systems and offers a range of testing services for the automotive industry.

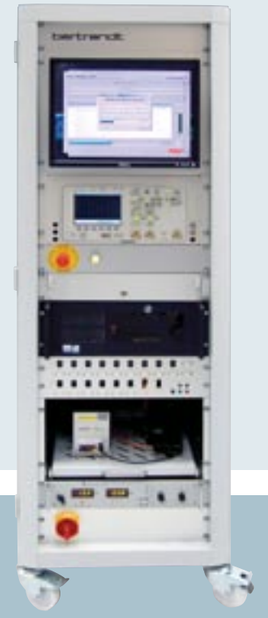
The networking test process

"The absence of errors in individual components is no guarantee that the products and applications will function perfectly and this cannot be achieved simply by optimising the individual processes," says Hans Mahler, chair of the quality working group at the German Electrical and Electronic Manufacturers' Association (ZVEI). Historically, networking tests have been an important means of ensuring the quality of communications from any type of ECU. As the number of ECUs in each vehicle grows, with many of them manufactured by different systems suppliers, communication problems are becoming more common in networks of ECUs, because of differences in implementation and configuration. As a result, data packages are not received correctly and in accordance with the specifications, are not received at the correct time or are not sent at all, which can cause specific functions (for example ACC, ESP etc.) or the entire system to fail.
Network tests are a reliable means of validating this. Every individual ECU at every integration level is tested in accordance with a specified test standard (CAN VW80118, VAG FlexRay test specification). The test object is evaluated in all possible operating conditions within a simulated vehicle environment.

The Bertrandt networking test centre

CAN network tester

FlexRay network tester



Multibus test bench

The Bertrandt networking test centre

The test regulations referred to above are mandatory within the Volkswagen Group. Their aim is reduce the number of errors during the early stages of developing an ECU, to rectify any errors found and to validate the fundamental communication behaviour of the bus participants.

System suppliers must provide proof that these basic tests have been carried out. Some suppliers do not have the necessary testing facilities, testing capacity or expertise. The Bertrandt networking test centre in Ingoldstadt offers testing services for CAN and FlexRay bus systems in a test environment identical to that of the customer. Not only systems suppliers but also OEMs can benefit from this range of services if their own testing resources are in short supply during peak periods (for example just before the start of production). The Bertrandt networking test centre provides e. g. an exclusive gateway ECU testing service (see the multibus test bench).

On all its test platforms, the test centre uses original VAG tools and test macros, which ensures that the test results are totally reliable and guarantees full reproducibility. In regression testing, reproducibility is of crucial importance.

The CAN network tester

The most reliable and most widely used communication system in cars is the CAN bus. Despite the fact that OEMs and their suppliers have extensive experience of the use of this bus, the protocols need ongoing validation. This is where the CAN network tester comes in. A fully automated program generator reads in the test base coordination documentation file (TBAD) specific to the ECU and, on the basis of the data in the file and the VAG test template, generates the appropriate messages for the bus simulation or the necessary error scenarios, depending on the type of test. The expected DTC error codes (target values) and the subsequent test report in HTML format are also created automatically. Bertrandt has a connection to the VAG toolkit.

The FlexRay network tester

The introduction of the FlexRay time-triggered bus system has increased the demands on the performance of ECUs and testing tools.

The network tester checks the communication behaviour of a wide range of ECUs in a simulated vehicle environment. All the bus signals from the ECUs can be recreated as part of the simulation and specific errors can be generated on the FlexRay bus. The ECU under evaluation must undergo a variety of tests. During the course of the testing, the responses of the ECU are monitored by logging the incoming information from the data monitor and representing it in physical form on an oscilloscope. The entire test sequence is controlled by the EXAM test automation system, which also includes automated logging of the test results.

The multibus test bench

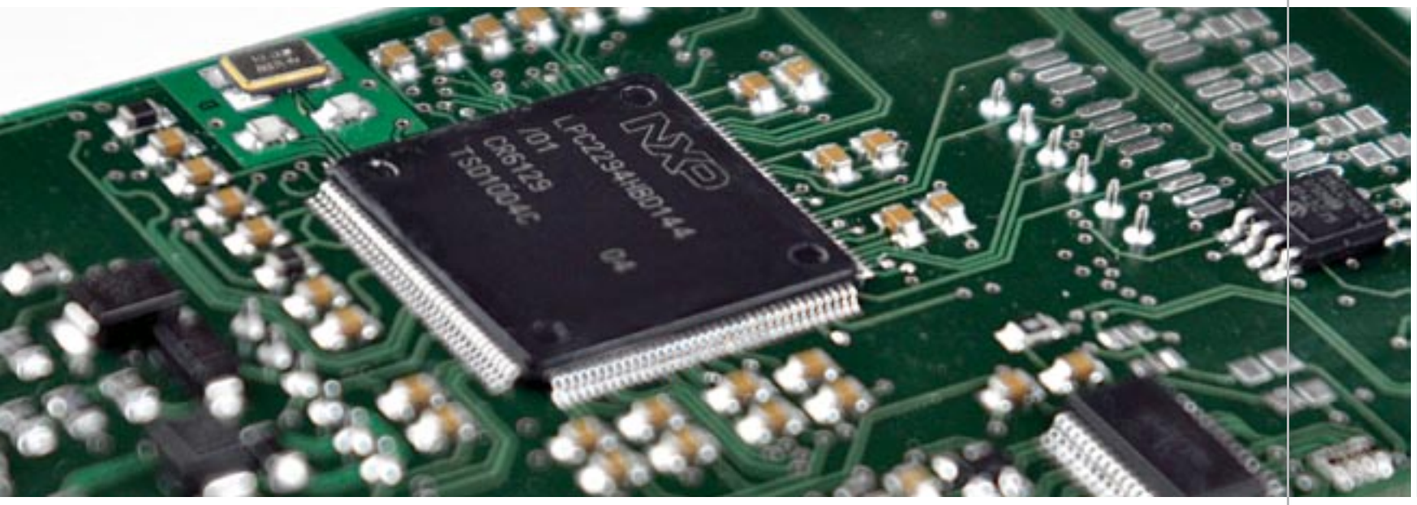
Over recent years the complexity of signal routing between the individual buses has increased significantly. This has imposed greater demands on the gateway ECU. Crucial factors in ensuring that the vehicle operates safely include the processing period, accuracy and fail-safety of message routing. The multibus test bench developed by Bertrandt systematically tests and evaluates the full range of functions in a gateway ECU in the early phases of the development process, helping to keep errors and costs to a minimum.

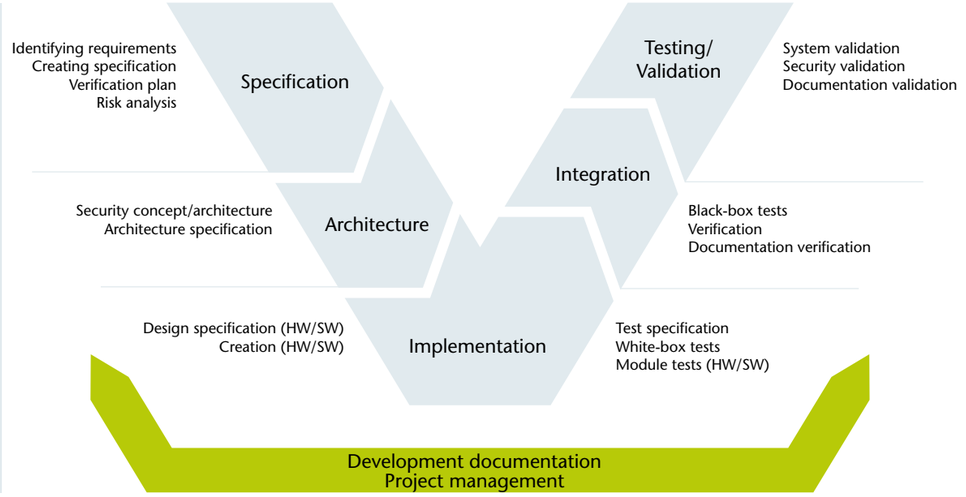
Summary

The Bertrandt networking test centre in Ingolstadt provides specific test environments which allow the communication behaviour of an ECU to be tested reproducibly during the early stages of development. The test services offered help to simplify the process of integrating an ECU into a communication network, to reduce the number of development cycles and to keep costs low for car manufacturers and system suppliers. ■

Arkadius Mitianiec, Marc Schilhaneck, Ingolstadt

Developing embedded systems for individual customers





The electronics department at the Bertrandt Technikum GmbH has developed a modular ARM7 architecture platform which will enable embedded systems to be created on behalf of customers quickly and efficiently. A basic software package has also been developed for customer applications to run on. The new platform has already proved successful in customer projects, as the two following examples show.

Configurable CAN gateway

The first project involved creating a configurable CAN gateway (CGW) as a cost-effective and highly flexible solution for routing messages between two CAN subnets. The special features of this CGW are its extremely compact design and its ability to receive CAN messages and to transfer them to another CAN subnet on the basis of configurable routing rules. The gateway is configured via a PC-based graphical user interface (GUI) which allows the routing rules to be set up for each individual message. When a message is received, the signals it contains can be interpreted, modified or enhanced. After a specified latency period, the message is routed onward with another, modifiable CAN identifier. Additional functions such as toggle/counter bits, parity and checksums can be entered as parameters. The message can be routed in either direction. In addition, the bit rates and the byte order (big-/little-endian) can be configured via the graphical user interface. The system is based on a 32-bit microcontroller, which allows for higher data rates without message losses. In addition, cyclical messages can be configured and generated using the GUI, for example in order to keep specific control units “awake”. The gateway functionality and the firmware are configured via the USB port.

Regeneration box

Another compact device has been developed on the same platform to monitor the soot loading of vehicle diesel particulate filters and to initiate filter regeneration manually. The so-called regeneration box is particularly useful for vehicles which travel only short distances. In this case, the regeneration process is frequently interrupted, which can lead to problems with automatic regeneration and to the engine oil becoming thinner. The regeneration box is used to protect the engine and the diesel particulate filter. It displays the soot loading for the driver to see and allows the regeneration process to be initiated manually as required. After each process the regeneration status and the accompanying distance travelled are stored internally with a time stamp. The regeneration protocols can be accessed via the USB port using a graphical user interface. A PC flash tool is used for encrypted updates of the firmware (program and copy protection). The regeneration box is connected to the vehicle via the OBD socket.

Embedded systems platform

Both of the customer applications described above are based on the modular embedded systems platform developed in the Technikum. This consists of a microcontroller core with an ARM7 controller from NXP and a range of hardware modules:

- Flash memory module
- E²PROM memory module
- CAN communication module
- USB communication module
- OBD interface
- LCD interface
- Digital I/O
- SD flash card

A basic software package has been developed for this hardware platform which the customer applications can run on. A series of software modules is also available, including:

- Diagnostics protocols (KWP2000/UDS)
- Data logger functionality
- Flash bootloader via USB
- Copy protection functionality

Using and constantly expanding the platform makes it possible to implement a wide range of customer applications very quickly, in particular for special solutions, the development of specialist control units and the creation of prototype functions. The services offered by the electronics development department at the Bertrandt Technikum GmbH can be combined with those of other departments to provide an extended portfolio. The products created in-house are based on the V model development process. This was specially designed and implemented for embedded system developments of this kind. The standard document templates make it easy for engineers and technical specialists to ensure the high quality of the products developed and to provide effective long-term documentation. ■

Hicham Dakir, Christoph Schelhammer, Technikum Ehningen

Workshop-style seminar

Ready to go with the new training course “Working on high voltage systems”

Practical training courses on high voltage systems are offered by Bertrandt in Cologne, Ingolstadt and Wolfsburg.

Environmentally friendly electric and hybrid cars place new demands on engineers as a result of the high voltage levels of the vehicle electrical systems. In order to ensure that engineering and technical specialists are fully up-to-date with the latest developments, the “Working on high voltage systems” seminar has been added to the Bertrandt Group’s training portfolio. At a number of sites, employees are undergoing training to enable them to meet these new technical challenges. Bertrandt Cologne gives an insight into the course.

Cooperation with Westfälische Ausbildungs-Werk GmbH

Bertrandt Ingenieurbüro GmbH in Cologne held the “Working on high voltage systems” seminar in collaboration with the specialist training company Westfälischen Ausbildungs-Werk GmbH (WAW). During the three-day course, participants gained an in-depth insight into the terminology and background to the subject. In addition, they had the opportunity to learn about practical tasks involving live high voltage systems and find out more about the relevant legal issues.

State-of-the-art technology

After an introduction to the technical vocabulary and definitions, the first day also involved an explanation of the rights and duties of an expert in high voltage systems. This included a description of the legal requirements for companies and managers and details of the responsibilities of trained employees. Bertrandt and WAW described the current status of technological development by presenting different drive concepts where high voltage systems are used.

From theory to practice: Hybrid and electric cars

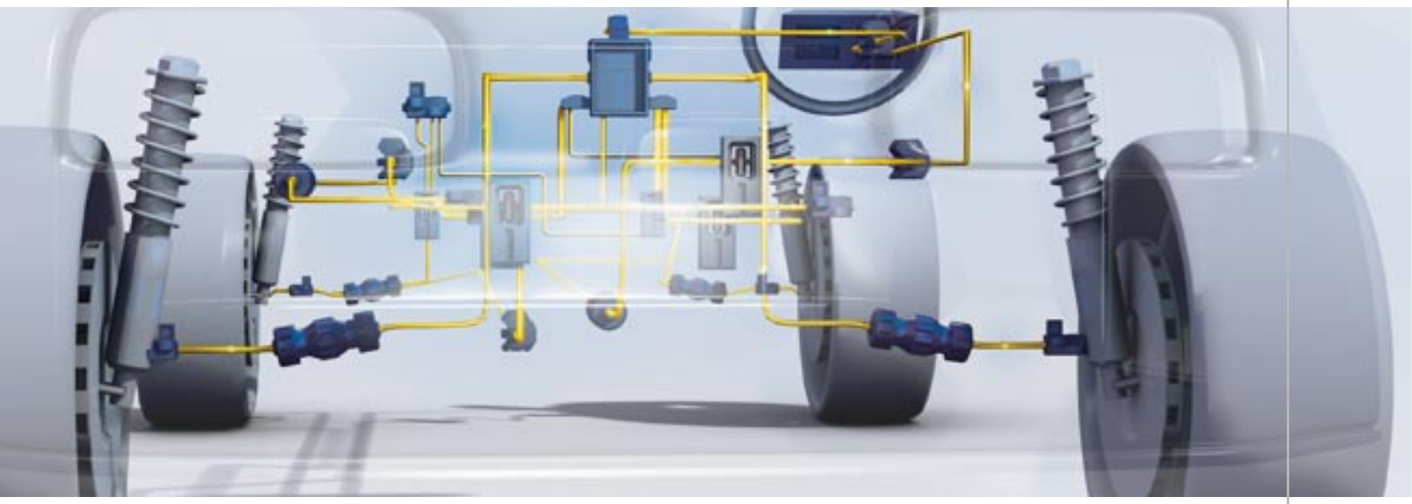
On the second day, the participants moved from theoretical training to practical experience. After being given detailed safety instructions, they had the opportunity to examine some hybrid and electric cars. In addition, the course participants were able to observe and investigate the interaction between all the components of a hybrid system on a special test set-up designed for training purposes. The focus in this part of the course was on determining whether or not the system was live using a voltage tester.

Direct experience of high voltage systems

The course continued on the third day with practical work on live components of a high voltage system. At the beginning of the day all the course participants were once again given theoretical instruction on the risks involved and the necessary safety measures. During the practical workshop which followed, the trainees had the opportunity to make use of the knowledge they had acquired and to demonstrate that they could use the tools and protective equipment correctly by carrying out test measurements on a real high voltage system. The course ended with a summary and the chance for the participants to give feedback. ■

Thomas Wilms, Cologne

Functional safety



Exposure/Frequency
- high (100 % – 10 % of service life)
- medium (< 10 % of service life)
- low (> once per year, < 1 driving cycle)
- very low (< once per year)

Controllability
- difficult to control or uncontrollable
- generally controllable
- easy to control
- always controllable

Severity		E x C					
		1	0.1	0.01	E-3	E-4	E-5
No injuries	S0	QM	QM	QM	QM	QM	QM
Slight injuries	S1	ASIL B	ASIL A	QM	QM	QM	QM
Serious injuries (likely to survive)	S2	ASIL C	ASIL B	ASIL A	QM	QM	QM
Life-threatening injuries (survival uncertain)	S3	ASIL D	ASIL C	ASIL B	ASIL A	QM	QM

ISO 26262: Quality management evaluation of processes and complete system concepts

ISO 26262 is replacing the current generic standard for functional safety in electronic systems, IEC 61508, as the mandatory standard for road vehicles. In 2009 it was published in the form of the draft international standard ISO/FDIS 26262 and has since gained international acceptance. No more fundamental changes are expected before the publication of the final version in mid 2011. Bertrandt is already applying the standard to safety-related areas of developments in vehicle electronic systems.

New standard

Road vehicles can only be regarded as roadworthy if their safety features meet the latest requirements. In order to avoid product liability claims, cars must, as a minimum, comply with current standards. Following the publication of ISO 26262, all new products which are brought onto the market must be developed in accordance with the standard and older products will also have to be evaluated on the same basis.

Requirements

Users of the new standard have to meet a demanding set of requirements. As well as having detailed technical knowledge of an individual product, such as an ECU, and its behaviour, they must take into consideration and evaluate its overall influence on the functions of the end product, in this case the vehicle itself. In addition, specific knowledge of the tools for identifying, evaluating and classifying errors is also required, together with end-to-end documentation. These requirements can only be met fully and comprehensively by well-structured teams with competent managers.

The standard presents new challenges, in addition to the familiar quality management (QM) methods in the field of electrics and electronics. Existing processes must be adapted to the overall product development process and extended accordingly. These include the creation of a safety programme plan, the appointment of a safety manager, an analysis of the risks of the functions, with the resulting ASIL determination and decomposition, and the use of specific ASIL-related methods, such as FTA or FMEDA.

Implementation as a service

Employees of the Bertrandt Technikum are already incorporating these changes into the process landscape. Bertrandt's specialists are taking part in risk analyses of vehicle systems on behalf of customers (OEMs), giving support for the introduction of functional safety concepts and for the expansion and amendment of tools and processes, in order to meet the new requirements of ISO 26262. The goal of the quality management experts is to provide customers with independent confirmation in the form of reviews, safety audits and assessments. Another service on offer is the provision of consultancy and the development of expertise in applying the new regulations among OEMs and suppliers. In addition, Bertrandt is continuing to provide its customers with reliable support services in the ongoing process of implementing functional safety in the context of development, production and after-sales. ■

Tobias Stöhr, Isabelle Könnel, Klaus-Peter Weidner, Technikum Ehningen

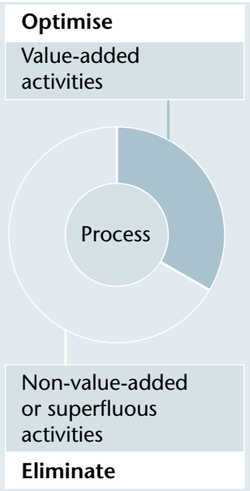
Glossar

FTA: Fault Tree Analysis. The FTA is a procedure for determining the likelihood of a fault. The analysis, which is suitable for all systems, identifies undesirable events and searches for all the critical paths which could trigger them. It is a type of system analysis and is described in the DIN EN 61025 standard.

FMEDA: FMEDA (Failure Modes, Effects and Diagnostic Coverage Analysis) is used to determine the safe failure fraction (SFF) and the diagnostic coverage (DC) of a system on the basis of the requirements of IEC 61508 and ISO/FDIS 26262.

ASIL: Automotive Safety Integrity Level. A means of measuring the safety-relevance of a malfunction in a system or in the vehicle as a whole. The ASIL is determined on the basis of a number of parameters: E (exposure), C (controllability) and S (severity). The values range from A (the lowest level) through to D (the highest level). Non-safety-relevant faults are evaluated using QM methods, because a standard quality management process is sufficient in this case.

Already lean? Or still wasteful?



The Engineering Services department adds to its portfolio of services: Lean Management and methodology trainings

Lean, leaner, leanest – this is the challenge which an increasing number of leading companies are setting themselves. But what really lies behind lean management?

In brief, it involves eliminating non-value-added or superfluous activities and optimising value-added ones. But, of course, this does not give the full picture of the concept, which is based on the Toyota Production System developed in the 1950s. The first global lean management wave arrived in the 1990s, but it was quickly forgotten by managers. Around 10 years later, lean management emerged again in many countries, including Germany. The recent worldwide economic recession has forced companies from all industries to evaluate the efficiency of their internal and external information and material flows. With the aim of improving their competitiveness, organisations began identifying and unlocking potential savings throughout the entire value-added chain.

New service with accompanying training course

In order to help customers to achieve their efficiency goals, a new "lean management" module was added to the range of services offered by the logistics and supplier management team in the Engineering Services department. A comprehensive range of training seminars has been held within the Bertrandt group to provide the employees from various departments and sites with the necessary in-depth expertise. The target groups include managers who want to expand their knowledge to provide added value for new and existing customers and employees who are responsible for lean management project assignments on behalf of customers in the fields of production, planning and logistics. Training courses are also on offer for external participants. The automotive industry in particular is subject to constantly growing pressures on costs and increasingly complex modular strategies within the value-added chain. As a result, lean management has become more and more important and is now part of everyday life in many manufacturing companies. Customers can book the entire training course or select and combine specific modules. The aim is to provide the greatest possible benefit for each customer. Another related module available from Bertrandt is a Kaizen workshop.

Course structure and seminar content

The training course is modular in nature and offers an overall perspective on the subject. Two blocks of seminars lasting five days in total provide both theoretical and practical instruction. The training is based on examples of best practice from the instructors' own experience. Some of the sessions take the form of workshops where the seminar participants have the opportunity to work independently on case studies.

Structure of the Bertrandt lean management training

Module		Title	Content
1		Introduction	■ Introduction to the history ■ Philosophy of the Toyota Production System ■ Concept and content of lean management
2	2.1	JIT logistics	■ JIT ■ One piece flow ■ Kanban ■ Milk run ■ Production levelling ■ Lean layout ■ Value stream design
	2.2	Process and work organisation	■ 5S: Clean and orderly ■ SMED: Setup time reduction ■ Total Productive Maintenance – TPM
	2.3	Quality (robust processes)	■ Jidoka ■ Quality alarm ■ Poka-yoke ■ Process FMEA
	2.4	Kaizen	■ 7 types of waste ■ Kaizen workshops ■ Problem-solving methods (7W, Ishikawa 4M, 5xW)
3		Implementing lean principles	■ Process focus ■ Procedure ■ Chances and risks ■ Lean Six Sigma
4		Lean production simulation game	■ Explaining the effectiveness of lean management ■ Putting the methods learnt into practice

Lean methods and tools

The **first block of seminars** gives an introduction to this exciting subject. Participants gain an overview of the methods and tools required, the historical background and initial information about the concept and the content and about the philosophy of the Toyota Production System. They learn about how the lean concept developed, what it involves, what its goals are, what every employee can contribute and why the automotive industry is using it.

The **second block of seminars** looks in detail at lean management methods and tools for more effective and productive working. The modules include:

- Just-in-time logistics
- Process and work organisation (plant availability)
- Quality (robust processes)
- Kaizen (continuous improvement process)
- Lean Six Sigma
- Modular implementation of the lean management principles

The training ends with a lean management game to add the finishing touches to the participants' newly acquired knowledge. Working in groups, they become familiar with the most important success factors of the lean concept, which can then be put into practice in their own projects or organisations.

Future prospects

The central themes of lean management include optimising material and information flows within companies, reducing throughput times, increasing the flexibility of production processes, standardising processes and systematically preventing waste. A closer look soon reveals that these are also the key challenges faced by industry. Globalisation is forcing companies to focus on precisely these issues in order to cut costs. Companies which introduce lasting improvements to their processes as part of the lean management approach will be able to establish positive, long-term relationships with customers and suppliers. They will also have happy, motivated employees who will help the company to grow successfully by adopting a new perspective based on the teamwork that has developed as a result of lean management. For this reason, expanding the lean management concept and holding Kaizen workshops that have a lasting impact are important success factors for today's companies which are exposed to globalisation and to growing pressure on competitiveness and costs. ■

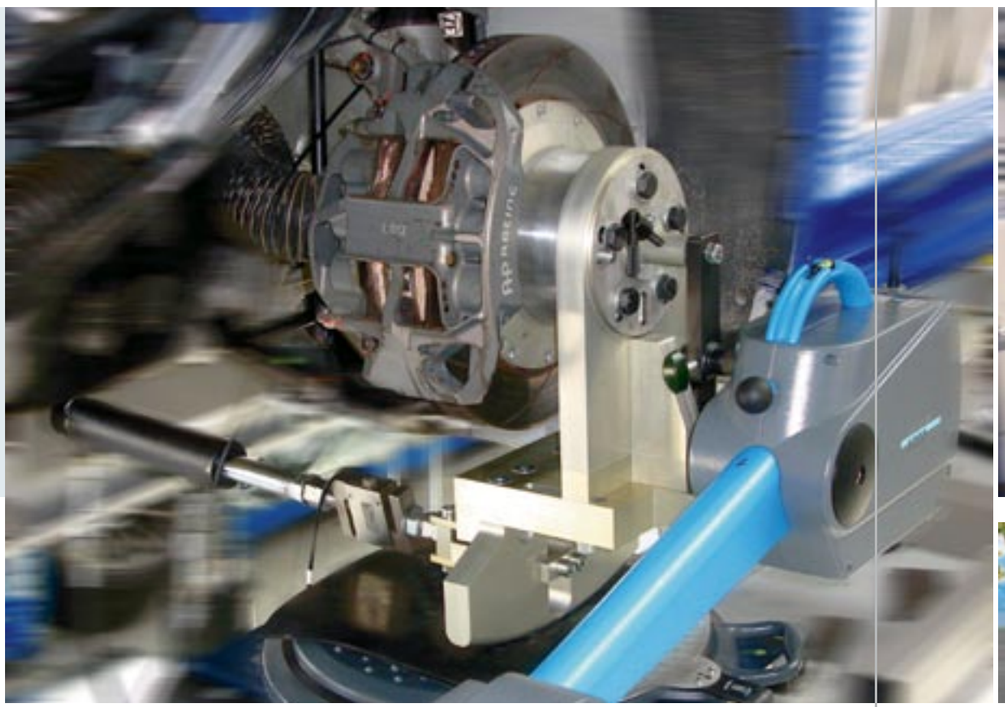
Betül Güler, Ehningen

If you have questions or suggestions, Betül Güler will be happy to help. You can contact her at Dilsat-Betuel.Gueler@de.bertrandt.com

Design in the loop

Functional chassis development

A number of new developments in the automotive world are resulting in an increasing emphasis being placed on chassis design. As part of its "design in the loop" programme, Bertrandt is using the latest tools and methods to evaluate the comfort and handling properties of a chassis as early as the design phase.



Variations in toe-in, camber and wheel load can be measured on the suspension and axle kinematics test bench via suspension travel and on the rolling body.

Close to reality with the Carmaker simulation tool – a simulation of a VW Beetle.

Focus on the chassis

Active safety and comfort are two of the main factors which determine how vehicles are perceived by customers. More than 50 % of the assessment criteria used in the industry press relate to the chassis. It also plays an important role with regard to the ongoing discussions on CO_2. Factors such as power loss through the tyres, slip angle and loss of traction have a huge influence on fuel consumption and, therefore, on carbon dioxide emissions. In the world of modern automotive engineering, the process of chassis development is increasingly moving away from an emphasis on traditional suspension and damping systems and towards a holistic, functional approach to the chassis, as an important factor which influences the entire dynamic behaviour of a vehicle. Alongside aerodynamic properties and car body stiffness, the major aspects of chassis design include modern electronic control systems and computer-controlled chassis components. These will be more and more widely used during the next few years and experience shows that they are likely to spread over time from higher-priced cars to small and mid-sized vehicles.

Managing complexity

The already complex subject of chassis engineering is made even more complicated by the growing number of vehicle derivatives and model variants and by shorter model cycles. The result for vehicle manufacturers is an increase in the quantity and the quality of development tasks which it is often difficult for them to manage using in-house resources, in particular given the short development timeframe for new models.
As an engineering service provider, Bertrandt constantly has to look to the future and, as a result, the company identified these changes at an early stage and began specialising in the use of state-of-the-art tools and methods for functional chassis development. As well as traditional CAD processes, where new features are constantly being made available, a vehicle's functions can also be represented using a functional digital mock-up (FDMU). This enables the manoeuvrability of a vehicle to be evaluated in three dimensions during the design phase.
Bertrandt also has high-performance hardware systems, for example in the chassis laboratory at its Tappenbeck site near Wolfsburg, which include a suspension and axle kinematics test bench (kinematic and compliance test bench) for vehicles up to a total weight of 2,200 kg.

Simulating driving dynamics cuts costs

Bertrandt is also investing in the latest driving dynamics simulation systems, which can significantly reduce the number of expensive real-life prototypes needed and the number of road tests that result from the increasing pace of model changes. The benefits for customers include considerable time and cost savings. From the perspective of the driving dynamics simulation systems, it makes no difference whether the virtual car has been generated from actual measurements of existing cars or components or from design data. The technology enables fundamental concepts to be evaluated even during the earliest phases of the development process. For example, effective and reliable tests can be carried out to determine how a newly developed chassis behaves in a specific environment or whether a fuel-efficient engine really produces less CO_2 in combination with other components, such as the chassis.
The standard of modern simulation tools designed for the vehicle development process has reached such a high level that ECE regulation 11/13 specifically permits their use under certain circumstances for the homologation of electronic stability systems for commercial vehicles, where a loss of control would be particularly critical.

Subjective assessment remains the most important factor

Despite the wide-ranging use of the latest simulation methods, the subjective assessment by customers of handling and comfort remains the most important factor for car manufacturers. In order to produce reliable results, the specialists in the Bertrandt chassis team use comparable and reproducible processes. As well as creating accurate definitions of the handling characteristics, which are particularly difficult to obtain when it comes to the comfort factor, the focus is on cause analysis. The objective is to improve existing vehicles or to achieve the required handling characteristics using the "design in the loop" approach, by recommending the appropriate designs to the customer or implementing them during the development process.

Portfolio of services covering the entire development chain

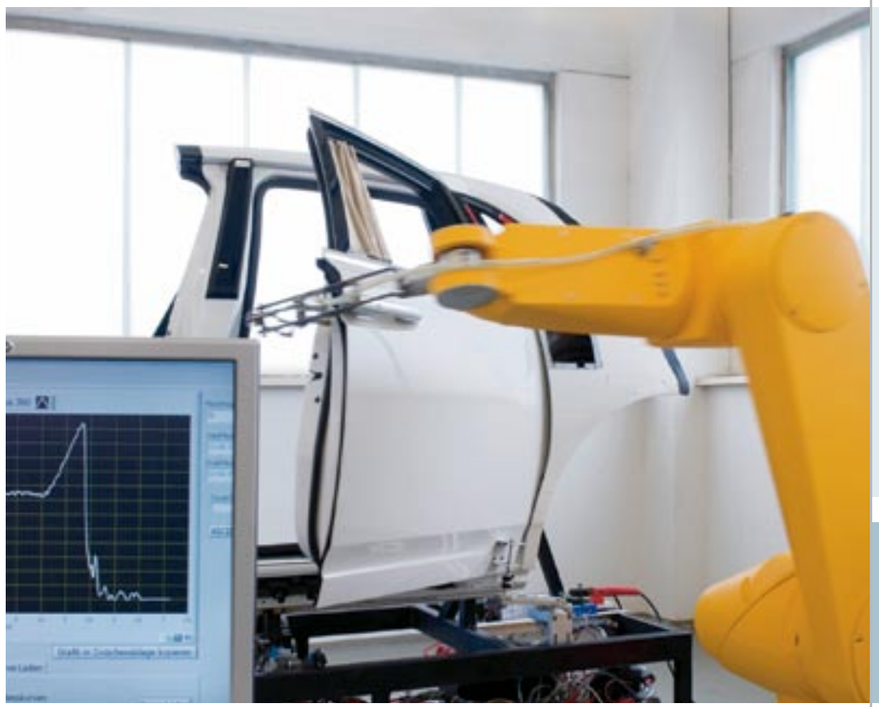
Bertrandt's "design in the loop" portfolio of services covers the complete development chain, including creating concepts using traditional CAD processes, designing components and assemblies, testing chassis functions at an early stage and evaluating and developing handling, comfort and active safety (including driver assistance and control systems) in real time and in a highly realistic environment using a driving dynamics simulation tool. Bertrandt can offer its customers reliable development support during the process of functional chassis development using state-of-the-art tools and methods. ■

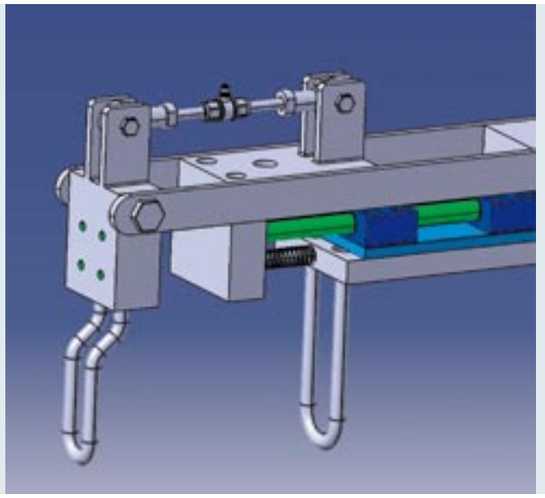
Dieter Scharpe, Wolfsburg

Realistic endurance testing

Test bench for moving bodywork components

Over the last three years, Bertrandt Munich has developed a new test bench concept for moving bodywork components and operating controls in the vehicle interior. This allows tests to be carried out whitch closely mirror customers' requirements and save both time and money. The concept takes into account ongoing reductions in development times and increases in the number of electronic functions in vehicles.





Combined endurance testing using a modular structure

The test bench is based on a software system architecture which has been designed to meet the specific requirements of vehicle testing. Key features include the robustness of the test bench, comprehensive measurement recording functions for analysis and reproducibility and rapid availability of results for the customer. The tests of interior and exterior components are broken down into different software modules. These range from opening and closing a door or boot lid through to seat testing and moving a gear lever or pressing a switch. The test bench operator can combine these modules intuitively to produce a comprehensive and, therefore, realistic endurance test. This is based on the principle of configuration rather than programming, which reduces possible errors caused by the operator. The test bench system has been created to fulfil the complex requirements of a wide variety of components and testing regulations.

Robots with integral measurement recording function offer high levels of flexibility

The use of industrial robots to provide the mechanical movement functions and to record the measurements makes the test bench extremely flexible. Long set-up times and special equipment are things of the past, partly because the laborious process of entering parameters for speed and release travel has been automated, as a result of the use of control circuits. This also enables customers' requirements for the rapid completion of tests and availability of results to be met. An interface developed in-house is responsible for communications between the robot and the test bench. This allows the movement sequences characteristic of testing processes and the measurement recording function to be set up within just a few minutes. Users of the graphical interface do not need any advance knowledge of robot programming. A highly flexible protective cover for the robot, which was also created in-house, enables the test bench to continue operating under extreme climatic conditions.

Shorter downtimes

The use of standard CANoe software as the interface to the vehicle electronics system allows the test bench electronics to be adapted to any vehicle model within only a few hours. Automated diagnostics functions and data bus recordings are also available in the case of errors. This leads to more informative test results and enhanced analysis options in the case of malfunctions. Other important features include improvements which allow the tests to be matched even more closely to customers' requirements and the elimination of atypical stresses on the test objects, with the advantage that the influence of the test bench itself is significantly reduced. In addition, the comprehensive recording of measurements and the analysis function enable the test bench system to respond automatically to changes in the test object and, for example, to adapt its actuating paths. The relevant parameters are monitored to prevent overloads, in particular in the case of electronic components. If the test comes to stop, the documentation function immediately sends a text message to the test bench manager, which allows the test to be constantly monitored. This is particularly important in the case of endurance tests, because two-thirds of the testing time is usually outside normal working hours.

These varied improvements and monitoring functions have allowed the downtimes to be reduced to a few percentage points when compared with previous systems. The test results are available to customers more quickly and are clearer and more informative, the test machines have very short downtimes and the work involved in managing the test process has also been reduced. In addition, the comprehensive recording of measurements makes it possible to reconcile the data with the simulation models in order to improve different approaches of virtual testing functions.

Tried-and-tested in practice

The project was implemented at Bertrandt in close cooperation with the departments responsible for endurance testing, the Technische Universität Bergakademie Freiberg and the University of Applied Sciences Osnabrück. During the project, the test bench underwent constant improvement, in particular with regard to its operational stability and test modules. Several of such test benches are currently in operation at Bertrandt. In future, software modules will, wherever possible, be created for all new tests and these modules will be integrated into the new test bench concept. ■

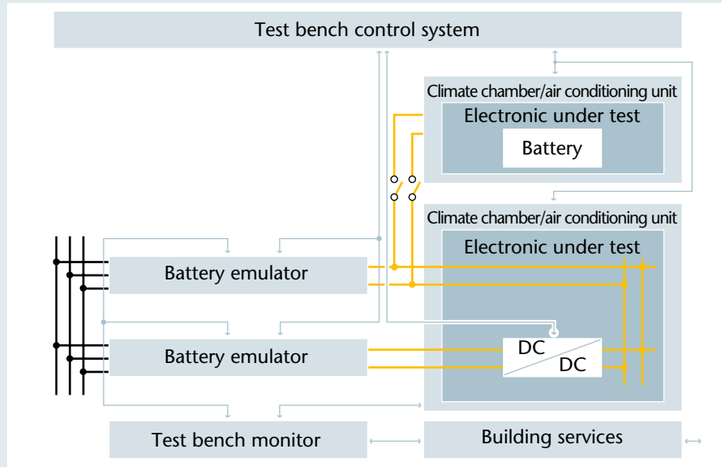
Jens Vogelpohl, Munich

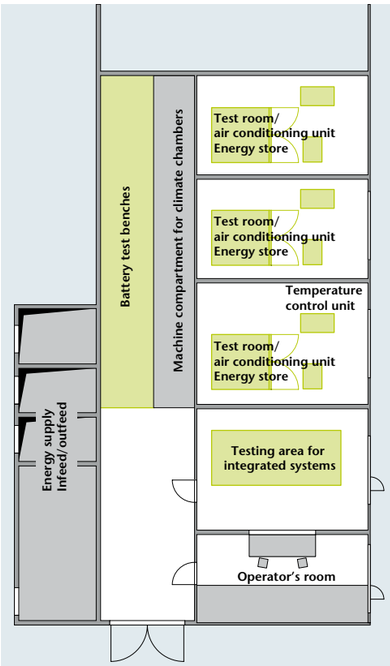
Highlights

- Rapid availability of results
- Comprehensive measurement recording function (analogue, digital, bus messages) provides reproducible tests and more informative results
- CANoe as the universal interface for all OEMs
- Modular test bench concept for all tests
- Combination of electronic and mechanical testing
- Tried and tested in climate chambers at temperatures between -30 °C and +80 °C
- Very short set-up times, ideal for spontaneous tests
- Continuing development process in collaboration with universities
- Wide range of applications in exterior and interior testing, including doors, closures, seats, compartment lids and gear levers

Expanding electromobility services

Electromobility is currently one of the key areas of innovation in the automotive world and will continue to be in the near future. The number of cars on the market with an electric or hybrid drive system is constantly growing. Germany's goal is to become the world market leader in the development of electric and hybrid vehicles. Bertrandt is working towards the same objective and its new battery test centre enables it to help its customers to test and bring onto the market new technologies, such as high-voltage energy storage systems.





New battery test centre in the Bertrandt Technikum

Flexible solutions

State-of-the-art high-voltage energy storage systems are used to supply energy to the new electric or hybrid powertrains. In line with the objective of bringing one million electric vehicles onto our roads by 2020, the demand for development services and the accompanying testing capacity is growing rapidly. This is where Bertrandt's new battery test centre comes in. It consists of a series of modular test systems in which all the channels can be configured separately. In addition, it is possible to define individual conditions for measuring and aborting each stage of the test. The creation of new testing sequences has been simplified by enabling existing subprocesses to be used as the basis for new versions. All the measurements from each test are presented in real time and the configuration can be modified or documented during the course of the test itself. The modular design of the test systems allows anything from individual components to complete assemblies to be tested.

State-of-the-art equipment

Battery testers and battery emulators

The battery test centre is divided into three testing areas. One or two batteries can be evaluated in each area. The components that undergo testing include power electronics systems and DC-to-DC converters and, in addition, the test system can act as a battery emulator.
The maximum output figures are:
Output power: ±180 KW (240 KW)
Output voltage: 50 V to 850 V (600 V)
Output current: ±600 A

Climate chamber for climate tests of integrated components

Individual components of the systems, such as the power electronics, can be tested separately from the battery in the test centre's climate and temperature control cabinets. The test temperatures range from -40 °C to +180 °C. An additional temperature control unit is available for battery testing which offers temperatures between -20 °C and +120 °C. This unit uses a one-to-one mix of water and glycol and has a flow rate which can be adjusted from 160 l/h to 1600 l/h.

Area for testing components in integrated systems

This testing area replicates the vehicle environment in order to allow components such as electric motors, power electronics and integral battery chargers to be tested as part of integrated systems. In these systems both digital and analogue measurements can be recorded and documented.
Other functions can also be tested if required, such as the integral insulation monitor in the battery management system which is specific to each vehicle. In addition, information about temperatures and other variables in the existing system can also be recorded synchronously for each customer.

Extending core competence

The battery test centre extends Bertrandt's expertise in the field of electromobility. The company's aim is to increase its knowledge of this future-oriented technology on an ongoing basis in order to support all the new developments relating to electric drive systems. ■

Jörg Fehrenbacher, Ehningen

b.energized

The battery test centre at the Technikum provides testing services for the latest high-voltage energy storage systems and helps to resolve customers' capacity bottlenecks. In the first phase, which will be completed in autumn 2011, a test environment for batteries for hybrid electric vehicles and battery electric vehicles will be established. The second phase (until end 2011) consists of a testing area for integrated systems consisting of the battery, electric motor, power electronics and integrated charging system (on-board charger).

Supporting patient health

Bertrandt Services opens design office in Kemnath

In the field of medical technology, the development processes, the products themselves and the infrastructure are governed by strict international standards and regulations. The quality and safety requirements for the use of medical products are significantly more stringent than in most other industries and are constantly growing. Against this background, Bertrandt Services can offer its customers specialist development services in the challenging environment of medical technology from its site in Nuremberg and its new office in Kemnath, which opened at the end of 2010.

Development support for the medical technology industry

Since the site in Nuremberg was established in 2007, Bertrandt Services (BS) has been constantly expanding its range of services for distinguished customers from the medical technology sector. The first projects to be completed successfully included providing development support services for a pinch guard for a detector drawer to ensure that patients' extremities do not become trapped.

Following a number of successful projects of this kind and other enquiries from the industry, Bertrandt Services decided to open a design office focusing on medical technology. The project office in Kemnath, staffed by experienced engineers with a background in medical technology, has been in operation since the end of 2010. It is equipped with the latest hardware and software, including I-DEAS NX, which allows Bertrandt Services to take responsibility for complete projects. In the Bertrandt network, Kemnath functions as an end-to-end engineering partner in the field of medical technology.

Complying with standards throughout the product development process

The Bertrandt Services team in Kemnath is responsible for mechatronic design tasks relating to supporting components of a variety of medical technology products. Load investigations and simulations are carried out to identify the critical loads on specific components or entire medical devices, such as a computed tomography (CT) scanner, while complying with standards relating to medical technology, such as IEC 60601. A number of design projects have also focused on improving the insulation of electric cables inside a variety of devices. In this area, Bertrandt Services is making an important contribution to ensuring patient safety on behalf of its customers. The main services provided by the team relate to X-ray devices and cover items as diverse as a patient couch and a mammography unit. The team is responsible for implementing the safety features and investigating new design options which will keep costs to a minimum in so-called design-to-cost projects. The engineers and technical specialists have also advised on changes to the materials which supporting components are made of and worked on optimising the enclosures. Detailed design and documentation services have also been provided for treatment devices. This includes creating requirements specifications and technical specifications for the devices in database form. In addition, a new version of a sensor cable has been developed and is currently undergoing clinical trials. The team's range of services also includes endurance testing.

Bertrandt Services covers the entire product development process from identifying initial ideas and producing designs through to building prototypes, documentation and implementation.

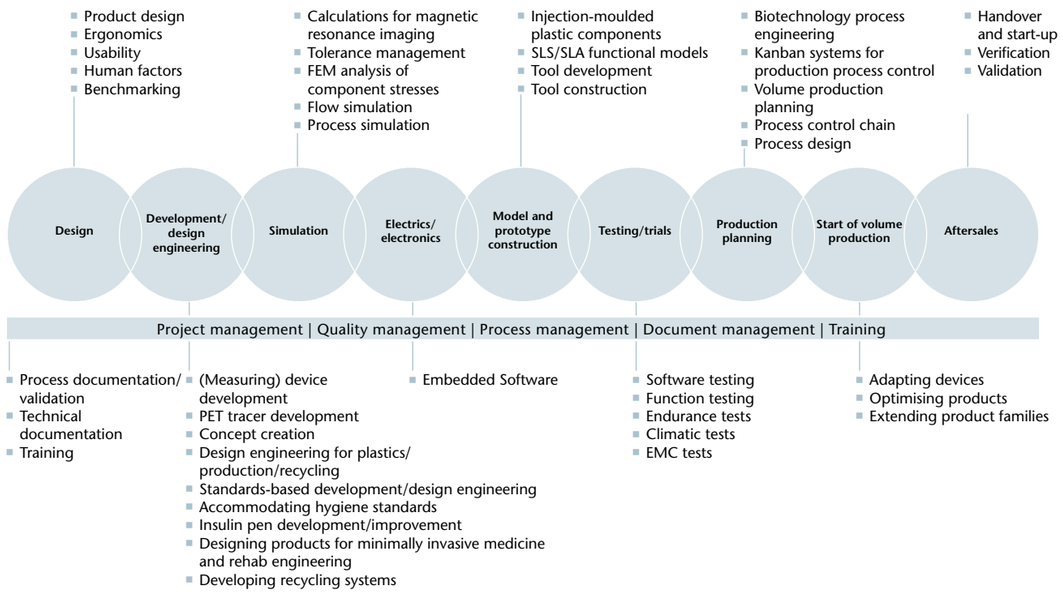
The strength of networking

As a result of the in-depth expertise available in the Bertrandt network, the Bertrandt Services team always has the right specialists at its disposal to meet its customers' requirements. For example, the team was able to call on the support of colleagues from the Ingolstadt site in the fields of requirements management and electronics hardware development. As a result, complex documentation tasks were completed within tight deadlines, which has proved to be a major benefit for customers from the medical technology industry.

One other thing has become clear to the members of the Bertrandt Services team in Kemnath: as a result of working in this field, they now see a visit to the doctor from a quite different perspective. ■

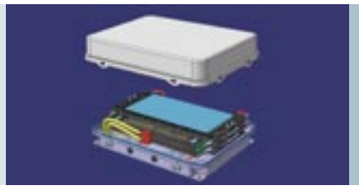
Gerhard Egloffstein, Sasa Peicic, Pascal Weiß, Ehningen

Medical technology services



Technical product designers lead the way

For the Bertrandt group, in-service training programmes are an important part of its human resources planning. In a dynamic environment, the training course for technical product designers in particular offers the company the opportunity to resolve the problem of a lack of trained staff and to fill its vacancies for qualified product designers. The designers at the Ehningen site give an insight into this interesting apprenticeship.



Job description

Technical product designers provide support for engineers during the development of technical products. Over the course of the three-year apprenticeship they learn how to create 3D CAD data sets, together with documentation, calculations and simulations, and they also acquire process and project management skills. As part of the training programme at Bertrandt, the technical product designers receive support during their projects in the form of training courses provided by the technical departments. Theoretical instruction is followed by practical tasks which the trainees work on in teams. The emphasis is placed on ongoing communication between the designers and the departments.

First year: Coffee machine project

During the first year of their apprenticeship, the technical product designers worked on developing a coffee machine. The product development process began with drawing up a schedule and a requirements specification. In order to identify the different potential solutions, a morphological box was created and the results were incorporated into the specification. This stage was followed by sketches of the designs. Next the dimensions were calculated and the trainees began the process of designing the machines in CATIA V5. In parallel with the coffee machine project, the designers underwent training in tolerancing, which involved initial exercises in geometric and dimensional tolerancing using the components they had already created. The fixtures concepts and quality features were designed and subsequently transferred. The result of the project was two different coffee machines which were presented by the trainees.

Second year: Battery module project

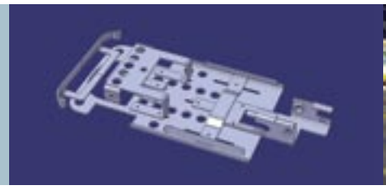
The project which the trainees worked on during the second year of their apprenticeship involved developing a battery module for a hybrid vehicle. The module consisted of the electrical system, the housing and the cooling system and was created by three teams who were supported by specialists from the component development department. The project was made up of planning, development and design phases, with the results being presented at the end of each phase.

Third year: Working in the departments

The technical product designers spent the last year of their training working in the relevant departments at Bertrandt, where they were able to put what they had learned into practice and become part of a new team. “Our colleagues always gave us plenty of practical, expert support,” said Tina Schreiber. “They had answers for all our questions and solutions for all our problems. The practical projects from the first two years of our apprenticeship and the slot car in particular gave us a feeling of pride,” explained Jan-Philipp Bähr. The new tasks and challenges in the third year were accompanied by additional responsibilities. “Some of us were able to work on projects at customers’ premises and gain additional experience. It was great to be given the chance to prove our abilities on-site.” It goes almost without saying that the contacts they made with customers and with the various departments in the Technikum will help the trainees in future and will certainly lead to some promising job interviews. “We all felt that the third year spent in the departments was very valuable. We learnt a great deal in technical terms and we also grew up a lot. We would like to thank everyone in the departments for their patience, their knowledge and their openness and for making the work so much fun,” was the final verdict of all the trainees. ■

The technical product designers and their trainer Friedhelm Fricke, Ehningen

Training at the Bertrandt Technikum



Ongoing slot car project

After becoming familiar with CATIA V5 during their first year of training, the technical product designers were given the opportunity to put their knowledge into practice independently. That was the start of the slot car project, which continued throughout the entire three years of the apprenticeship. The objective was to build a slot car on the basis of Bertrandt’s rules that was ready to race.

During the first year, the trainees designed the car body. They began with sketches and ideas on paper which were then converted into 3D models, taking into consideration the specifications. Important aspects at this stage included the key geometric data (for example wheelbase, track etc.), ease of manufacturing and mould release.

The second year was spent designing a suitable chassis. This also involved starting with sketches and designs on paper which were then entered into the CAD system. A comprehensive requirements specification formed the basis for the chassis design process, with the emphasis being put on adjustability, weight and ease of assembly.

The slot cars reached the racing track at the end of the third year. Firstly, the bodies had to be thermoformed in the workshop and the chassis kits ordered. The designers then began to add components to this basic setup. “Building the chassis was relatively easy for us,” said Manuel Cramer. “The surprise came when we had to fine-tune it.” However, a solution was found with the help of the experts. “After several attempts at painting the bodies, each of us came up with a personalised and very creative bodywork design,” said Markus Prokopp with legitimate pride. Once the cars were finished, the designers turned into real “speed junkies”. Races have been held regularly ever since the completion of the three-year slot car project.

Kick-starting your career

Prospects at Bertrandt

Training and developing solutions for customers – important success factors and motivating forces for Sebastian Gabelunke.

Customer satisfaction – according to Marika Reiser this is the best thing about working as a quality engineer.

Lifelong learning – Philipp Seitz enjoys the varied tasks and facing new challenges every day.

Bertrandt offers a wide variety of opportunities for engineering graduates and technicians and also for specialist engineers to gain experience of the automotive, aircraft and mechanical engineering industries and to develop and consolidate their expertise in these areas. As a result of the dynamic environment at Bertrandt, employees are constantly presented with new challenges, which represent the perfect opportunity for personal and professional development for anyone who is prepared to take them on. This is clear from the stories of three company insiders who give us an insight into their work.

Powertrain test engineer: At the cutting edge of development

When his degree course came to an end, Sebastian Gabelunke had clear ideas about the sort of job he was aiming for: "I didn't want to spend all my time sitting in front of a computer." At Bertrandt, his requirements have been met: "As a test engineer in the engine development department, a large part of my job consists of practical tasks and working directly with the test benches." Sebastian Gabelunke describes his initial period at Bertrandt as "the normal start to a graduate's career". During the first few weeks he was "thrown in at the deep end" but also had a "very structured" environment. Right at the start he began work on a project involving the design of a new engine. Working together with subcontractors, the team produced the solutions needed for a newly developed assembly. This included tasks such as designing and coordinating a variety of components, as well as planning, preparing, implementing and evaluating component, module and complete powertrain tests. "You need to have the basic knowledge that you acquired during your degree course constantly at your fingertips," says Sebastian and explains that additional specialist knowledge is essential to allow ideas to be developed further together with the customer and the team. This requires commitment both from the employee and the company, which must provide a wide range of training courses to give its staff all the support they need throughout their career path. Sebastian Gabelunke is particularly interested in working with new approaches to development. He explains his commitment to the company, which involves a continuous learning process and working with total dedication on solutions for customers, as follows: "I really enjoy being at the cutting edge of development and having the chance to compare the methods and practices that have become established over the last century and the opportunities offered by new materials, technologies and production processes." ■

Quality engineer: Discipline and commitment required

Marika Reiser joined Bertrandt as soon as she completed her degree. As a quality engineer she provides support for several quality teams in the field of powertrain electronics on her current project. "Our job is processing customer feedback, including so-called 0-km parts. These are components which are shown to have defects after being installed in the vehicle," she explains. Problems highlighted by the customer are reported to Marika by the aftersales department. She compiles the data needed for the vehicle's workshop visit, which is used by the development engineers to follow up complaints. In addition, the team works together to decide on the customer service measures that must be taken. "Our ultimate goal is to ensure that the customer is satisfied," she says.

According to Marika Reiser, the most important characteristics of a quality engineer are: "The ability to think analytically, to focus on results and to define objectives and, most importantly, the determination to achieve these objectives." Bertrandt offers its employees the support they need to be able to do this. Quality engineers have an extensive and exciting range of responsibilities and need to demonstrate both discipline and commitment. "We find solutions to problems, take the necessary action and ensure that objectives are met. At the end of the day we have satisfied customers and this is the really good thing about my job," says Marika Reiser. ■

Lead aviation development engineer: Varied tasks and challenges

Philipp Seitz also began his career at Bertrandt. After completing a degree in aerospace engineering at the University of Stuttgart, he joined Bertrandt as a design engineer and, only two and a half years later, was promoted to lead engineer in the aviation development department. The aspects of his job at Bertrandt that he particularly enjoys are the variety of tasks and the new challenges which give him the opportunity to constantly broaden his horizons. He finds it especially exciting to be able to follow the entire product development process from the initial design, the design engineering phase, simulation and testing through to the construction of prototypes. He feels that the dynamic environment at Bertrandt is a very positive feature of his job. "Streamlined processes and rapid decision-making are very important for me. In a very short time you can gain valuable insights into a wide range of subject areas – at the moment for example in E-Mobility," explains Philipp Seitz. ■

Sandra Fischer, Ehningen

Lake Constance – a location for innovative companies

New premises in Friedrichshafen

Bertrandt has had a presence in the Lake Constance region for over eight years. The successor to its project office in Markdorf is a new central office at the Prisma technology park in Friedrichshafen.

Background

In order to provide support for its initial projects in the Lake Constance area, Bertrandt Technikum GmbH rented premises in Markdorf. A project office was established in the Continental building where employees from the electrics/electronics department developed software and tested control units. The close partnership between Bertrandt and Continental has been constantly developed. Bertrandt-electronics and IT specialists, together with employees from other disciplines, are currently working on driver assistance systems at A.D.C., a Continental AG subsidiary in Lindau.

Electrics/electronics and Engineering Services: Individual services on the customer's doorstep

Lake Constance is an attractive location for innovative companies from a range of industries. ZF, Conti, TRW and other suppliers to the automotive industry are based here or have a development or production site in the area. Well-known names in the field of mechanical engineering include MTU, Schuler and Voith. Companies from the pharmaceutical and medical technology sector, such as Qiagen, Boehringer and Vetter, have a presence here, while the aerospace industry is represented by Dornier and EADS. These are all good reasons for Bertrandt to develop its activities in the area in order to provide customers with specialist, customised services right on their doorstep. The new central point of contact for business partners from all industries is the office at the Prisma technology park in Friedrichshafen, not far from the airport. Stephanie Seth is the contact person for Engineering Services and Rigobert Prestel for electronics development. The office has been providing services to customers since January 2011.
The employees in the new premises include Bertrandt engineers working on test systems based on National Instruments hardware and software. The portfolio of services on offer includes developing function testers for customers' products. The Bertrandt team's extensive experience, which results, among other things, from the company's collaboration with National Instruments, enables the team members to develop complex solutions in the field of electronics. Employees in the Engineering Services department provide functions such as project management, quality assurance, production planning and design and offer a range of high-quality, specialist development services. ■

Jürgen Weimer, Ehningen

Rüsselsheim to become model town for sustainability and mobility

Bertrandt joins the working group

In its role of development service provider with end-to-end expertise, Bertrandt has become a member of the "Sustainability and Mobility" working group. On 11 March 2011, the mayor of Rüsselsheim Stefan Gieltowski and a number of partner companies signed a declaration of their intent to work together to transform the town of Rüsselsheim into a model town for sustainability and mobility.

With its comprehensive knowledge of complete vehicle design and its expertise in the technologies relating to electro-mobility, the Bertrandt Ingenieurbüro is one of fourteen members of the working group. Other partners involved in the forward-looking project include the Rhein Main University of Applied Sciences, car manufacturers Opel and Hyundai, engineering service providers and the town's public services. They will be involved in developing and putting into practice new forms of local individual and public transport and energy supplies. The network is being coordinated by the town's business development agency. ■

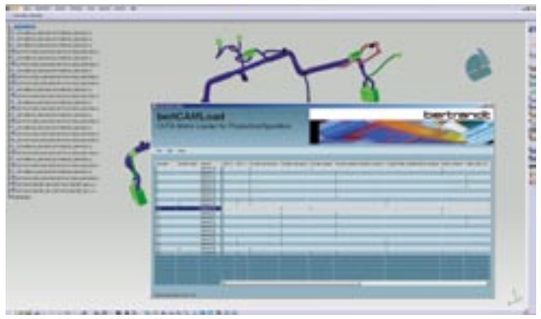
Anja Schauser, Ehningen

Bertrandt Cologne presents a CATIA V5 macro at the Dassault European Customer Forum

Complexity management for modular wiring looms

Around 1,500 decision-makers and specialists from the automotive and aircraft industries attended the Dassault European Customer Forum to discuss the use of CATIA. At the prestigious event, which was held in November 2010, Bertrandt presented its experiences of using CATIA in the development of vehicle electrical systems.

Interested experts at the Dassault European Customer Forum in Paris.



The BertCamLoader macro helps to manage complexity of the process of developing vehicle electrical systems.

The challenge in developing electrical systems: Increasing complexity

The growing number of electronic systems and the increasing personalisation of cars have had a significant impact on the process of developing vehicle electrical systems. Alongside new technological requirements (for example, electric cars), it is the ever greater number of functions and the resulting complexity that present the major challenge. For modern cars, it is often the case that as many as several thousand different wiring looms have to be produced during the course of one development project. Taking into account the surrounding electrical and electronic systems is just as important as considering the mechanical ones. In addition, the wiring loom plays a connecting role in relation to individual components throughout the vehicle.

Complexity management: Rapid solutions required

How do developers face up to these challenges? The first approach involves product lifecycle management (PLM) systems, many of which provide complexity management solutions. However, there are still some PLM systems which are not up to the job or which, for a variety of reasons, cannot be incorporated into the project.
At the Paris event, Bertrandt's Cologne site presented the CATIA Matrix Loader, a macro for CATIA V5 that manages this complexity within the development process, together with the relevant data. The CATIA Matrix Loader controls a feature-based list which is linked to the relevant CATIA V5 model. When a wiring loom variant is selected in the CATIA Matrix Loader, all the accompanying data sets are transferred to CATIA V5. New properties can also be incorporated quickly and easily, for example when a product specification changes. This allows complexity errors to be prevented right from the start.

During the presentation and in the discussions which followed, the audience had the opportunity to find out about the functionality of the CATIA Matrix Loader and Bertrandt's electrical and electronics expertise. The team from the Cologne site were able to make numerous contacts and to agree on dates for follow-up meetings to discuss in detail possibilities for future cooperation with other companies on the development of vehicle electrical systems. ■

Klaus Schulte-Austum, Thomas Bovenderd, Cologne

Corporate Calendar | Bertrandt Sites

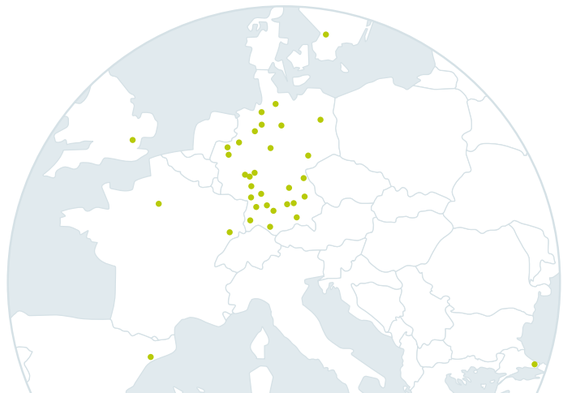
15–25/09/2011	64th IAA Cars in Frankfurt
16/09/2011	VDI recruiting day, Dortmund, Westfalenhallen Congress Centre
22–23/09/2011	Impress3D, Berlin
26–28/09/2011	ISAL 2011, Darmstadt
11/10/2011	VDI recruiting day, Karlsruhe, Congress Centre
12–13/10/2011	Electronic Systems for Motor Vehicles 2011, Baden-Baden
18–20/10/2011	EuroCarBody 2011, Bad Nauheim
19/10/2011	Career Contacts, Karlsruhe University of Applied Sciences
20/10/2011	VDI recruiting day, Fürth, town hall
26/10/2011	Company contact fair, Magdeburg
26–27/10/2011	Chance, Osnabrück University of Applied Sciences
26–27/10/2011	bonding, Berlin
27/10/2011	Connecta, Regensburg University of Applied Sciences
27–29/10/2011	Composites Europe Expo, Stuttgart
02/11/2011	meet@ Ostfalia University of Applied Sciences, Wolfsburg Campus
03/11/2011	Career Day, University of Ulm
03/11/2011	ZWIK, business and industry contacts, Zwickau
08/11/2011	meet@ Darmstadt University of Applied Sciences
08/11/2011	Company contact fair, Trier University of Applied Sciences
09/11/2011	Company day, Bonn-Rhein-Sieg University of Applied Sciences
10/11/2011	meet@ Rheinmain University of Applied Sciences, Rüsselsheim site
10/11/2011	Konaktiva, Dortmund
11/11/2011	VDI recruiting day, Ludwigsburg, Forum am Schlosspark
14–15/11/2011	bonding, Braunschweig
17/11/2011	VDI recruiting day, Munich, M, O, C
18/11/2011	Kontaktpunkt fair, Konstanz
23/11/2011	Fair for medium-sized IT companies, Esslingen University of Applied Sciences
30/11/2011	meet@ Dresden University of Applied Sciences
28–30/11/2011	bonding, Aachen
30/11/2011	VDI recruiting day, Hamburg, Chamber of Commerce
30/11–01/12/2011	Technology area at the Graduates Congress in Cologne
08/12/2011	Annual report press conference, Stuttgart
08/12/2011	Analysts press conference, Frankfurt
19/01/2012	meet@ Mittelhessen University of Applied Sciences, Friedberg Campus
15/02/2012	Bertrandt AGM, Sindelfingen

Bertrandt

Bertrandt AG | Head Office	+49 7034 656-0	info@bertrandt.com
Altenburg	+49 3447 8900-00	altenburg@de.bertrandt.com
Bremen	+49 421 163359-0	bremen@de.bertrandt.com
Ehningen	+49 7034 656-5000	ehningen@de.bertrandt.com
Donauwörth	+49 906 98004-15	donauwoerth@de.bertrandt.com
Friedrichshafen	+49 7541 37479-0	friedrichshafen@de.bertrandt.com
Hamburg	+49 40 7975129-0	hamburg@de.bertrandt.com
Ingolstadt	+49 8458 3407-0	ingolstadt@de.bertrandt.com
Kassel	+49 561 8907821-0	wolfsburg@de.bertrandt.com
Cologne	+49 221 7022-0	koeln@de.bertrandt.com
Mannheim	+49 0621 81099-289	mannheim@de.bertrandt.com
Munich	+49 89 316089-0	muenchen@de.bertrandt.com
Neckarsulm	+49 7132 386-0	neckarsulm@de.bertrandt.com
Nordsteimke	+49 5366 9611-103	wolfsburg@de.bertrandt.com
Regensburg	+49 89 316089-0	regensburg@de.bertrandt.com
Rüsselsheim	+49 6134 2566-0	ruesselsheim@de.bertrandt.com
Stadthagen	+49 5721 9274-50	stadthagen@de.bertrandt.com
Wolfsburg	+49 5366 9611-0	wolfsburg@de.bertrandt.com
Projektgesellschaft	+49 7034 656-0	bpg@de.bertrandt.com
France		
Montbéliard	+33 3 81993500	sochaux@fr.bertrandt.com
Paris	+33 1 69351505	paris@fr.bertrandt.com
Great Britain		
Dunton	+44 1268 564 300	dunton@uk.bertrandt.com
Sweden		
Trollhättan	+46 520 4865-00	trollhattan@se.bertrandt.com
Spain		
Barcelona	+34 93 777 87-00	barcelona@es.bertrandt.com
Turkey		
Istanbul	+49 7034 656-0	istanbul@tr.bertrandt.com
USA		
Detroit	+1 248 598 5100	detroit@us.bertrandt.com

Bertrandt Services

Head Office	+49 7034 656-4500	info@bertrandt-services.com
Berlin	+49 30 243102-186	berlin@bertrandt-services.com
Bielefeld	+49 521 923970-0	bielefeld@bertrandt-services.com
Dortmund	+49 231 725198-0	dortmund@bertrandt-services.com
Düsseldorf	+49 211 5206577-0	duesseldorf@bertrandt-services.com
Flörsheim a. M.	+49 6145 54606-0	floersheim@bertrandt-services.com
Frankfurt	+49 6134 2566-700	frankfurt@bertrandt-services.com
Freiburg	+49 761 888572-0	freiburg@bertrandt-services.com
Göppingen	+49 7161 65883-0	goeppingen@bertrandt-services.com
Hamburg	+49 40 7975129-2800	hamburg@bertrandt-services.com
Heilbronn	+49 7132 386-400	heilbronn@bertrandt-services.com
Karlsruhe	+49 721 6273699-0	karlsruhe@bertrandt-services.com
Kemnath	+49 9642 705-2140	kemnath@bertrandt-services.com
Cologne	+49 0221 7022-490	koeln@bertrandt-services.com
Mannheim	+49 621 432707-0	mannheim@bertrandt-services.com
Munich	+49 89 1202127-0	muenchen@bertrandt-services.com
Nürnberg	+49 911 3506449-0	nuernberg@bertrandt-services.com
Stuttgart	+49 7034 656-4600	stuttgart@bertrandt-services.com
Ulm	+49 731 715783-00	ulm@bertrandt-services.com



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