Bertrandt*magazine*

The Customer Magazine of the Bertrandt Group
Nr. 15 | September 2015

POWERTRAIN
Developing drive systems

OPEL CORSA
From the initial concept to the start of production

ACCESS CONTROL FOR CONTAINER PORTS
High-quality automated safety system

EDITORIAL INFORMATION

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For reasons of simplicity and clarity, the pronoun "he" is used in general references to employees. This is not intended in any way to discriminate against female employees.

EDITORIAL

Dear reader, the automotive world is in a state of constant change. Against the background of the latest trends, which include environmentally friendly transport solutions, comfort, safety and networking, the car industry is making an important contribution to innovation in terms of technological progress and providing a wide variety of interesting jobs that guarantee both a high standard of living and a good quality of life. As a development specialist, Bertrandt is part of this environment and, with its services, is helping to develop the transport solutions of the future, alongside manufacturers and suppliers, from the initial concept right through to volume production.

The latest issue of our customer magazine gives you an insight into our work. The central theme is current and future developments in the powertrain department. These include, for example, every aspect of the megatrend for environmentally friendly transport. Bertrandt's projects are characterised by interdisciplinary skills and one example of this is the development of the latest generation of the Opel Corsa in Rüsselsheim. The depth of services that Bertrandt can provide is demonstrated by the networking solutions produced by the electronics development department. Engineers in our testing department have created a protective restraint system to improve safety levels for vehicle occupants. Another article in this issue covers innovative testing methods for vehicle air conditioning systems.

I would also like to invite you to visit our stand at the Frankfurt International Motor Show (IAA) where you will have the opportunity to experience the latest technological developments at first hand in the form of our driving feel simulator and gesture control system.

What else is happening at Bertrandt? We are constantly expanding our portfolio of services to meet the requirements of our customers and the market. Over the last two years, we have invested more than 100 million euros in our technical infrastructure to ensure that we will continue to be a reliable, competent and trustworthy partner in future.

I hope you enjoy reading this latest issue of the Bertrandt magazine.

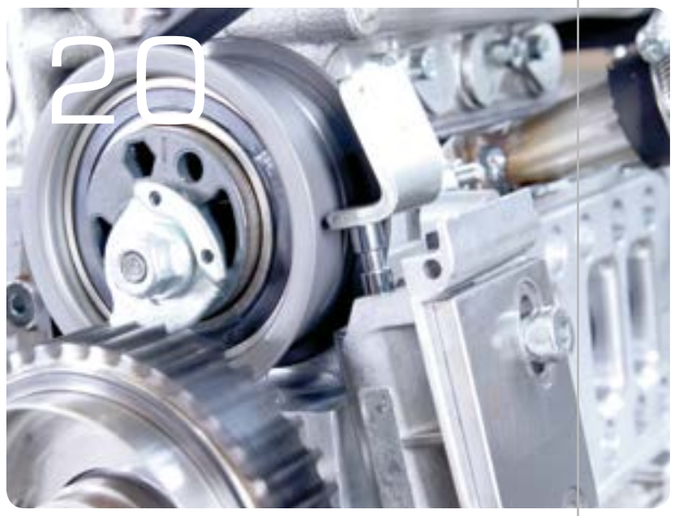
Dietmar Bichler

IN THIS ISSUE

OPEL CORSA

ACCESS CONTROL SYSTEM FOR CONTAINER PORTS

POWERTRAIN



INNOVATIVE DRIVER ASSISTANCE SYSTEMS

RESTRAINT SYSTEM FOR FRONTAL COLLISIONS

AUTOSAR TESTS

SPOTLIGHT

Design modelling and rapid technologies

HIGHLY EFFICIENT MILLING MACHINE FOR COMPONENTS LARGE AND SMALL

The Technikum in Ehningen has invested in a new Fooke gantry milling machine. This is the Endura 904LINEAR, one of the largest machines used for creating vehicle models. The new Fooke machine will come into operation on schedule at the end of 2015. The figures are impressive: the machining area is 7.5 metres long, 3.5 metres wide and 2.5 metres high. This allows even large models, such as SUVs, to be milled in one piece. In addition, the Endura 904LINEAR can be loaded via a door or from above using a crane, which is particularly practical given that some of the components for milling can weigh up to eight tonnes. The huge machine can also perform precision tasks and, therefore, it covers the whole range of milling requirements. Components 7.5 metres in length and those only 20 centimetres long do not present a problem for the new Fooke machine. A dynamic linear drive motor, similar to that of a high-speed train, leads to shorter processing times, increased efficiency and more reliable processes. ■

Powertrain

PRACTICAL DRIVING SEMINARS

In cooperation with Mdynamix AG, Bertrandt has expanded its repertoire of driving seminars with a practical course entitled “The interaction between chassis and handling”. Participants have the chance to experience how the chassis and the vehicle’s handling interact with one another and to learn about the influence of individual components on the vehicle’s behaviour. The ability to carry out and reproduce specific driving manoeuvres forms the basis for identifying handling differences. Experienced instructors explain the background to the driving manoeuvres and help the participants to perform them more effectively. In the car, the participants discover how changing individual component parameters affects the handling. The course is aimed at specialists from car manufacturers, suppliers and research institutions working in areas such as chassis design, driving dynamics and road testing, simulation / CAE, powertrains, electrics and electronics, functional development and preliminary development. ■

Electronics development

TELEMATICS TEST FACILITY

COMPLETE INFRASTRUCTURE FOR VALIDATING TELEMATICS SYSTEMS

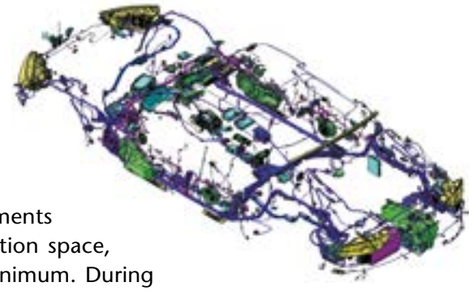
A comprehensive testing infrastructure is needed to validate complex telematics and infotainment systems. In order to enable our customers to carry out these tests, Bertrandt has established a test facility with 100 workstations. The IT systems in the test facility are linked to those of the customer. The test workstations have the necessary antenna signals for testing satnav, telephony and infotainment systems, such as radio and television. Bertrandt has invested in a central antenna system and a distributor to provide the high frequency signals at the workstations. Of course, it is also possible to connect international broadcasting systems from the USA or Asia to the high frequency distributor to allow the systems to be fully tested. Special signal generators allow the original signal streams from the target countries to be reproduced. The large number of different components that require testing calls for individual test equipment and this is maintained and managed by Bertrandt in its role as the operator of the test facility. Bertrandt is also responsible for organising and preparing for vehicle tests as part of complete projects. Our customers commission the tests in packages of different kinds, which means that engineers from other companies often work alongside Bertrandt’s specialists in the test facility. Car buyers are putting increasing emphasis on telematics and infotainment systems and, as a result, the development services and innovations in this area are likely to increase. The telematics test facility represents an important investment in the future of Bertrandt. ■

SPOTLIGHT

Electronics development

WIRING HARNESS DEVELOPMENT AND ELECTRICAL PACKAGE

COMPLEX COMPONENTS INTEGRATED INTO THE DESIGN OF THE AUDI A6/A7



Electronic systems form the basis for a variety of new functions and, as innovation drivers, fulfil the requirements of legislators and customers alike. As a result, cars have become more reliable, safer, more comfortable, more user friendly and more environmentally friendly. Because of the growing proportion of electronic systems in vehicles, the development of wiring harnesses has in recent years become one of the most important areas of technical development in the automotive industry. The wiring harness is now the heaviest and most expensive electrical and electronic component in vehicles and plays an important role in their overall quality. Bertrandt was commissioned to help define the functions of the electrical components, ensure that they were correctly positioned in the vehicle and develop the most efficient wiring harness design. As a result, we were involved with the entire vehicle and took responsibility for meeting the design requirements and keeping the installation space, weight and cost to a minimum. During the A6/A7 project, we coordinated and supported the systems suppliers who were developing complex wiring systems. Our engineers also had to integrate the modular longitudinal matrix into the electrical development process and into the wiring harness and vehicle structure. In addition, we took responsibility for standardising the electrical package across the different derivatives with specific drive systems and energy concepts. ■

Machinery and plant construction

FOCUS ON AUTOMATION

The miniature production line developed against the background of the Industry 4.0 trend demonstrates one aspect of our specialists' expertise. The focus was on creating linked processes and system controls, for example by connecting tasks and machines using intelligent robotic functions. As part of this activity, our engineers networked different system controls to create a functional and compatible electrical circuit for the production line. An additional safety feature was included to provide fully automatic protection for restricted areas. Some individual components are in constant communication with one another, in order to guarantee the highest possible level of safety, for example during maintenance work or the modification of components of the production line or of one production area. The exhibit exploits the synergies between the key technical sectors – the automotive, electrical engineering, mechanical engineering and plant construction industries – and also demonstrates how individual processes and systems can be networked. ■

Medical technology

DEVELOPING INNOVATIVE CARDIAC TECHNOLOGY

SUCCESSFUL COLLABORATION WITH BERLIN HEART GMBH

Berlin Heart develops, produces and markets innovative systems that provide mechanical support for the heart for patients of all ages. The fast time to innovation and the technological features of this market leading company's products are unique and impressive. Since 2013, Bertrandt has been providing software development, design, testing and electronic hardware development services for Berlin Heart.

EXCOR® Adult

Implantable and external systems support the heart

Berlin Heart offers help in the form of two different systems to patients whose hearts can no longer pump enough blood through their bodies. One is the INCOR® system that can be implanted to support the left ventricle. A portable control unit powered by a battery gives the patient a high level of flexibility. The INCOR® system is used for people who are waiting for a donor heart or who are not suitable for a transplant. The other system is the EXCOR®, which is not implanted, but instead pumps blood into the blood vessels from outside the body via cannulas. The EXCOR® system can support one or both ventricles and can be used in the short, medium or long term. Berlin Heart offers another solution specifically for children, infants and babies which is based on the EXCOR® system and is compatible with a wide variety of blood pumps and cannulas.

Successful partnership between Bertrandt and Berlin Heart

Bertrandt has been providing development services for these highly sensitive products since 2013. The Bertrandt employees who work for Berlin Heart must meet very high standards and take a great deal of responsibility. They have been involved, among other things, in programming the software algorithms that control the communications between different components of the system, designing the housing for the next generation pump and reworking the electronic assemblies so that they can be approved for use in new markets. They have also helped with testing the redesigned EXCOR® drive system before product approval.
Our experts have enabled Berlin Heart to continue supplying reliable and globally recognised products that promote the health of patients of all age groups. ■

INDUSTRY EXHIBITIONS

AUTOMOTIVE ELECTRONICS IN FOCUS

The key themes at this industry event in Baden-Baden were HMI and multicore processing. Using the gesture control system “b.Motion II”, Bertrandt was able to demonstrate its electronics development expertise.
apply & innovate
Members of the powertrain / chassis department attended the apply & innovate fair for the first time. The mobile driving feel simulator developed by Bertrandt in-house received a positive response from the visitors to the conference.

AACHEN ACOUSTICS COLLOQUIUM

The colloquium focused on noise quality, troubleshooting and sound design, NVH measurement, aeroacoustics, simulation and virtual reality. Experts from Bertrandt’s testing and validation department presented their specialist services.

I+E INDUSTRY + ELECTRONICS

i+e is the largest industry exhibition in south-western Germany covering electrical engineering, electronics, mechanical engineering, metal-working, information technology, plastics and industrial services. One eye-catching exhibit on the Bertrandt stand was the innovative e-scooter that has been developed in-house.

Vehicle quality.

DAGA.


Vehicle electrical systems.

AACHEN COLLOQUIUM “AUTOMOBILE AND ENGINE TECHNOLOGY”

The participants in Europe’s largest congress on automotive and engine technology discussed the latest trends in research and development. Once again, specialists from the Bertrandt powertrain department attended the event.

SIMVEC “SIMULATION AND TESTING”

Experts from our simulation and testing departments were in great demand at this conference in Baden-Baden, providing information about the most recent developments in the fields of simulation and validation.

Find out more about the exhibitions attended by Bertrandt on our website:
http://www.bertrandt.com/en/investor-relations/dates.html

DAGA

The key topics at this annual acoustics conference included electroacoustics, noise assessment, hydroacoustics, vibration engineering, speech processing, acoustic measurement equipment, vehicle acoustics, sound design and flow acoustics. Specialists from Bertrandt’s testing department were much in demand.

PLASTICS IN AUTOMOTIVE ENGINEERING

The latest innovations in the field of components and materials represent a major step forward in terms of energy efficiency, weight reduction, safety, functionality, design and comfort. Bertrandt’s bodywork specialists attended this conference in Mannheim.

VEHICLE ELECTRICAL SYSTEMS

Development experts from the electronics department travelled to Ludwigsburg to discuss key issues such as the use of aluminium in electrical systems, new cooperation models in the development process and requirements for future electrical system components.

HANOVER FAIR

Automation was the key theme of the Hanover Fair. Our engineers demonstrated an exhibit developed by Bertrandt in-house.

ADVANCES IN AUTOMOTIVE ELECTRONICS

The Bertrandt electronics development department presented its expertise in the fields of infotainment / connectivity, networked vehicles, autonomous driving, electric cars and vehicle architectures. The gesture control system “b.Motion II” was well-received by attendees at the event.

Hanover Fair.


Aircraft Interiors Expo.

AIRCRAFT INTERIORS EXPO

At Aircraft Interiors Expo in Hamburg the focus was on innovations in the field of aircraft interiors and the related services and products. Specialists from Bertrandt’s Hamburg site discussed a variety of issues relating to the aviation industry.

CHASSIS.TECH PLUS

Networking the powertrain and the chassis systems increases ride comfort and safety and also makes new functions available. In addition, the modularisation and electrification of the powertrain requires innovations in chassis design. Our powertrain team presented their expertise in this field using an exhibit developed in-house.

THE OPEL CORSA SETS NEW STANDARDS IN ITS SEGMENT

SUPPORTED BY BERTRANDT FROM THE INITIAL CONCEPT TO THE START OF VOLUME PRODUCTION

The Corsa is a bestseller. More than 12.4 million have been sold since the model was first launched 32 years ago. The fifth generation of the Corsa is setting new standards in the small car segment in terms of its chassis and drive systems, networking and driver assistance.

Headlights with LED daytime running lights.

Sophisticated and spacious interior.

Attractive rear view: broad and dynamic.

A tried-and-tested concept using the latest technology

The goals of the development process for the new Corsa were to retain the spacious interior and compact external dimensions of its predecessor, to comply with new standards and to introduce innovations. As Bertrandt had already worked on the development of the previous model, we were fully familiar with the requirements of the small car segment. For the new generation of the Corsa, we were commissioned by Opel and its system suppliers to develop components for the body, doors and closures, exterior, lighting systems, electrical and electronic systems and interior. The services we provided covered the initial package phase, including the design of the vehicle, the creation of the concept and the development of the components through to the start of volume production.

High standards of ride comfort and safety

The new model is almost exactly the same size as its predecessor, but has a completely new chassis. The intention was also to retain the dynamic Corsa silhouette, which is part of the characteristic Opel design philosophy. Integrating a range of assistance systems and comfort functions presented a challenge for the entire Opel development team, the system suppliers and Bertrandt. On the one hand, the strict rules on retaining the main dimensions and components allowed us to work on a more clearly defined package than has been the case with other projects. On the other hand, the rules led to greater demands being placed on our engineers.

Expertise in styling, technology and interfaces

The newly designed front end was highly challenging. With its elegant headlights, wing-shaped daytime running lights and trapezoid grille with a prominent chrome bar and large lightning badge, it gives the new Corsa a strong presence on the road. At the same time, the engineers had to meet the strict frontal impact and pedestrian protection requirements. We completed the relevant tasks during the course of several development loops in collaboration with the Opel specialists and system suppliers. The development of the rear of the vehicle was also a challenge for us. The outward leaning, two-part rear lights and the horizontal lines give the rear end a stretched appearance which makes the car seem wider. As Bertrandt was responsible for integrating both components, it was possible to take a cross-departmental approach to developing and evaluating them. This allowed us to present solutions in our meetings with Opel that had previously been agreed on, which reduced the number of development loops and saved valuable time.

Generous interior with excellent networking

The sophisticated interior of the new Corsa makes use of high-quality materials with a premium finish. The clearly designed cockpit with its eye-catching instrument panel has a spacious feel. In the centre, between the driver and passenger, is a seven-inch touch screen for the IntelliLink infotainment system. Working with the project engineers from the various Opel departments, our electrical, bodywork and interior specialists were responsible for positioning the different sensors and control units which provided a range of safety systems and comfort functions for end customers. The proximity between our developers and the experts from our validation and testing department in our new electronics competence centre was very helpful, particularly during the start-up phase. The new Corsa comes with lane departure warning, side blind spot alert, traffic sign assist and forward collision alert, together with advanced park assist and a rear view camera. The steering wheel and windscreen are also heated, which is rare for a car of this class. ■

Christian Hemme, Michael Schmitt, Rüsselsheim

IN BRIEF

OPEL CORSA

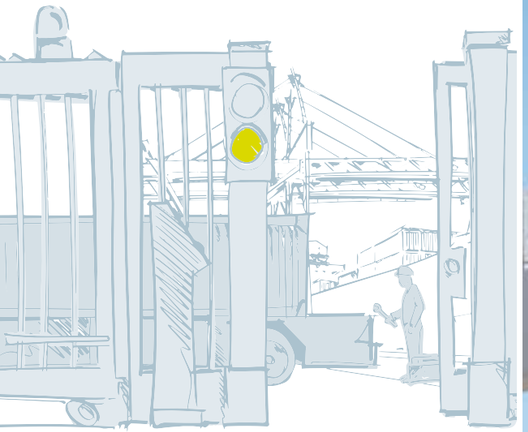
Development and design

- Interior (instrument panel, door trim, roof liner, floor coverings / insulation)
- Body
- Doors / closures (door, tail gate)
- Exterior (bumpers, grille)
- Lights (headlights, rear lights, third brake light, fog lights)
- Electrics

HIGH-QUALITY AUTOMATED SAFETY SYSTEM

DEVELOPING AN EFFECTIVE ACCESS CONTROL SYSTEM FOR CONTAINER PORTS

High-performance systems for ports are becoming increasingly important, because of the need for a rapid throughput of containers, the cost of waiting times in ports and the complexity of the logistical loading and transport processes. In order to guarantee the port's efficiency, everything must run smoothly. This brings major competitive advantages in the tough container shipping business. Bertrandt has developed a safe, automated access control system based on programmable logic controllers from Siemens which can communicate with other controllers and distributed units.



Access control system.

Automated guided vehicles transport containers at up to 6 m/s.

Guaranteeing safe operations at the port

The access control system makes certain areas inaccessible to the automated guided vehicles (AGVs) that transport containers at speeds of up to 6 m/s and to the loading cranes for the ships, trains and interim storage facility on the port site. The area where the fully automatic container transport systems operate is completely fenced off. Gates and barriers allow access to the automated area, but only when the area immediately beyond the gates and barriers has been blocked off by the access control system to ensure that it is safe. The system enables people to use the site safely when the terminal is in operation while the AGVs continue to function normally on the remainder of the site.

Complex tools developed in-house

The different layers of the system from the control unit on the gate (button, key-operated switch etc.) to the graphical user interface on the computer screen communicate with one another by means of a standardised software interface. As this is the first system of its kind in the world, there were no existing, functioning subsystems that could be used for development and testing purposes. In order to ensure the high quality of the system, a generic .NET-based library was developed at the site. It is highly flexible, scalable and easily integrated. It also incorporates the general functions of the OPC (Open Platform Communications) standard, which are software interfaces that allow data to be exchanged by applications from different manufacturers within the automation system. The library also offers complex application-specific functions.

On the basis of the library, an intuitive, generic OPC client was created which allows messages to be logged and filtered, without the precise structure being known when the program starts. An editor was developed that enables data of any kind to be compiled, visualised and sent at regular intervals.

The strict separation between sending and receiving makes it possible to test specific components independently of one another and to control or monitor individual parts during the commissioning process without influencing the complete system or needing the use of its functions.

As these applications will operate regardless of the reaction from their counterparts, because they send without evaluating the response, another program was written which provides all the functions needed to implement complex test cases at run time using scripts.

In order to make the system easier for users to understand, a “terminal observer” program was developed towards the end of the project, which shows all the relevant components and their status on a map of the port facility. This is so flexible that it can be used for any subsequent port. The framework takes responsibility for all the protocol-related communications so that users can focus only on the functions relevant to them.

Flexible test set-up

These tools made the process of testing the interaction of all the components in the system significantly simpler. Endurance tests could be run on the test set-up in the Düsseldorf project office, while the auxiliary programs could be used for logging and data checking live on the port site during the commissioning process. Because of their generic structure, these programs are suitable for use in future projects for testing and quality assurance purposes. ■

Ingo Fanelsa, Düsseldorf

IN BRIEF

HIGH-QUALITY AUTOMATED SAFETY SYSTEM

Complexity, modularisation and standardisation are factors that characterise the fields of automation and software. Working closely with our customers, we develop innovative mechatronic and electronic solutions. During this process, our engineers maintain a consistent focus on infrastructure development and interface management. Our portfolio of automation and software services is as follows:

Automation

- Programming (high-level languages, PLC)
- Fail-safe systems
- Application development
- Product development support
- Planning
- Networking / process data management
- Visualisation / interfaces
- Bus connections / M2M communication protocols
- Process control engineering
- Robotics / measuring and control systems
- Commissioning service

Software

- Software architecture
- Software development
- Model-based software
- Embedded systems
- Basic and application software
- Code generation
- Software testing
- Test specifications
- User interfaces
- Database development
- Software processes and methods
- Safety software

POWER-TRAIN

Meeting ever higher demands regarding vehicle dynamics while ensuring low emissions and good fuel economy – these are the challenges facing engine development. The key drivers of innovation are not only new and alternative powertrains, for example hybrid and electric drive systems, but also the further development of existing concepts. A development service provider is required to have interdisciplinary expertise, above all in the fields of internal combustion engines and alternative drive systems. Component development, thermodynamics, thermal management and engine management are the main fields of activity at Bertrandt. Our developments are focused on engine calibration, exhaust aftertreatment, reduction of emissions, downsizing and the electrification of the powertrain.

DEVELOPING DRIVE SYSTEMS

MATTHIAS RÜHL, HEAD OF THE POWERTRAIN COMPETENCE CENTRE, ON THE NEW CHALLENGES IN THE POWERTRAIN SECTOR

Increasingly strict emissions legislation and fuel efficiency regulations, the growing number of competing powertrain concepts and more and more complex sub-systems are demanding a comprehensive consideration of the powertrain, How are you helping the automotive industry to comply with future emissions legislation?

Our powertrain development is fundamentally concentrated on three pillars to provide expert and forward-looking support for our customers on current issues. The first is the tightening of worldwide emissions standards, which involves new test cycles such as the Worldwide Harmonized Light Duty Test Cycle (WLTC) and the Real Driving Emissions (RDE) tests. The introduction of the WLTC not only increases the dynamic proportions and the top speeds in the test cycle compared to the New European Driving Cycle (NEDC), but also tightens the testing conditions, such as the level of vehicle equipment and the environmental conditions. We are talking about a test in which vehicles for different markets are tested under identical conditions. The focus is on the comparability of the test stand measurements. At the same time, the EU Commission is planning to introduce RDE legislation. For that reason, a further focus for us is on real driving emissions and the related PEMS (Portable Emission Measurement Systems) measurements in real driving conditions. >

> The tightening of worldwide emissions standards will also result in new driving cycles.

Equally demanding for us is the worldwide emissions legislation on CO_2 regulation. Think, for example, of the EU7 standard, which controls pollutant emissions and foresees a mean limit value of only 95 g/km for vehicles in Europe from 2020 onwards. Our challenge is to present feasible solutions. Parallel to this, we have expanded our expertise in exhaust aftertreatment with our own PEMS systems and the development of a random cycle generator – a complex tool with which we can create random driving cycles that can then be driven on a roller dynamometer or an engine test stand for RDE calibration. And, of course, we are continuing to develop our measuring and evaluation methods.

> When it comes to CO_2 reduction, we are called upon to find feasible solutions.

Powertrain control systems are also facing greater challenges regarding driving performance, exhaust standards and fuel consumption. More complex powertrain architectures, including electrification, require the continuous further development and new development of functionalities and applications. How is Bertrandt positioning itself in this environment? What methods and tools are your specialists using to address these new challenges?

For us, the increasing complexity of functions also means a significantly higher amount of effort for on-board diagnosis. >

> Our aim is to automate calibration work, at least partially.

For example, the number of labels that need to be parameterised in the next ECU generation will increase by a factor of three to four. We are attempting, at least in part, to automate the calibration effort involved by applying Design of Experiments and similar procedures. And we must not forget our own development “b.eco”, which is currently in the validation phase.

Here, “eco” stands for Engine Calibration Optimisation. We want to use this tool to generate engine maps by exploiting the maximum degree of automation, for example to optimise specific fuel consumption. We integrate the tool online into common test stand equipment, thus significantly reducing measuring and calibration time and the costs involved. Continuous self-diagnosis ensures data consistency in order to detect hardware and software faults immediately – distinctive advantages in the development process. >

Reducing emissions by intelligent thermal management – our industry is discussing the influence of thermal management on fuel consumption and emissions more than ever before. How does this affect the development services at your Competence Centre?

A very special focus at Bertrandt is on thermal management, which is an important technology pillar at the Powertrain Competence Centre. We at Bertrandt can already offer our customers fast, low-cost and reliable efficiency statements at an early stage of development. This is because we implement parameter studies, reveal optimisation potentials and perform validation in simulation, on the test bench and directly on the vehicle. In short: we have established a complete development process chain – from virtual 0D and 1D simulation and real simulation with cold and hot water test stands through to validation on test stands and on the vehicle and calibration of control functions in the vehicle itself.
We designed and commissioned the cold and hot water test stands ourselves, including a measuring chain that we developed and our "b.automized" test stand automation system. At the moment, validation of the measuring chain is taking place in the vehicle, and we have built a test vehicle based on an AUDI A3 especially for this purpose.

Thermal management is an important technology pillar at the Powertrain Competence Centre.

Measures to reduce friction and weight are being applied to improve fuel economy. How do you evaluate this discussion? Are there such approaches or competence projects also at Bertrandt?

You will, of course, find the usual discussion regarding downsizing, but we are also examining issues such as optimum component development, endurance strength and lightweight design, which correspond to our key areas of expertise in engine mechanics. I would particularly like to point out our competence project, Bertrandt's low-cost engine (LC engine), which we have developed as a technological concept study. This engine represents a preliminary study that will lead to a fundamental examination of the combustion process. The initially modest size of the engine will still offer considerable potential for reducing weight in the next stage of development. Our motivation was the approach towards developing and implementing unconventional engine concepts, as this has been right at the top of car manufacturers' agendas for several years. The technical requirement profile for engines is changing significantly, especially with regard >

to powertrain configurations in which the internal combustion engine is mechanically decoupled from the drive train and is used only as a range extender. For that reason, we decided to develop the LC engine as a technological experimental unit in the light of the increasing level of hybridisation in powertrains.

> Due to increasing degrees of hybridisation, we have developed the low-cost engine as a technological test unit.

Another technologically pioneering development is our engine management system, a highly flexible control unit based on a rapid control prototyping platform. For this purpose, we chose the PROtroniC development control unit solution. The starting point for the software architecture is a diesel functional model that is specially adapted to the LC engine and which includes a new fuel path for activating the injectors. To simulate the start of activation and the duration of the feed to the solenoid injectors, we introduced additional parameters to the fuel paths. Furthermore, the synchronisation of the crankshaft drive and the valve timing assembly was modified to allow for the functional release of the injection system. In order to ensure a reproducible injection sequence, we defined a suitable feed sequence which was spread over the different activation phases. In addition, the functional model for the air path was adapted and the control of the centre of combustion was adjusted and modelled on the basis of the charging pressure and cylinder pressure.

Bertrandt specialists are therefore very active in these issues, and for that reason we are often invited to give semester lectures at universities. We also work closely together with students who are fans of motor sport by promoting young talent. For example, since 2012 our Cologne office has been supporting the Formula Student team from Bonn-Rhein-Sieg University of Applied Sciences, which has even moved on to Formula Student Electric. The young students are researching and working on the optimisation and further development of sustainable powertrain and energy concepts. The result: their electric racing car “Rosana” has already been very successful. >

The Connected Car is becoming more important than ever before in the vehicle development process due to the integration of modern driver assistance systems and the hybridisation and electrification of powertrains. How are you responding to this in the Powertrain Competence Centre? How does cooperation with other disciplines within the Bertrandt Group work?

Our customers are expecting us to take on more and responsibility in projects. One competence centre alone can hardly achieve this. For example, in the function development of engine management systems, we rely on the software expertise of our colleagues from the Electronics Competence Centre. Good examples of this cooperation are the control unit for our LC engine and our driving dynamics simulator. For these purposes, we worked together with the Electronics Competence Centre to develop an electronic damper control system than can be experienced on the simulator. Or take the example of battery technology, which is currently moving into a new dimension. Whereas the battery used to be only an intermediate storage system for end devices, it is now responsible for making a vehicle efficient. This development work cannot be performed by one discipline alone – after preliminary development and design work for energy management has been carried out, the electronics specialists then become an additional part of the team. And after that, the testing experts get involved and apply their various testing methods, for example to test discharge behaviour or durability. For Bertrandt, it is vitally important to master the interfaces between the different disciplines – and this interdisciplinary cooperation across the borders of different specialist fields ensures that projects are successful. >

> Interdisciplinary cooperation across the borders of different specialist fields ensures that projects are successful.

A subject that is being intensively discussed in the media is Powertrain 4.0 – today, the Connected Car already encompasses the powertrain. The engine and transmission might soon be able to "see into the future". Can connected powertrains really help to reduce fuel consumption and help to protect the climate?

This really is a very exciting future topic. GPS data, for example, or various environmental data can be used to make the powertrain as efficient as possible for the individual usage case. A keyword in this context is without doubt predictive powertrain control, which – when adapted to a route profile calculated in the navigation system – can, for example, optimise the state of charge of the battery in a hybrid vehicle. Automatic recognition of low emission zones, in which a hybrid vehicle can switch over to its electric drive system and therefore operate with zero emissions, is certainly a further approach for the years to come. And in this case too, there is a clear demand for interface management – the expertise and experience of our colleagues from Electronics and Testing. >

> GPS and various environmental data can be used to enable the powertrain to be used as efficiently as possible.

Powertrain technology is a development field with many options. Matthias Rühl, how do you focus on those topics that your customers will be occupied with in 2025? How do you meet the highly demanding expectations of the automotive industry?

Bertrandt has been involved in the vehicle development activities of many car makers for around 40 years now. This also gives us a very robust view of the important issues of the future. At the Powertrain Competence Centre, we also carry out a process every year that enables us to consider the key technology trends of the next decade and to derive the necessary development steps for Bertrandt. Our experience and the stability of our customer relations are, of course, very valuable in this analysis. Our specialists carry out the tasks that result from this and develop correspondingly innovative methods and tools for project work. ■

Interview by Gudrun Remmlinger

> We have a very robust view of the important issues of the future.

DEVELOPING INNOVATIVE DRIVER ASSISTANCE SYSTEMS

BERTRANDT PAVES THE WAY FOR AUTONOMOUS DRIVING

Autonomous driving, which involves the car being controlled automatically by a computer, is no longer merely a vision, at least from a technical perspective. Developments in this area are progressing rapidly and several manufacturers have already completed short test drives with almost no intervention from the driver. The date when the first driverless car will actually travel in real traffic depends heavily on the legislation in this area. There are many benefits. Driving will become significantly less stressful and there will no longer be a need to waste time looking for parking spaces. In addition, automated rules will improve the flow of traffic, which will lead to higher average speeds. More space will be made available in inner cities, because cars will independently look for places to park outside the centre.

Starting with driver assistance systems

In the aviation industry, people's lives are already being entrusted to systems which are largely controlled by computers. However, fully automatic forms of transport have so far rarely been used in normal traffic on the roads. But driver assistance systems have been providing valuable support for drivers for a long time and the number of these systems in cars is constantly growing. They will continue to pave the way for the move from partially to fully automated driving, with the aim of reducing the number of accidents to zero. Many central functions, such as the electronic stability program (ESP), emergency brake assist, parking assistance, drowsiness detection, lane departure warning, side blind spot alert, traffic sign assist and intelligent light systems, are already helping us to make progress towards "Vision Zero". The ongoing development of new and existing driver assistance systems in order to increase their range of uses is very probably the way in which the transition to autonomous driving will take place. The systems must function reliably under any conditions, so that the driver never feels that human intervention is necessary.

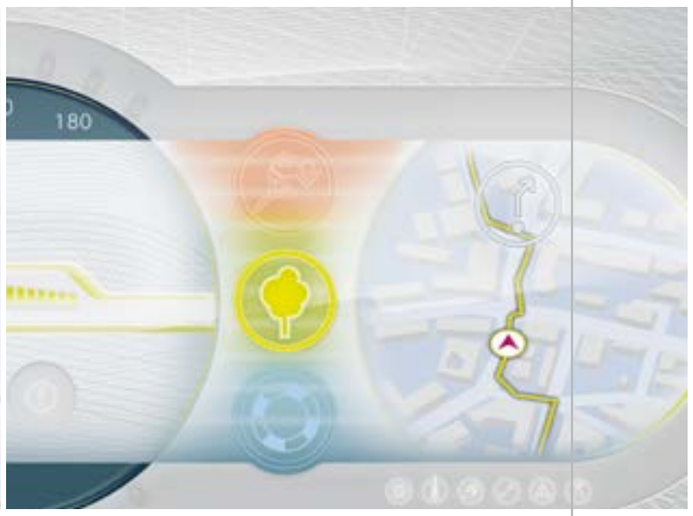
The car in the context of its environment

Current driver assistance systems are already correctly assessing many standard situations on the roads using sensor data and responding accordingly. However, the functions that these systems can perform are generally relatively limited and the amount of data exchanged is small. Nevertheless, the central processing and interpretation of all sensor data can result in significant synergies. Bertrandt initially approached this subject from an abstract perspective by compiling all the relevant information about a vehicle's environment. The next stage was to identify the factors that are decisive for the control of the vehicle. When these were classified, they fell into the following categories: physical factors, psychological factors and the traffic situation. The physical factors are all those that influence the control of the vehicle in physical terms, for example road surface friction. The psychological factors only cause mental stress for the driver, such as a narrow road. The traffic situation includes legal restrictions, for example speed limits, and other road users.

From the concept to the prototype

After completing these preliminary measures, Bertrandt transformed the theoretical concept into a prototype. A fully equipped luxury saloon was available as a development platform. All the sensors in the vehicle were taken into consideration and, where possible, validated. For example, a tunnel detection system was implemented using the navigation data and the brightness sensor. The current traffic density was determined using the front and rear radar sensors and the built-in camera. In addition, it was possible to detect certain characteristics of the road, including the width and the number of lanes, along with specific weather conditions. Furthermore, the psychological stress caused to the driver as a result of the environmental conditions was evaluated, for example in the case of poor visibility. However, the way that this stress is dealt with varies from driver to driver, which presents a further challenge for current driver assistance systems, because they are unable to adapt to the driver. >

Programmable instrument panel.



Driving style recognition.

Test set-up for driver assistance systems.

Human-machine interaction

Although modern assistance systems often offer a wide range of configuration options, these are generally rarely used by the majority of drivers. A driving style analysis and subsequent dynamic adaptation to the driver in question can help to resolve this problem. Bertrandt focused initially on the driving style, taking a simple driver model as the basis for its work, which defined the driver on the basis of key characteristics such as sportiness, awareness of safety and energy efficiency. The characteristics were determined by means of a range of different manoeuvres. Using the characterisation of the driver, various parameters of the driver assistance systems could then be dynamically adapted. In concrete terms, the driver characterisation process consisted of the following steps. Whenever a certain manoeuvre by the driver was detected, for example acceleration, the manoeuvre was given a specific rating for sportiness. The existing sportiness figure for the current driver was then moved a little way towards the rating given for the manoeuvre. This ensured that each individual manoeuvre did not have too strong an influence on a characteristic, while several similar manoeuvres would result in an unchanging figure for the characteristic. Regardless of the specific approach used for driver adaptation, it is sensible to establish a close link with the environment detection function. As every driver adapts his or her driving style to the environment, driving manoeuvres should always be interpreted in the context of the current driving situation. Even a sporty driver will drive more defensively in conditions of poor visibility, but this should not result in a less sporty characterisation. In general, the adaptation algorithms should be understood in abstract terms as the application of a driving situation to a specific set of parameters in the assistance systems. A control strategy is assigned to each situation and the assignment itself represents the driver model. This means that detecting the vehicle's environment plays a central role in this context.

Autonomous driving in the future

It is clear that detecting all the important environmental conditions of a vehicle and adapting them to the driver are two key aspects of fully automated individual transport. The car of the future will provide even more support for the human driver. It will adapt its driving dynamics to mirror the preferences of the occupants. Safety and ride comfort will be improved and this will pave the way, sooner or later, for autonomous driving.

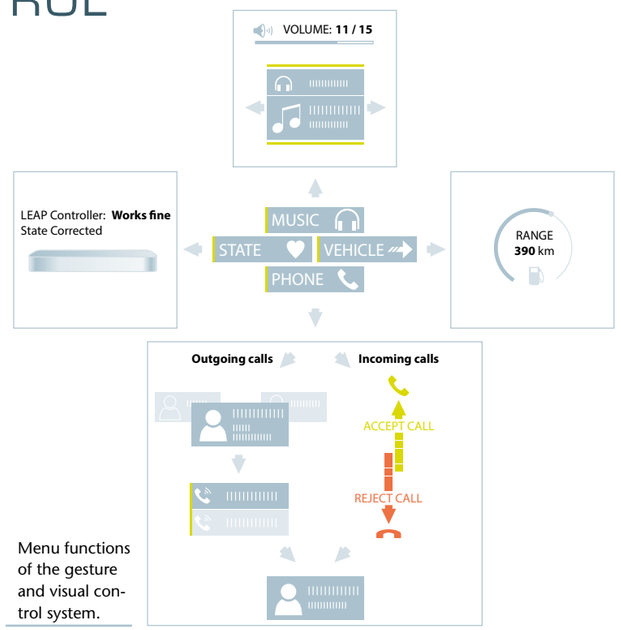
At Bertrandt, we are closely involved in this process. ■

Ralf Schoenen, Sebastian Schierenberg, Ingolstadt

INTUITIVE 3D CONTROL SYSTEM MAKES DRIVING EASIER

GESTURE AND VISUAL CONTROL SYSTEM DESIGNED BY BERTRANDT

Bertrandt has developed a control concept which aims to reduce visual and manual distraction for drivers. Other objectives of the internal project included investigating the technical feasibility and cognitive ergonomics of the concept. The “b.Motion II” exhibit consists of a gesture control system combined with a head-up display.



Menu functions of the gesture and visual control system.

Reducing the risk of driver distraction

Modern vehicles offer a growing range of interactive functions, together with smartphone compatibility, which can cause the driver to become distracted. Innovative control concepts aim to reduce this risk. Our “b.Motion II” concept is based on a non-contact gesture and visual control system that enables drivers to use functions by making hand movements, without taking their eyes off the road. When this is combined with a head-up display, it allows system messages and other menu functions to be projected onto the car’s windscreen.

Functionality of “b.Motion II”

The innovative control concept has been developed in the form of an exhibit which is managed by a multimedia system. The driver’s gestures are detected by a 3D motion sensor and checked for plausibility before being converted into commands for the relevant functions. The sensor is incorporated into the armrest of the centre console, which not only makes the system easy and ergonomic to use, but also guarantees that the driver’s hand can reliably be positioned in the sensor’s detection field. Selected menu functions have been developed in the form of an Android app and can be presented on a head-up display. Using the Android app, content such as the phone function with a selection of contacts or audio streaming can be provided via the central control computer.

Ergonomic, user friendly controls

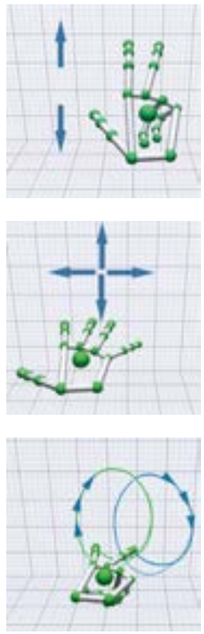
To ensure that the system is easy to use, the gestures are restricted to three hand movements, each of which controls one function for the menu item that has been selected. The system is activated using a clear vertical hand movement with three fingers extended, which prevents gestures from being misinterpreted. To select menu items, change music tracks or use any of the phone functions, drivers move one hand to the left, to the right, up or down with all five fingers extended. The volume can be adjusted by making circular movements with one, two or three fingers, depending on the speed required.

Once the system has been activated, four pre-configured types of content can be chosen: music, sensor status, vehicle information (simulated fuel level display and the remaining distance available) and phone, with access to the contact list. If the driver selects the “Music” menu item, the audio streaming service in the Android app starts and transmits the music via the WLAN. By making swipe movements to the left and right, the driver can change tracks. The “Vehicle” function shows the simulated fuel level display with the remaining distance that the vehicle can travel. The connection status of the sensor can be displayed using the “State” function. “Phone” displays the contact list and selects contacts. If a call is received or made, the volume is automatically muted and then returns to its normal level when the call has ended. A Bluetooth interface is used for the phone function. The information displays are designed so that the driver can position them anywhere on the projection area.

Future prospects

Additional infotainment and driver information functions will be added to the gesture and visual control system. The system will be developed further with the aim of helping to reduce the stress on drivers and prevent accidents. It can be combined with speech control functions, new driver assistance systems and additional information that is displayed on the windscreen. ■

Helmut Visel, Ehningen

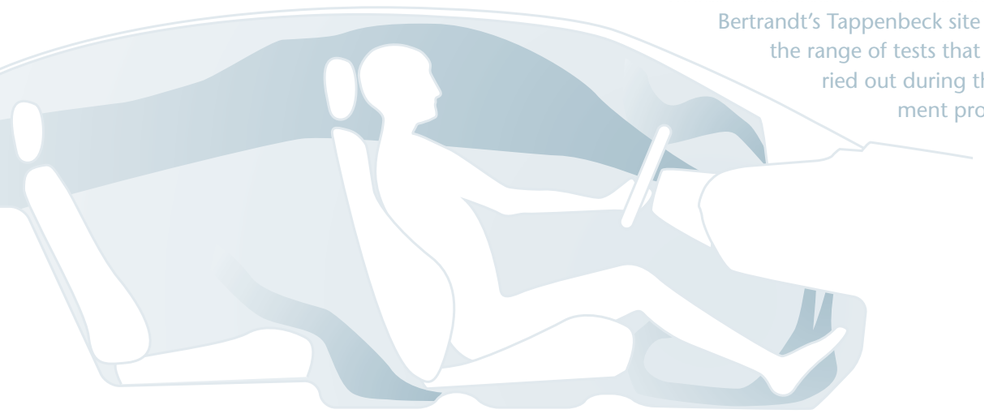


Activating the system, controlling the functions and adjusting the volume

THE INCREASING IMPORTANCE OF VEHICLE AIR CONDITIONING

NEW TEST FACILITIES FOR HEATING, VENTILATION AND AIR CONDITIONING (HVAC) AT BERTRANDT

The air conditioning of vehicle interiors is becoming more and more important. The widespread introduction of start / stop systems and the growing number of electric vehicles means that the level of noise emissions produced by air conditioning systems needs to be reduced. New test equipment at Bertrandt's Tappenbeck site has extended the range of tests that can be carried out during the development process.



Setting high standards for vehicle air conditioning

Air conditioning systems have to meet a wide range of requirements. A car that has been parked in the midday sun must be quickly cooled down to a comfortable temperature and a consistent temperature level must be maintained throughout its entire journey. In addition, requirements often vary from one market to another. For example, drivers in North America prefer a jet of cold air that can be directed at different areas of the interior, while European car users generally opt for an indirect, diffused air flow. One function which is particularly useful in winter is the ability of the air conditioning system to prevent the car windows from becoming misted because of moisture in the air. The components of the system have to fit in the small area below the instrument panel and in the engine compartment. They are also required to be cost-effective, low-maintenance, quiet and lightweight in order to keep the vehicle weight and fuel consumption to a minimum.

Analysing flow noise

As a result of start / stop functions and alternative drive systems, the level of noise emissions in the interior of vehicles in everyday use has fallen significantly. This means that the flow noise caused by interior air conditioning systems has become more noticeable. Measuring the noise emissions inside cars will indicate whether perceptible or irritating flow noise is being produced by the air conditioning systems. Bertrandt's semi-anechoic chamber can accommodate an entire vehicle and the necessary acoustic measuring equipment.

Testing heating systems

The central heating and air conditioning unit is responsible for cleaning incoming fresh air with a pollen filter, cooling it using an air conditioning condenser or heating it via a heat exchanger and then distributing it throughout the interior of the car. A range of tests can be used to determine the quality and quantity of the air inside the car. These can be carried out in parallel with virtual flow simulations. Examples include testing the temperature homogeneity and measuring the volume flow rate distribution and the characteristic curve. It is also possible to measure the efficiency of the heating and air conditioning system and the air pressure inside the vehicle.

Efficient defrosting function

A test based on EU directive 78 / 317 / EEC demonstrates the ability of a car to defrost its windows over a period of up to 40 minutes. The test is carried out inside a climate chamber and records the defrosting curve at predefined intervals. A thermal camera is used as part of the test. The result indicates the heating capacity of the heating and air conditioning system and the ideal position of the defrosting strip and the side window air vents.

Specific test for air vents

The air vents are a design feature of the car and are located in the direct field of vision of the occupants. Therefore, their ability to direct and distribute air must be thoroughly tested both as separate components and as part of the car. The directional analysis shows how effectively the fresh air entering the interior can be directed to the required area and how dense the air flow is. The trajectory indicates the speed of the air at pre-defined distances from the vent.

All the tests are available at Bertrandt's Wolfsburg site as individual evaluations or as combined testing programmes. The range of tests available is constantly being extended and includes additional measurements of the cooling capacity of the air conditioning system.

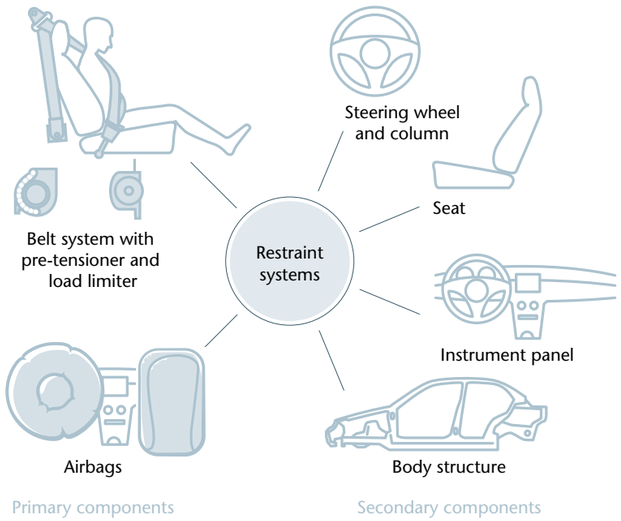
Maik Winningstedt, Wolfsburg

Near field measurement of the air vent

DEVELOPING A RESTRAINT SYSTEM FOR FRONTAL COLLISIONS

BERTRANDT'S MODERN SLED SYSTEMS SUPPORT THE DEVELOPMENT OF VEHICLE SAFETY FEATURES

Current studies show that frontal impacts are the most common form of road accident. Fortunately, developments in the fields of active and passive safety are reducing fatal injuries.
A well-designed restraint system is a key element in cutting the number of injuries to vehicle occupants.



Components of a restraint system

The function of a restraint system during a collision is to reduce the forces exerted on the car occupants and, therefore, to lower the risk of injury. In terms of their function, restraint systems are divided into primary and secondary components. Primary components, such as safety belts with pre tensioners, fasteners and load limiters, together with frontal and knee airbags, reduce injuries to vehicle passengers. Secondary components, for example the steering wheel, steering column, instrument panel and vehicle body, fulfil other functions, but have a significant effect on the restraint system and on the protection of car occupants.

Simulation and testing in parallel

Close cooperation between the simulation and testing teams brings major benefits for the design of restraint systems. On the one hand, simulation models are available earlier in the development process than the components themselves. On the other hand, tests for comparative purposes or using different configurations are very costly.

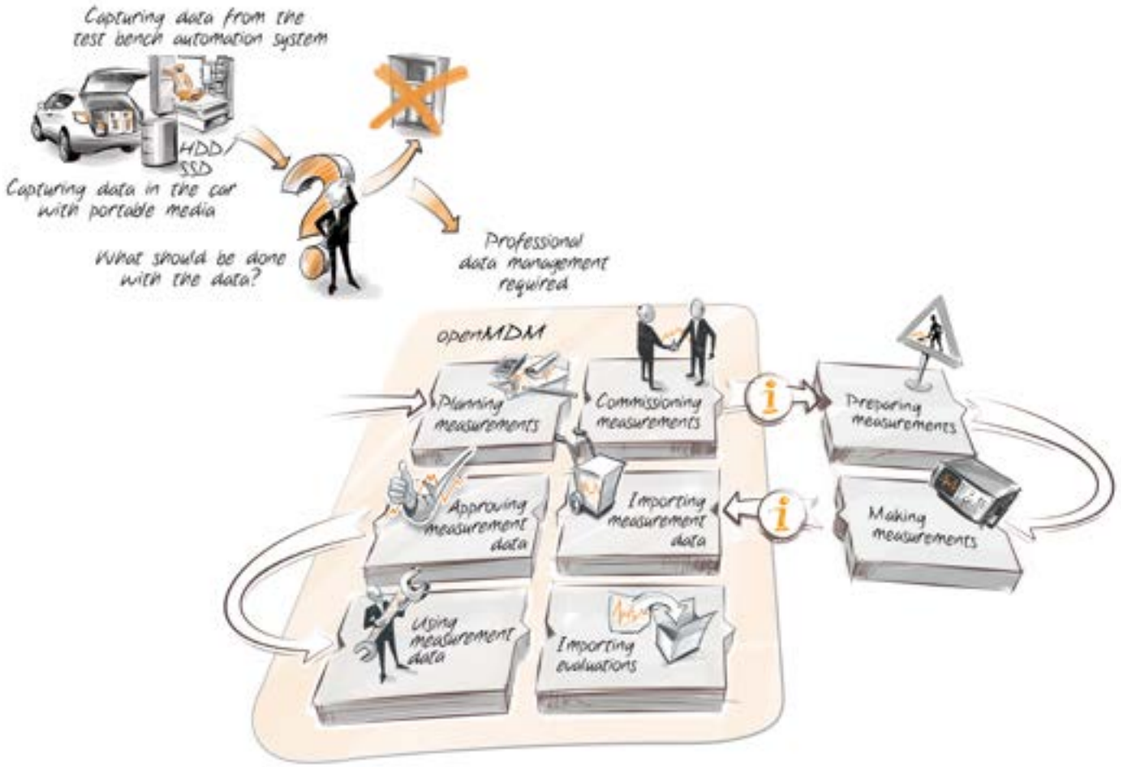
Preliminary design of a restraint system

During the initial phase, an analysis is carried out of the planned markets and their legal and consumer protection requirements. The car can be positioned on the market on the basis of the consumer protection objectives. A competitive analysis of these objectives in relation to safety equipment will give initial indications of the components to be used. The possible assessment criteria include the biomechanical stresses on vehicle occupants, the vehicle deceleration and the active components of the restraint system. The preliminary selection process for the components is completed by evaluating the previous model of the car.

From the concept to the production configuration

During the concept phase, suppliers develop the components and test them on substitute test equipment. The results of this process should be a definition of the basic performance of the components and a selection of pre-validated simulation models. Tests carried out on a substitute test bench similar to a real car provide the initial findings concerning the restraint system. Simulating this phase of the process is also recommended.
Once the component development has been successfully completed, the next phase can begin. During the sled tests and the accompanying simulation, the complete restraint system with all its components is evaluated for the first time. The challenging aspect of this phase is determining the deceleration pulse, as no real structural pulses are available during the early part of the project. The sled tests ensure that the restraint system is well-prepared for the subsequent vehicle crash test and crash simulation.
Ideally, the vehicle crash test should be the one-off final test in this stage of development. However, the restraint system has to be evaluated more than once in these crash tests, because the structural pulses can change during the development process. The crash tests also allow detailed adjustments to be made to the restraint system.
Because of the complexity of the relevant phases, the availability of the components and the car, and the correspondingly high costs, the development and initial coordination of the components of the restraint system is carried out on substitute test benches. Sled tests are used to coordinate the complete restraint system. The final detailed adjustments are made during the vehicle crash test process. ■

Dr. Knut Poeschel, Ingolstadt



BIG DATA MEETS BERTRANDT

EFFICIENT MEASUREMENT DATA MANAGEMENT

Bertrandt engineers are gradually putting together the pieces of the puzzle for the big data and business intelligence megatrends to produce customer-focused solutions. Big data has a number of different facets from Bertrandt's perspective, starting with the creation of the data. Following the development of new video-based sensor systems, data is being recorded at rates of up to 2 GB/s and bringing new challenges for infrastructures, data management and analysis. Processing the data requires the use of a more standardised system.

Challenges

The example used here is the development of driver assistance systems, where sensors provide information about the driving situation. Recording information using cameras during test drives produces large quantities of data. In order to avoid repeating costly tests, the data must be captured systematically and archived transparently.
The ongoing developments in the fields of driver assistance systems, autonomous driving, environment recognition and sensor data fusion are resulting in enormous increases in the volumes of data produced. Testing one single driver assistance function can generate as much as 5 petabytes of data (approximately 5,000,000 GB).
The measurement data management system openMDM® (open measured data management) is a standard solution which is used to manage this vast amount of data and to standardise the number of different test results.

The solution

openMDM® allows measurement data from all manufacturers to be stored, compared and shared by different companies. It is an open-source, freely configurable software building block for managing measurement data. Based on open standards and open interfaces, its other key features include high reusability, flexible expandability and universal usability.
The standardised data model ensures that the component-based architecture is scalable and can be adapted to meet individual requirements. Once the data from the various measurement systems has been converted into ASAM ODS format, it can be stored in one database.
openMDM® can store metadata and measurement results separately, with the metadata in a central location and the measurement data in some cases distributed all over the world because of its sheer volume.
Using a business intelligence solution it is possible to analyse and evaluate the measurements. Subsequently, their significance, patterns and trends can be identified. On the basis of analytical algorithms, the big data approach is used to generate findings from large amounts of data in different formats, sometimes with imprecise data types, and from real-time data flows. One enhancement of big data is the combination of the latest database technologies (Hadoop, In-Memory) with predictive analytics software.
This allows for efficient data storage with subsequent evaluation, which represents a major step for Bertrandt into the world of big data.

openMDM® working group

As a member of the Eclipse Foundation, Bertrandt is involved in the openMDM® working group, which has set itself the goal of developing openMDM® further and ensuring that it becomes more widely used.
Bertrandt can take responsibility for the entire life cycle on behalf of its customers, from planning and implementing measurements to storing the data produced and, in future, evaluating it. ■

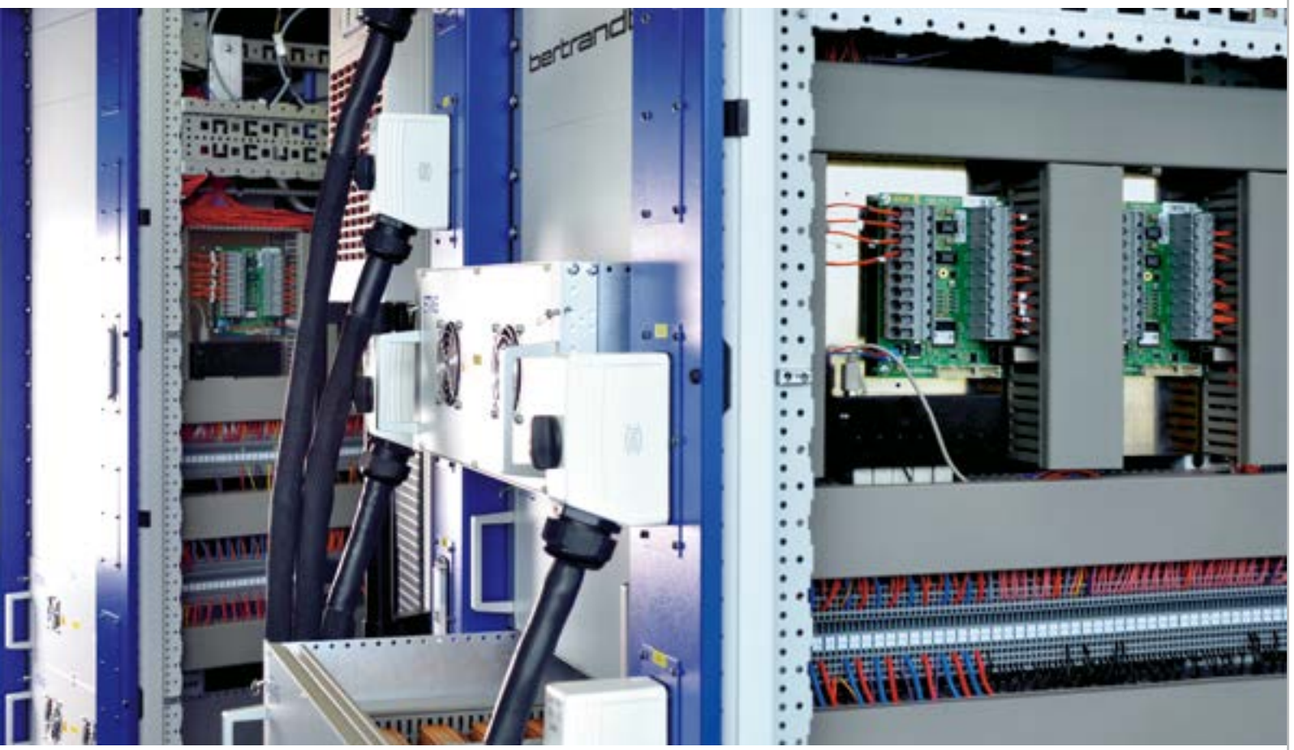
Andreas Egen, Ingolstadt

MEASUREMENT DATA MANAGEMENT

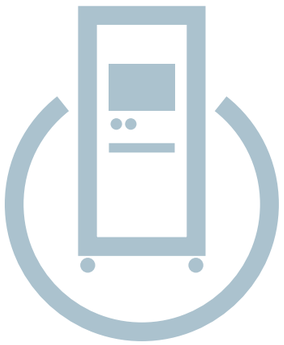
Big data
- Data fusion
- Analytical algorithms
- Transforming data into information
- Hadoop
- Business intelligence

openMDM®
- Eclipse RCP
- Flexible building block
- Standardised data model
- Integrating different data formats
- Vendor-independent
- Data classification

Eclipse working group
- Developer platform
- Sharing experience



HIL SYSTEM CONCEPT VALIDATES COMPLEX ELECTRONIC ARCHITECTURES



ADDED VALUE: HIGH-QUALITY, IN-DEPTH TESTING BY THE BERTRANDT SYSTEM

A car is much more than just a means of transport that takes us from A to B. The increasing complexity of the electronic systems has turned a simple vehicle into a technological masterpiece. Functions such as integral satnav systems and innovative control, display and infotainment systems have become an essential part of the comfort features of modern cars, while lane departure warning and drowsiness detection systems improve safety on the roads. Cars have a wide variety of systems and functions. But how can drivers be sure that all the control units in the car are operating and performing the required functions correctly?

Bertrandt has invested in new HiL test equipment for this purpose. HiL, which stands for hardware in the loop, is a means of testing control unit functionality. Software is used in a closed loop to test whether control units are functioning correctly, whether signals are arriving without errors and whether the right functions are being performed.
Electronic architecture is becoming increasingly complex. Functions are often distributed across several control units and control units are networked using different bus systems. In order to accommodate this complexity, several levels of testing have to be integrated. Depending on the size of the model range being tested, Bertrandt can run as many as 8000 test cases to test 120 individual control units for each project.

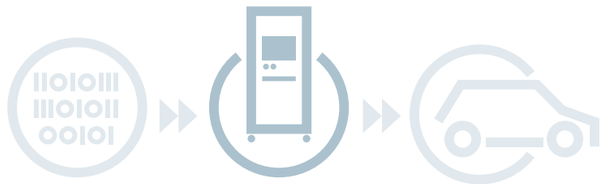
Complex test systems

The test system consists of a total of nine HiL test benches with three different levels of testing: the component level, the cluster level and the system integration level. This means a total of more than 30 19" cabinets containing test equipment, specially designed for the electronic architecture in question. Because of the large number of test cases, the systems run 24 hours a day, seven days a week, so that high-quality test results can be produced quickly when changes are made to the software in the control units. In the component HiL, inputs, outputs and the functionality of the control units are tested. Tests on this level involve only one control unit, such as a door unit. The cluster HiL is used for subsystem tests. Several components are combined to form a subsystem and this allows the functions of this subsystem to be tested, for example lock systems or light functions. The system integration HiL covers all the control units in the vehicle and tests them as a complete system. Bertrandt's test system concept offers customers added value in terms of testing quality and depth, by allowing several HiL systems to be connected together to form a complete HiL.

Developed by Bertrandt

The Bertrandt engineers developed the entire test system concept, which has been implemented by a partner company in the form of the HiL systems. Different measurement boards and computers record currents, voltages and frequencies or simulate them. Real-time computers make it possible to capture several channels at the same time and to process the information. Depending on the components or systems being tested, actuators and sensors are subjected to real loads or to substitute loads as part of simulation processes.
In addition to the HiL tests, other tests are carried out in cars to evaluate systems from the perspective of the user. The HiL and in-car testing methods complement one another perfectly. The results are essential for increasing the maturity and, therefore, the quality of electronic systems. ■

Christoph Schelhammer, Ehningen



Increasingly complex electronic tests.

FULLY COMPATIBLE

BERTRANDT TESTS AUTOSAR ARCHITECTURE TO ENSURE THE CORRECT FUNCTIONING OF CONTROL UNITS

Some modern cars have well over 100 control units. The individual units are in constant communication with one another and exchange huge quantities of data over the various bus networks. In order to be able to manage these complex systems effectively, the aim is to make all control units compatible with one another, regardless of the manufacturer. AUTOSAR, the Automotive Open System Architecture, enables applications to be completely decoupled from the hardware they run on and makes software compatibility across different devices easier. The AUTOSAR architecture allows control units to be replaced without any changes on a functional level.

Project involving OEMs and suppliers guarantees joint benefits

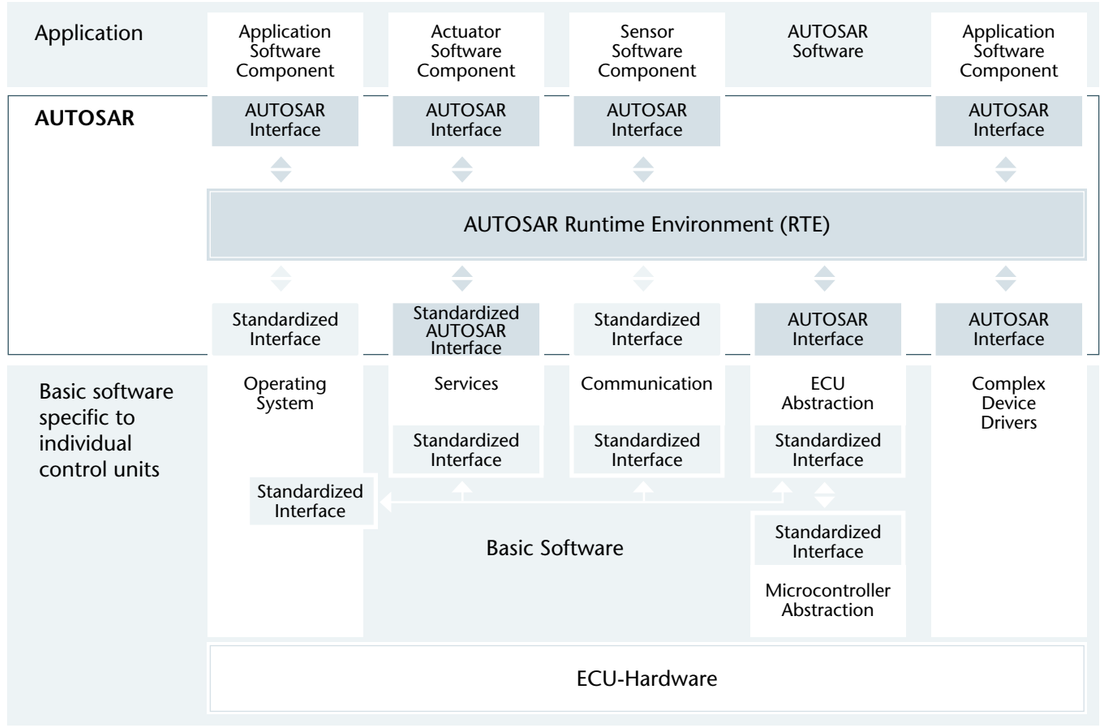
The decoupled, standardised software runs on a so-called AUTOSAR stack which consists of individual program modules. Many OEMs and suppliers are working together on the principle of “cooperate on standards – compete on implementation” and have undertaken to comply with specific standards. The AUTOSAR software functions as layered architecture and decouples driver modules specific to individual control units from the functional application level.

Tested for compatibility

When the AUTOSAR committee agrees on new software features, tests have to be carried out to ensure that the new functionality is compatible and that applications can continue to run as before. This is where Bertrandt comes in. We provide testing services for OEMs to determine whether the new AUTOSAR components function correctly and to identify which configurations are needed in individual modules, so that the functions required by the customer remain available. Our development specialists use test applications that run on reference hardware platforms together with the AUTOSAR stack being tested to evaluate the functionality and the maturity of the modules in the stack. If errors occur, our engineers analyse them, report them and pass them on to the customer with the appropriate recommendations.

Comprehensive expertise in the field of embedded software and in-depth knowledge of the AUTOSAR architecture and the constantly growing range of standards are essential requirements for testing the AUTOSAR basic software. ■

Christoph Schelhammer, Ehningen

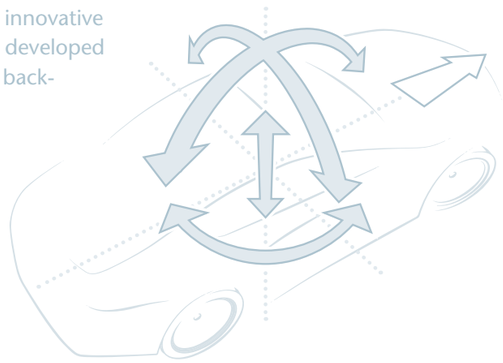


AUTOSAR architecture.

HANDLING AT FIRST HAND

DEVELOPED IN-HOUSE:
BERTRANDT'S DRIVING FEEL SIMULATOR

Short development cycles and increasingly complex new and networked systems are leading to a greater use of simulation tools by vehicle manufacturers. This innovative technology allows new car models to be developed over a much shorter period. Against this background, Bertrandt has created a driving simulator which dynamically represents situations that drivers encounter on the road and can be used to develop electronic stability programs and driver assistance systems.



Flexible and modular solution

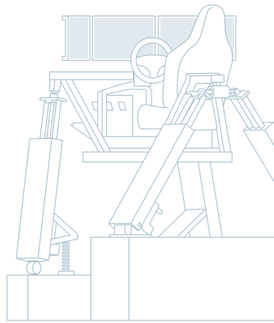
The mobile driving simulator consists of two modules. One is a platform fitted with a driver's seat, steering wheel and pedals. The driving environment is displayed on three monitors. The second component of the system is a quadropod with four electric cylinders. To give the driver a realistic feeling of being on the road, the platform is mounted on the quadropod, which allows movements in the four degrees of freedom – pitching, rolling, heaving and yawing – to be simulated.

Real-time control

The specifications for the movement of the quadropod and the acceleration and tilting of the vehicle are determined in real time by the CarMaker software package from IPG Automotive. It allows the dynamic behaviour of the car to be precisely simulated and different road routes to be provided. All the three-dimensional parameters (gradients, tilts, curve radiuses) and their properties, for example surface quality and coefficients of friction, can be represented. Almost any driving situation can be simulated on the virtual road.

Subjective experiences of vehicle handling

The software allows the car to be driven by a virtual or a real driver. For this purpose, the simulator is equipped with a steering wheel and a set of pedals that are fitted with force-feedback components. As a result, the driver receives feedback about the current driving conditions. The noises the driver hears are produced by sound generators and loudspeakers that function independently of the driving conditions.
The Bertrandt driving feel simulator can also be used to represent the functions of electronic stability programs and driver assistance systems and enables the driver to experience the effects of the different settings and control strategies on the handling of the vehicle. The free modelling of the vehicle environment allows critical driving conditions to be simulated reproducibly, which in turn makes it possible to develop specific control functions. This feature can be used to identify a basic configuration for control systems in the simulator, such as ESP or torque vectoring, so that only fine-tuning is needed in the real-life road trials. This in turn results in significant savings in both costs and time.
Another aspect of the system brings benefits for the development of driver assistance functions. The vehicle's environment, including other road users, can be freely modelled, driver assistance systems can be calibrated and the level of customer acceptance of the assistance systems can be evaluated. Our testers validate and assess newly developed driver assistance systems on the simulator.



Validating control systems

As well as being deployed in the early stages of the development process, the driving simulator can also be used to validate the control systems that have been developed in the context of MiL (model-in-the-loop), SiL (software-in-the-loop) and HiL (hardware-in-the loop) tests. During MiL and SiL tests, the models and the program code are implemented in the vehicle environment and tested under different conditions. For HiL tests, the simulator offers a range of interfaces for integrating the necessary hardware, such as control units or actuators, into the simulation environment and testing the functions that have been developed.

Conclusion

The Bertrandt driving feel simulator is mobile and flexible because of its modular structure. The movement of the simulator in the four degrees of freedom gives a realistic impression of driving, which is reinforced by the active steering wheel and pedals. The simulation of a complete vehicle makes it possible to implement and coordinate electronic stability programs and driver assistance systems quickly with the help of IPG CarMaker and MATLAB/Simulink. In addition, the simulator enables the systems to be validated using MiL, SiL and HiL tests. ■

Matthias Wilmes, Cologne

BERTRANDT WORLD

Cologne

ELECTRIC VEHICLE SOLUTIONS FOR NORTH RHINE-WESTPHALIA

Electric vehicles on the streets – Engineering Services from Bertrandt. The second phase of the project that began in 2008 as a partnership between Ford, RheinEnergie AG, Duisburg-Essen University and the City of Cologne, with funding from the German federal government's second economic stimulus package, has been running successfully since 1 July 2012. The first phase involved collecting important information about the use of electric transport systems in large cities. In the second phase, a total of 60 electric vehicles are in use on the streets of Cologne and its surrounding areas. The fleet currently consists of cars from the US market. To enable the electric cars to be driven on German roads before their European launch, they had to undergo homologation and special approval processes. The cars are fitted with data loggers and are now supplying valuable information about the day-to-day use of electric cars in urban areas. Bertrandt is responsible for analysing and evaluating this data and for running the website where the project partners can track and assess their own driving behaviour. The specialists at our Cologne site are coordinating all the project and quality management activities, together with the budget and financing.

Wolfsburg

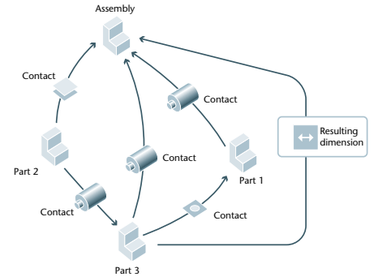
ENHANCED TEST FACILITIES FOR VEHICLE BODY STIFFNESS

Vehicle body stiffness is an important factor in vehicle design. It influences the handling, ride comfort, noise levels and, of course, also the durability and the perceived quality of the car. One of the key aspects of quality involves the clearances and the joint sizes, in particular those that are visible. They must be as small as possible and largely parallel. A high level of stiffness is also important in order to keep to a minimum the elastic deformations that occur under dynamic loads (normal driving) and to avoid creaking and groaning noises. In addition, stiffness has an impact on the car's handling, in particular on poor road surfaces or in extreme situations. At high speeds or when cornering on a bumpy road, the bodywork and the add-on parts can move in relation to one another, leading to unwanted noise and abrasion. At Tappenbeck, two separate procedures are used for testing static and dynamic body stiffness to a high standard of quality and in compliance with all the current testing regulations. The services have been validated and accepted by our main customer using a round-robin test.

Ingolstadt

EFFICIENT TOOLS FOR GEARBOX DEVELOPMENT

The demand for innovative technologies in the automotive industry is giving rise to a wide range of new requirements and development objectives, including improving cost-effectiveness and reducing CO_2 emissions. The advent of electric vehicles and modern driver assistance systems involves far-reaching changes in every area of the powertrain. A variety of new gearbox concepts is being developed, in addition to the already ongoing improvements in performance and efficiency and reductions in weight. The growing complexity in this area, combined with the aim of cutting costs and increasing comfort, requires the targeted use of efficient development tools. At our Ingolstadt site, two tools for gearbox development have recently been introduced. CETOL 6σ is used for design-related tolerance analysis and SimulationX for natural frequency analysis during development. They provide the necessary information for correct decision-making in the early stages of the development process. The successful introduction of the two tools has made available a comprehensive interface for developing powertrain components efficiently and to high level of technical quality. As a result, they make a useful contribution to the entire value chain.



Munich

NEW PREMISES, NEW IDEAS AND NEW APPROACHES

In order to accommodate the growth in staff numbers at Bertrandt Munich, additional properties have been acquired in the area around Hufelandstraße and Anton-Ditt-Bogen. The new buildings have enabled Bertrandt to expand its range of services significantly, including installing a new sled system for crash testing. The additional workshop and office areas have also given Bertrandt Munich the opportunity to restructure its services by subject area and sphere of responsibility, for example in the testing department. The main advantage is that all the buildings are very close to our customers.

Bertrandt China

GROWTH IN SHANGHAI AND CHANGCHUN

The year 2010 was a milestone for Bertrandt. It saw the start of the first large-scale Chinese project for the Wolfsburg site, which involved developing the successor to the Jetta A2. As part of the project, many Bertrandt employees worked on the customer's site in Changchun. The success of this project was the trigger for us to expand our activities in Asia and to set up Bertrandt Engineering Shanghai Co., Ltd. In 2014, another Bertrandt site was opened in Changchun. Florian Sirowatka, the site manager, looks back over the initial period: "Over the course of a year, we have built up a good core team in Changchun. We have worked on projects in different areas of vehicle development and this has put us in a very strong position. The close cooperation with other Bertrandt sites, including those in Germany, is a major advantage for us." The portfolio of the Chinese subsidiary is impressive. It includes body-in-white, exterior, CAE and interior services, together with Engineering Services, such as project management and model facelifts. And according to Florian Sirowatka more is yet to come: "Our aim is to expand our portfolio of services and our projects on an ongoing basis. China is increasingly becoming an important location for the international automotive industry." ■

Bertrandt France

CREATING NEW JOB PROSPECTS IN PARIS

The Chamber of Commerce in Essonne presented Bertrandt Bièvres with an award for its special commitment to training in a number of areas and, among other things, for the introduction of its CAD designer apprenticeship. The new training course, run jointly by Bertrandt and the Lycée Diderot vocational college in Paris, offers nine future CAD designers the opportunity to learn the basics of design engineering for the automotive industry. This includes, for example, developing components and modules for the interior and exterior of vehicles. The year-long apprenticeship is intended to enable the young people to acquire the most important theoretical knowledge and to give them a basic insight into the practical skills involved. The goal of the course is to equip them to enter the world of work.

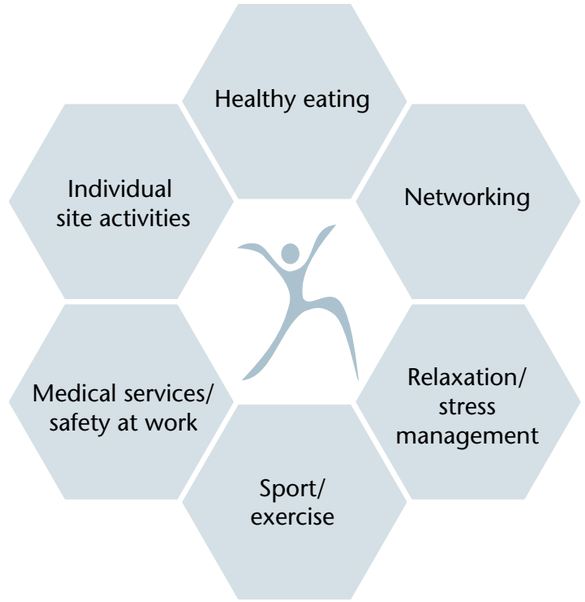
Social responsibility is an important consideration for Bertrandt France. The French site plans to provide more places for trainees in future. Against the background of France's intergenerational contract, Bertrandt also intends to increase its commitment to training and to offer young people good job prospects during a period of high youth unemployment. ■

Bertrandt Group

HEALTH IS IMPORTANT TO US

The Health 4Bertrandt project has got off to a successful start across all our sites. Employees from every part of the group now have the opportunity to take part in a variety of campaigns and to find out more about healthy lifestyles from information modules on the intranet.

In order to ensure a standardised approach across the entire group, health coordinators have been appointed for every site who are working on planning and implementing the Health 4Bertrandt campaign. A wide range of campaigns, some of them specific to individual sites, have been launched, covering subjects such as nutrition, networking, relaxation and stress management, sport and exercise, together with medical services and health and safety at work. These have included healthy eating weeks, stress workshops, skiing trips, company runs, relaxation exercises in the workplace and trial golf and Black Role lessons, all of which have proved to be very popular. Our goal for the future is to motivate employees to live a healthy lifestyle. ■



Bertrandt Group

BERTRANDT SUPPORTS THE SALZGITTER SOS CHILDREN'S VILLAGE

Helping children and young people to grow and develop has been one of Bertrandt's objectives for many years. This year our charitable donation went once again to an SOS Children's Village, in this case in Salzgitter. The SOS Children's Village in Salzgitter near Wolfsburg has been caring for children of all ages and young adults since 1980. The donation from Bertrandt enables the organisation to help young people to grow and develop by offering them individual and team-based sports activities and mobility projects. In addition to its children's day care centre, the village also has a multi-generational house, which brings together younger and older people. ■

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RANGE OF SERVICES

You can find the latest detailed information about Bertrandt's complete range of services on our website:

http://www.bertrandt.com/en/range-of-services.html

www.bertrandt.com

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