

# Bertrandt Magazine

The Customer Magazine of the Bertrandt Group  
No. 19 | November 2019



## Connecting megatrends

Digitisation  
Autonomous Driving  
Connectivity  
Electric Mobility

## Projects

Renault Alpine A110  
DS 3 CROSSBACK

## The world of Bertrandt

Test Centres



New technologies are being developed in increasing numbers.

Editorial information

**Publisher**

Bertrandt AG  
 Birkensee 1  
 711 39 Ehningen, Germany  
 Telephone: +49 7034 656-0  
 Website: www.bertrandt.com  
 E-Mail: info@bertrandt.com

**Editorial responsibility**

Gudrun Remmlinger

**Redaktion**

Bertrandt AG, Gudrun Remmlinger  
 Telephone: +49 7034 656-4413  
 Fax: +49 7034 656-4242  
 E-Mail: gudrun.remmlinger@de.bertrandt.com

**Contributors to this issue**

Katrin Kraus, Hartmut Mezger,  
 Julia Nonnenmacher, Gudrun Remmlinger,  
 Felix Schulz

**Layout**

Hartmut Mezger, Bertrandt Technikum GmbH

**Printing**

Druckerei Mack GmbH, Schönaich

**Reproduction**

All rights reserved.

Not to be reproduced, copied or duplicated, in full or in part, without written permission.

Text and images with the kind permission of the business partners referred to in this issue.

Male pronouns are used in this text for the sake of simplicity and legibility. They are intended to refer to people of all genders.

Dear readers,

We presented HARRI, our innovative in-house technology platform, to the public for the first time at ELIV, the International Congress for Automotive Electronics. In this show car, we bring together the megatrends of digitisation, autonomous driving, connectivity and electric mobility along the entire value chain of future mobility concepts. New technologies are being developed in increasing numbers and, for Bertrandt as an engineering partner, the variety of disciplines involved is growing. In areas such as agile development, next reality, digital twins, big data and artificial intelligence, predictive maintenance and smartification, our in-depth knowledge across a wide range of industries gives us excellent market opportunities.

As projects become more complex, we can also offer project management expertise, alongside our specialist engineering services, for projects such as the development and production start-up of the Alpine A110 and the creation of the innovative cockpit for the DS 3 CROSSBACK.

This latest issue of our customer magazine showcases only a part of our spectrum of services. Our extensive investment in a new high-voltage test centre, two Bertrandt powertrain solution centres and an acoustics centre of competence guarantees that we can be a reliable partner across all disciplines. As a specialist engineering service provider, we are already focusing today on the market and customer requirements of tomorrow. Our goal is to find the best solution for every customer!

The board of management  
 Hans-Gerd Claus, Michael Lücke, Markus Ruf



The HARRI show car demonstrates the technical expertise of the Bertrandt Group in linking together the major megatrends. Alongside automotive applications, these include individual solutions for municipal infrastructure, for logistics companies and for passenger transport. HARRI also combines all the latest trends, such as digitisation, autonomous driving, connectivity and electric mobility, in one vehicle.



Bertrandt provides engineering services during development and production start-up

Validating the powertrains of the future

Bertrandt develops an innovative cockpit

## Connecting megatrends

- 06 Connecting megatrends
  - Digital, autonomous, connected, electric: HARRI!
  - The data journey
- 12 Digitisation
  - An individual approach to digitisation
  - Living in the future with next reality
  - The fourth industrial revolution
- 26 Autonomous Driving
  - Self-driving cars: the solution to future mobility
- 34 Connectivity
  - Big data and artificial intelligence come together at Bertrandt
  - Software testing for a secure future
- 40 Electric Mobility
  - High-voltage test centre

## Projects

- 46 Renault ALPINE A110
  - Bertrandt provides engineering services during development and production start-up
- 54 DS 3 CROSSBACK
  - Bertrandt develops an innovative cockpit

## The world of Bertrandt

- 62 Validating the powertrains of the future
- 64 The latest news from the world of Bertrandt
- 66 Social responsibility
- 68 Bertrandt wherever you are – worldwide
- 69 The Bertrandt portfolio of services

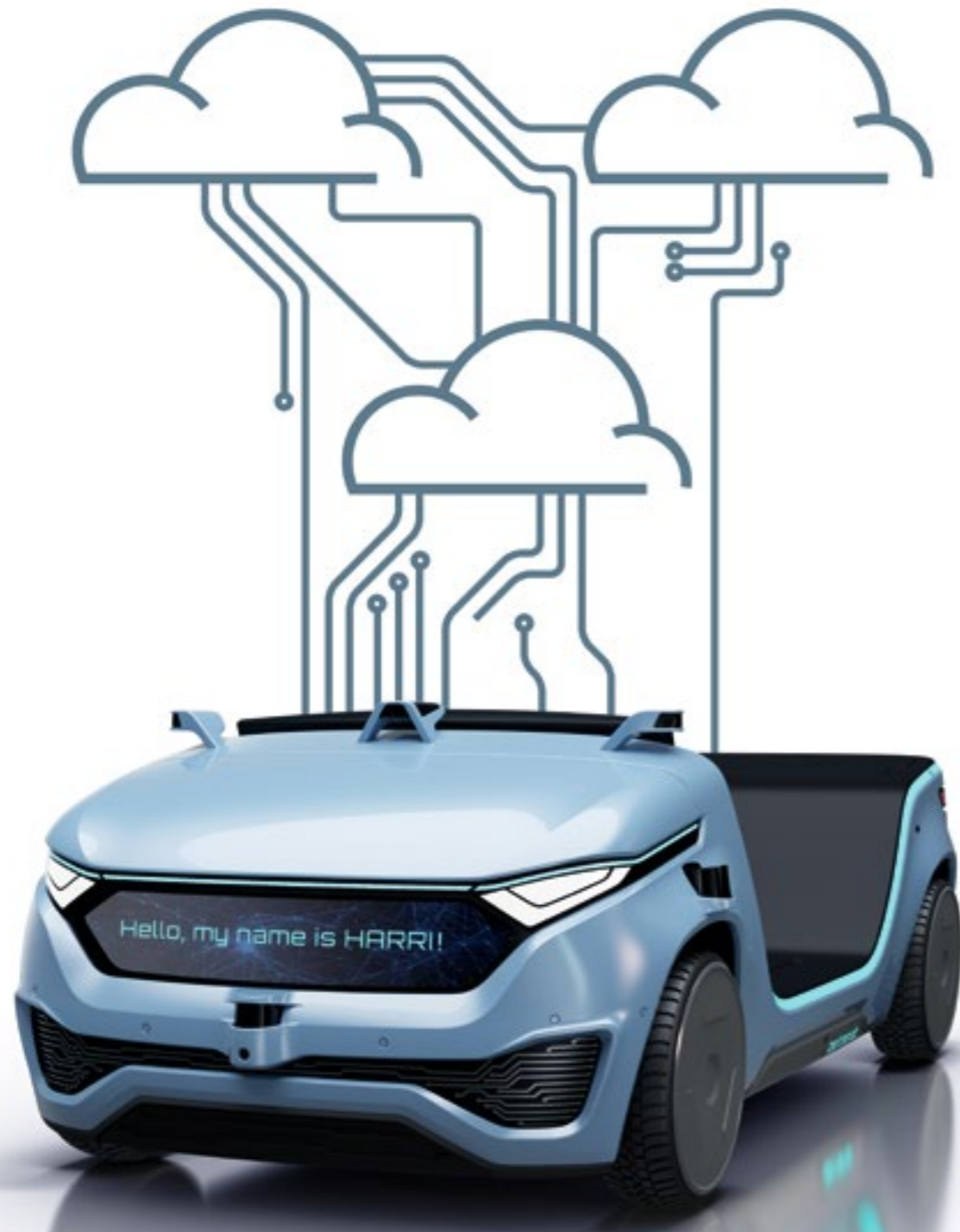




# Connecting megatrends



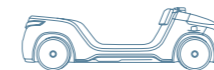
# Digital, autonomous, connected, electric: HARRI!



**B**ertrand's innovative HARRI (Highly Automated Driving Platform for Innovation) technology platform brings together the megatrends of digitisation, autonomous driving, connectivity and electric mobility. It impressively links the complex interactions between the individual trends by providing intelligent solutions and actively implements autonomous driving and connectivity functions. On the basis of this technology platform, Bertrandt can provide its customers with individual, customised solutions.

## EN ROUTE TO LEVEL 5

Autonomous driving is already a reality. The dramatic developments in driver assistance systems are accelerating the arrival of driverless transport solutions. Artificial intelligence is becoming increasingly widespread and a new approach is needed to human-machine interaction. AI, sensor systems and functional safety are the key catalysts for autonomous driving. Bertrandt has been developing its own innovative solutions in this field over several years and has demonstrated its expertise in autonomous driving with its comprehensive "Park and Charge" project. This included the creation of algorithms for environment detection sensors, data analysis based on machine learning and the development of complex driving functions. In pioneering projects in the field of automated driving on SAE levels 3 and 4 and autonomous driving on SAE level 5, Bertrandt has shown that it has in-depth engineering knowledge in areas such as localisation, connectivity and cloud applications.



Find out more about our HARRI technology platform in the article on autonomous driving from page 28 onwards.

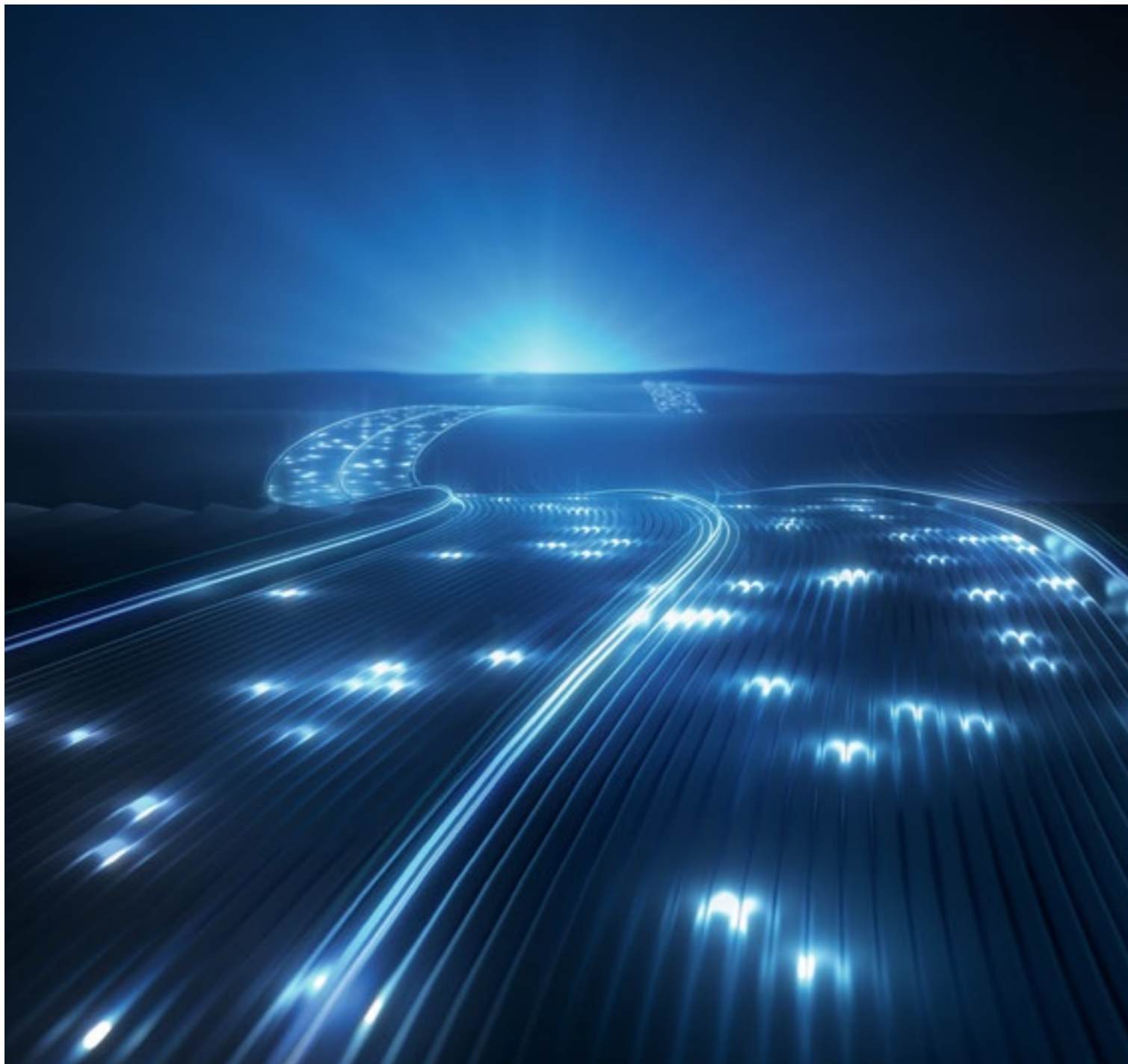
One central consideration involves the planning and implementation of autonomous movements. We have developed an intelligent autonomous driving system that can react and make decisions independently using information about the environment. The key aspects of the project included developing the software and also gaining an overall understanding of the interactions between the software, the hardware and the mechanical systems. The objective of the project is to enable the car to drive autonomously and safely to a predefined parking location, to return when requested to do so and to start its charging process independently. This meant

that we needed to overcome a number of problems that we would encounter on the public roads, which involved creating highly accurate localisation and obstacle detection functions and planning problem-solving strategies.

In addition to localisation, other important factors are environment detection, trajectory planning, lateral and longitudinal control and additional higher-level functions. It is essential for the car to know at all times where it is and how it is positioned. This is the task of the localisation function. Environment detection helps to assess the car's surroundings and to identify and classify objects using a variety of sensors. The same sensors also play an important role in determining the location of the car with a high degree of precision. Higher-level functions are responsible for diagnostics and for communicating with the vehicle bus. If the car receives a remote command from its owner, it uses all the information available about its environment to plan its trajectory. It calculates a driving strategy that will take it safely to the parking space. The role of the lateral and longitudinal control functions is to follow the specified trajectory or movement path. This requires advanced control algorithms for the steering, powertrain and brakes. Additional important factors are connectivity, backend systems, ADAS validation, batteries, charging and the charging infrastructure, power electronics, the human-machine interface and technology demonstrators. It is also essential to focus on innovations, concepts, processes, methods and quality.

//

# The data journey



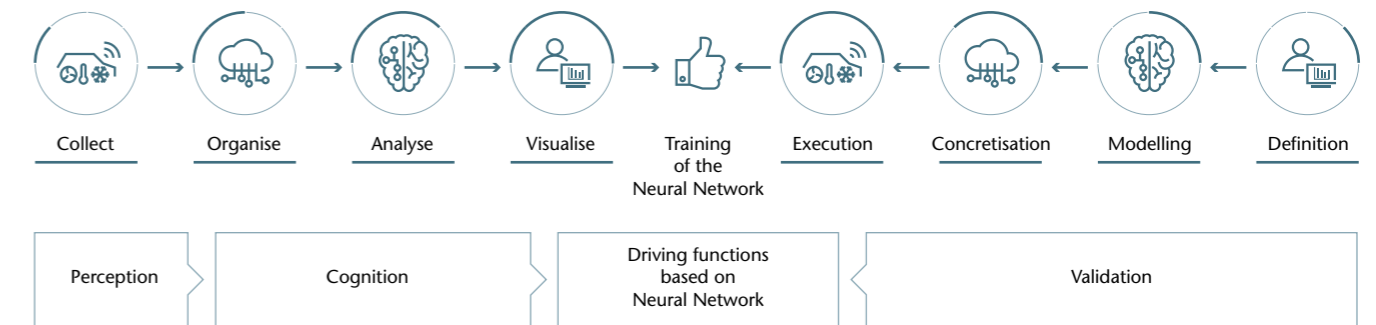
“Data and artificial intelligence are closely interlinked.”

**B**ertrandt's cooperation with IBM led to the opportunity for us to attend the IoT Exchange congress in Berlin in June 2019. We gave a presentation to an audience of 200 managers from a range of different industries describing our extensive expertise in the field of big data.

Peter Schiekofer, head of autonomous driving and connectivity, explained the complex interactions between all the key trends in the automotive industry: digitisation, autonomous driving, connectivity and electric mobility. He also highlighted the fact that Bertrandt is already actively working on projects involving autonomous, connected vehicles. His presentation covered the in-house “Park and Charge” showcase project and the company's technology platform. The key questions included: What does autonomous driving really mean? How can we access the data? How should neural networks be tested? What sort of training do neural networks need? What form do the data flows take? The audience showed a great deal of interest in the solutions developed by Bertrandt which reflect our in-depth expertise and advanced capabilities.

Covering areas such as data collection, calculation, action and validation, artificial intelligence, the connected car ecosystem, the multi-cloud on level 5 and big data, the journey through all the aspects of data and artificial intelligence from capture through to validation, with and without neural networks, demonstrated Bertrandt's comprehensive capabilities in these fields. //

## THE DATA AND AI JOURNEY.







Trends

# Digitisation

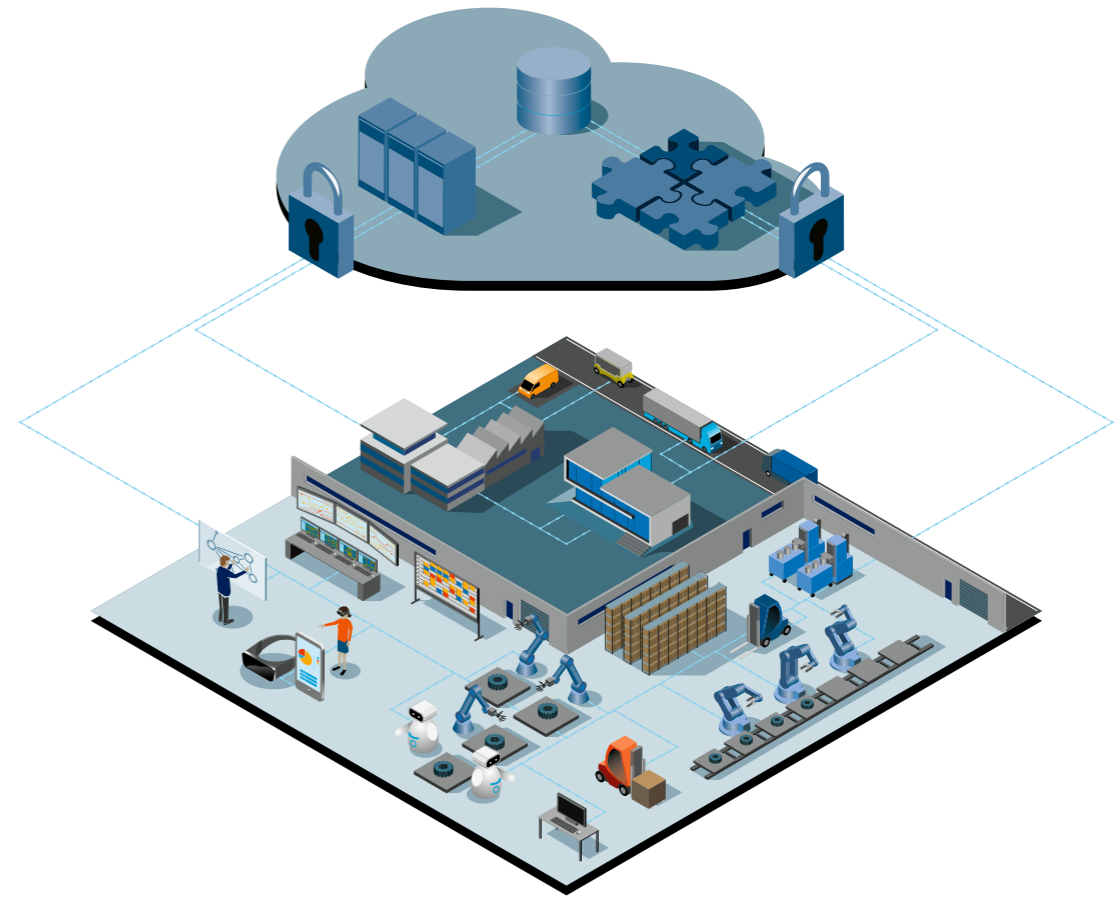






Managing director **Ingo Fanelsa** takes the responsibility for individual digitisation in industrial enterprises.

## An individual approach to digitisation



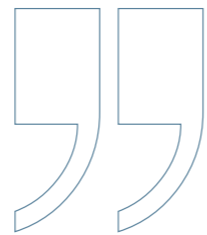
”

In areas such as agile development, augmented reality, digital twins, artificial intelligence, predictive maintenance, smartification and autonomous driving, Bertrandt’s in-depth knowledge of digitisation opens up a wide range of opportunities.”





Development is making very rapid progress.



Digitisation is currently having an impact on every area of industry. Ingo Fanel, what is your view of this trend and what is its effect on Bertrandt?

Digitisation is no longer a trend. We are talking about the fourth industrial revolution and the future has already arrived. The technology we are using, for example artificial intelligence systems, is allowing us to make very rapid progress. If we combine neural networks with artificial intelligence, that will increase the pace of change even further. Machine producers and manufacturing companies will have to take digitisation on board, because in future the intelligence of a plant or a machine will depend mainly on its software. Many plants and machines are becoming more complex to manage and increasingly often this is where the USP lies. We are digitising production processes and recording as much data as possible. By evaluating the data we can increase the quality and efficiency of production from 85% to 95% for example. This ten percent improvement will allow the company to focus on moving into new areas of business and developing new products. These optimisation measures, combined with predictive maintenance, can make manufacturing processes much more efficient. The fourth industrial revolution (the IoT) was not originally intended just to improve production, but that is how we understand it Germany and in the rest

of Europe. The USA is taking a different approach. The IoT is seen as a step towards developing new products, opening up new markets and introducing new sales methods. It is not about improving what is already there, but about starting afresh. In Europe we regard it instead as being all about optimising production processes and introducing digital twins. At Bertrandt we are moving into completely new markets across all industries. The main market segment is traditional machinery production and plant construction, together with all the areas of industry where products are manufactured.

### Do you only develop software?

Not necessarily. In the past, we have been involved in traditional automation projects for machines and plants and in logistics, for example for the port of Rotterdam and Los Angeles, and we have introduced automation into systems that are managed by people. Now we are in the phase where automated systems are becoming autonomous and digitised. In the past an individual forklift was operated by a driver. The next step was for it to travel independently on a pre-defined route. Now large numbers of intelligent forklifts, not just one, are being controlled by artificial intelligence and algorithms and are finding the shortest and most efficient paths for themselves. This is precisely what digitisation is all about. The intelligence is part of the secure system and people are simply responsible for administration. Industrial trucks can now travel autonomously, identify obstacles independently and bypass them, whereas in the past all we had was screened robot cells.

### HOW DOES THIS RELATE TO SMARTIFICATION?

This is only part of what we are working on. We are also involved with smartification, which ultimately means making production intelligent, for example by capturing machine data. We are making the systems smart. Smartification is part of the digital transformation. We take data out of the machine and develop or adapt a suitable device. If necessary, we transfer the data into the cloud or onto a local server. This is what is known as edge or cloud computing. The data is then visualised, for example on a control panel or on a smartphone, laptop or monitor in the factory. Customers have direct access to their data and can run their processes in digital form. If we continuously collect and evaluate data over a certain period of time and analyse the correlation between peak data and capacity utilisation or faults, we can draw the appropriate conclusions and create an intelligent algorithm. Because if we can identify a build-up before this peak or event, we can determine the cause of the fault and carry out the necessary maintenance in advance. This is called predictive maintenance and it results in the introduction of optimisation loops and greater production efficiency. If we were the machine manufacturers and had a digital twin, we could make direct use of the data to improve the operation of the machine.

Via smartification, the connectivity of the data in the cloud and the information that is obtained as a result, companies can put in place predictive maintenance processes and introduce digitisation. This allows them to free up resources to safeguard their future.

Our customers are producers of standard and special machinery and also companies in all other areas of manufacturing industry. At Bertrandt we have already undergone the digital transformation and have moved from classic automation to digitisation. We no longer specialise in traditional engineering but in solutions. This means that when we talk about smartification, the cloud and connectivity, we already have available semi-finished or finished modules which we have developed in advance and which include software that belongs to Bertrandt. This gives our customers a basic software product that they can lease or buy from us. They can use our product and we will develop precisely the applications they need so that their systems can interact perfectly with our modules. The benefits for customers include time savings and reduced costs. Of course, we can also develop completely new systems for our customers on request. We provide neutral advice including recommendations for a suitable cloud, from Amazon, Google, IBM or Microsoft for example. Bertrandt offers independent consultancy and helps customers to develop and implement new ideas. >



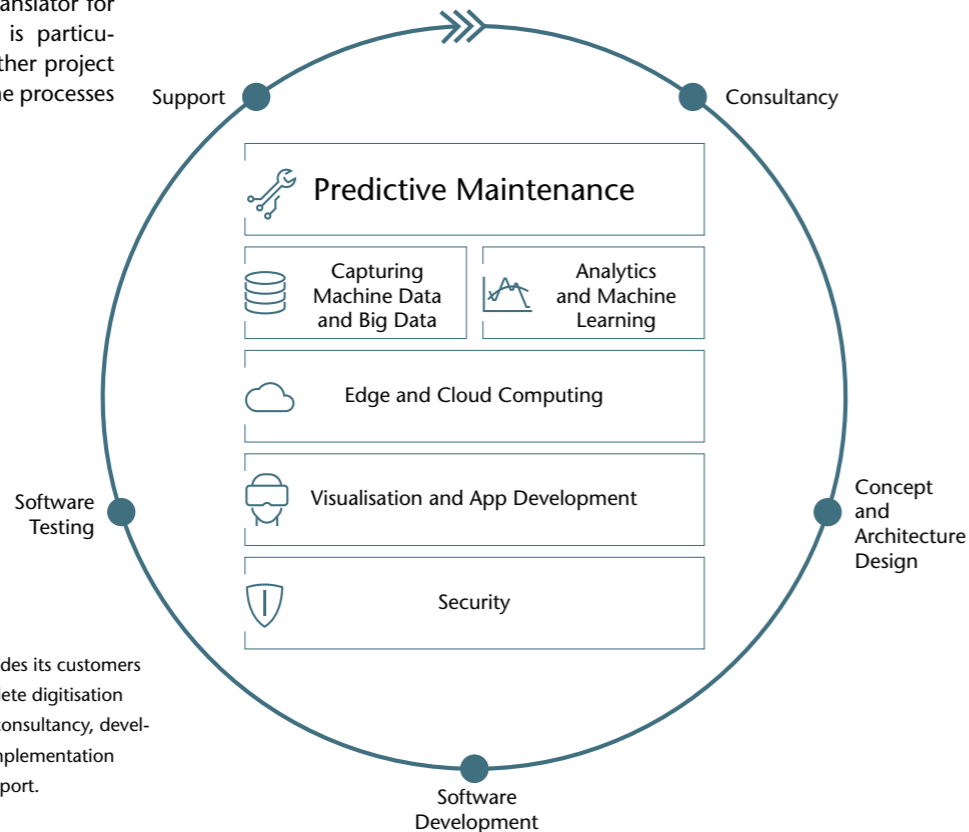


### What are the key features of your team?

Our head of software development has the following motto: "Our employees must be able to understand the matrix and have experience in all areas, including architectures, the cloud and apps." Our team is mainly made up of experienced software engineers, electronics specialists, electrical engineers, physicists and mathematicians. We spend a lot of time visiting universities and putting challenging software puzzles on social media. Our approach to recruitment is unconventional. We find that job applicants are interested in our inspirational and innovative projects, our use cases and the freedom that Bertrandt has to offer.

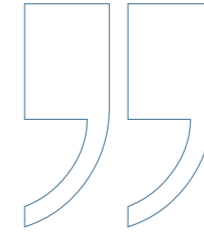
### Do you have a reference project that you can tell us about?

We are currently working on a digital control panel and we have put together an agile unit to develop it. We are based in Düsseldorf, but the project leader or scrum master is located at the customer's site. He prepared the use cases and we developed the software, the concepts and the innovations in sprints. It is essential for us to study the process which is being digitised carefully in advance including all its interfaces and this then has to be incorporated into the software. We communicate mainly via Skype or chats which keeps travel to a minimum. At the start we provided the customer with conventional consultancy and created the concept which led to the five use cases. Three of these are still being implemented. One has been completed: a translator for the HoloLens in 60 languages which is particularly important for export markets. Another project involved capturing data and digitising the processes in the control panel.



Bertrandt provides its customers with the complete digitisation process, from consultancy, development and implementation through to support.

We provide our customers with the complete digitisation process.



### What are the benefits for our customers and what services does Bertrandt offer?

We provide our customers with the complete digitisation process, from consultancy, development and implementation through to support. This is a cycle which includes capturing and processing machine data and establishing connectivity. We also transfer the data to the cloud and offer services such as big data, visualisation (AR/VR) and security, in cooperation with partners. The boundaries between digitisation and automation are disappearing and we will see much closer cooperation in specialist areas. We will be taking an increasingly global approach to software development.

The benefits for our customers are that their plants and processes can be made more efficient very quickly on the basis of our expertise. This cuts costs, saves time, increases their profits, safeguards their production processes, makes them more competitive and puts them in a strong position for the future. All of these things then allow them to focus on new areas of business, new products and new ideas. The digital transformation gives our customers the freedom to develop new products for the future.

We advise our customers on how to use their data to identify the causes of faults, optimise their performance and improve their designs. Our Bertrandt Industry Cloud (BIC) is our own modular solution which allows us to offer services such as data fusion, data analysis, machine learning and algorithm development. Our expertise and our in-depth insights into all aspects of development, design, production and support ensure that we can provide our customers with rapid and reliable data analyses.

### What is your USP?

We understand how a machine or a plant supplied by a manufacturer functions, because our background is in the automation of these systems. In the past we used PLCs to automate machines. Today we can provide our customers with support throughout the changeover from standard automation to digitisation, because we understand how their machines were automated. Our USP is our understanding of our customers, their challenges and the need to move into a new world. We create a connection between the two worlds. Our expertise in visualisation is another of our selling points.

### What do you think the next steps in digitisation will be?

Digitisation is the future. The world is changing and we are helping to take the transformation forwards. The Internet of Things has become a reality. What we thought was science fiction is now part of our everyday lives, like the HoloLens. Very soon intelligent neural networks will begin revolutionising our development processes. Digitisation is inspirational and opens up opportunities that would have been hard to imagine just a few years ago. Bertrandt is at the cutting edge of development and we have plenty of plans for the future.

*The interviewer was Gudrun Remmlinger.*



# Living in the future with next reality



**“The use of interactive set-ups speeds up decision-making, improves processes and increases efficiency.”**

The major trends in the world of mobility are the key catalysts for the development of new concepts. Virtual engineering, for example, is set to bring about fundamental changes in the product development processes of tomorrow. The team at Bertrandt's Ingolstadt site is using augmented reality (AR) and virtual reality (VR) in different ways to find the ideal solutions for its customers. The value chain has become more tightly knit with the aim of creating more effective and efficient solutions.

#### NETWORKING IS THE FUTURE

The use of next reality technologies makes it possible to overcome the increasing challenges presented by more and more complex parts and machine components. In order to improve products and processes in the long term, close links between manufacturing and production systems and design and testing departments are an essential prerequisite. Another factor which should not be underestimated is system integration and modular system design for the creation of scalable products or model variants. One solution being offered by the next reality specialists from Ingolstadt is virtual efficiency, which involves making systems more efficient with the help of next reality technology. An interactive vehicle model developed by Bertrandt is already being used in this context.

#### INTERACTIVE VR INTERIOR MODEL

The VR interior model is a hybrid mix of physical and virtual vehicle components. The set-up consists of a variety of tracking components such as motion cameras, a body suit and gloves, a large number of

visual markers, a high-performance visualisation computer and a presentation screen. The physical model is made up of a steering wheel, two normal car seats for driver and passenger, plus a cockpit, instrument panel and centre console. The pedals, controls, roof liner, doors, rear-view mirror, windscreen and back seat of the car are not visible from outside, but as soon as users put on the VR headset, they can see the entire interior of the vehicle as if it were real. This set-up allows objects and people to be tracked in great detail. For example, users' head and body movements, including small movements of their arms, legs, hands and even fingers, can be recorded and reproduced in the virtual world. One major benefit is that all the components of the interior model are modular and can be used individually without any impact on the functionality of the system. This makes it possible to meet customers' requirements effectively and efficiently with next reality solutions, which function in this case as tools not toys.

In addition to using the VR interior model on customer projects, Bertrandt has also presented it to an industry audience at various events and congresses, including the Future Interior Summit in Böblingen in Germany. The summit focused on the

differences in the interiors of the cars of tomorrow as a result of the mobility transformation. Everyone who attended the event agreed that the conventional vehicle interior will gradually be replaced by high-tech digital components which will offer greater flexibility in terms of their function and operation, more customisation options for users and increased intelligence as a result of integrated software systems and self-learning algorithms. Virtual reality will play an important role in the development of future interiors, because the possibility of overlaying virtual objects onto real ones with a high degree of precision opens up many options for the strategic testing and validation of new components. For example, this makes it possible to determine whether different surfaces can be successfully combined and allows component tests to be carried out and the installation of parts to be investigated at a very early stage of the development process.

#### VIRTUAL EFFICIENCY

Several recent industry events have taken virtual efficiency as their theme. Using the interactive VR interior model, Bertrandt has been able to demonstrate potential improvements in efficiency with the use of virtual reality. The key benefits include the realistic visualisation of components very early in the development process, faster decision-making and a reduction in the number of physical models needed. “The use of interactive set-ups like this one speeds up decisions, improves processes and, as a result, increases efficiency,” explains Axel Unger, head of the multimedia and virtual reality team. >



“The aim is to produce effective and efficient solutions.”



The quality of the visualisations has now reached a high standard. The integration of the technology enables the demands placed on the models to be met comparatively quickly and highly flexibly.

The use of next reality will have a major impact on the product development process. The increasing availability of hardware components and the growing expertise in integrating the technology will make the virtual testing process even more efficient and will eventually lead to the development of virtual products with the help of digital twins. A key factor in the success of MR applications is their effective integration into existing processes and systems. This is why the MR specialists at Bertrandt insist on carrying out a thorough inventory at the start of each project.

#### NEXT REALITY AT BERTRANDT IN INGOLSTADT

The next reality team at the Ingolstadt site provides support for Bertrandt teams in other locations. Its services range from the concept and the creation of the initial idea through to the implementation and testing of innovative AR and VR applications. Bertrandt's digital projects department ensures that the projects run smoothly and helps with process control.

The technological basis for the VR interior model was developed and implemented as part of the Bertrandt EE2020 innovation programme. Synergies of this kind highlight the close links between technological development and digitisation and, in this case, virtual reality in particular. //

*Leonard Kaup, Ingolstadt*

#### Technology set-up

- Immersive VR experience with head-mounted display
- Visualisation of real components in a virtual world
- Interaction with virtual reality using finger tracking
- Streaming the VR user's view on the presentation screen

#### Use cases

- Individual data presentations on other output devices
- Shopping basket analyses of physical objects or virtual targets
- Component and variant testing, component conflicts and manufacturability
- Charging situations
- Ergonomics studies and usability tests
- Visualisation of lighting conditions
- Simulation
- Cross-site multi-user collaborations with visual communication and meeting documentation

#### Benefits of next reality applications

- Modular system set-up allows for customisation
- Realistic visualisation at an early stage of development
- Cost reductions, faster processes and shorter times-to-market
- Higher quality decision-making at an earlier point in the product development process
- Fewer misinterpretations because of the availability of authentic depth information in the scale 3D model
- A reduction in the number of prototypes leads to lower costs
- Simulation in realistic conditions
- A reduction in training costs
- More reliable processes
- Employees can acquire new skills in a shorter time
- Users become aware of information more quickly because it is positioned in their field of vision
- Realistic presentations of products that cannot be transported or have not yet been manufactured

#### Interactive VR interior model



## The fourth industrial revolution

**W**hat are the key features of the latest industrial revolution? The IoT or perhaps VR and AR? These are concepts that are having an impact on companies across all kinds of industries. But what added value do these innovative tools offer? As a result of the rapid progress being made by digitisation and the increasing pace of change, the competitive pressure on businesses is growing. Shorter product life cycles require the use of innovative technologies, such as virtual and augmented reality and predictive maintenance, and these can act as turbochargers for businesses.

“In the 1980s design meetings were still held next to the drawing board. Nowadays they involve analysing 3D data on computers. In future, technical advances will enable people to attend meetings wherever they are simply by putting on a VR headset,” explains Hendrik Keune, team leader in the production planning department. During the planning phase of the product development process, the new technology allows products and plants to be inspected in more detail. This makes it possible, for example, to identify potential faults before commissioning begins and to save money and time by making extensive modifications. We worked with a customer using VR to investigate their employees’ tasks from the perspective of accessibility and ergonomics. As a result, we were able to validate, fine-tune and perfect the planned concept.

A wide range of tools is available for digitising the manufacturing process. During the development of the initial concept, software packages such as Process Designer, Process Simulate and Plant Simulate can be used to plan production processes in a 3D environment. These programs allow buildings, machines, production facilities and products to be represented and to interact with one another. In the detailed planning stage, VR can help to analyse whether the safety requirements have been met. VR also makes it possible to provide training for employees in using and maintaining the production line. “The use of AR for maintenance purposes offers huge potential and has a wide variety of applications. One option is the creation of centres of competence, which can provide direct assistance on the machine itself from anywhere in the world. This makes the company’s extensive experience easily and immediately accessible,” says Steven Pfefferkorn, head of the production planning and factories department at Bertrandt in Tappenbeck near Wolfsburg.

A broad variety of systems is available for integration into smart factories. For example, logistics workflows can be made more efficient with the use of automated guided vehicles (AGVs) which transport materials and products independently. For our customer, a major German carmaker based in the state of Lower Saxony, we have created an AGV concept for a large assembly building and also extended and improved existing systems. The new approach reduces labour costs, increases reliability and keeps transport damage to a minimum.

The concept of the digital twin, a virtual representation of a product or production process that is linked via sensors with the real production line, is still in its infancy. In the planning stage, production facilities, equipment and workflows are frequently modified and this is often not documented in detail. The digital twin will help to compensate for the lack of documentation and reduce the work involved in integrating new generations of products, for example.

The fourth industrial revolution will pave the way for a broad spectrum of applications which are both creative and all-encompassing. We work with our customers to analyse their production processes and provide them with support along the entire value chain. //

*Hendrik Keune, Steven Pfefferkorn,  
Wolfsburg*



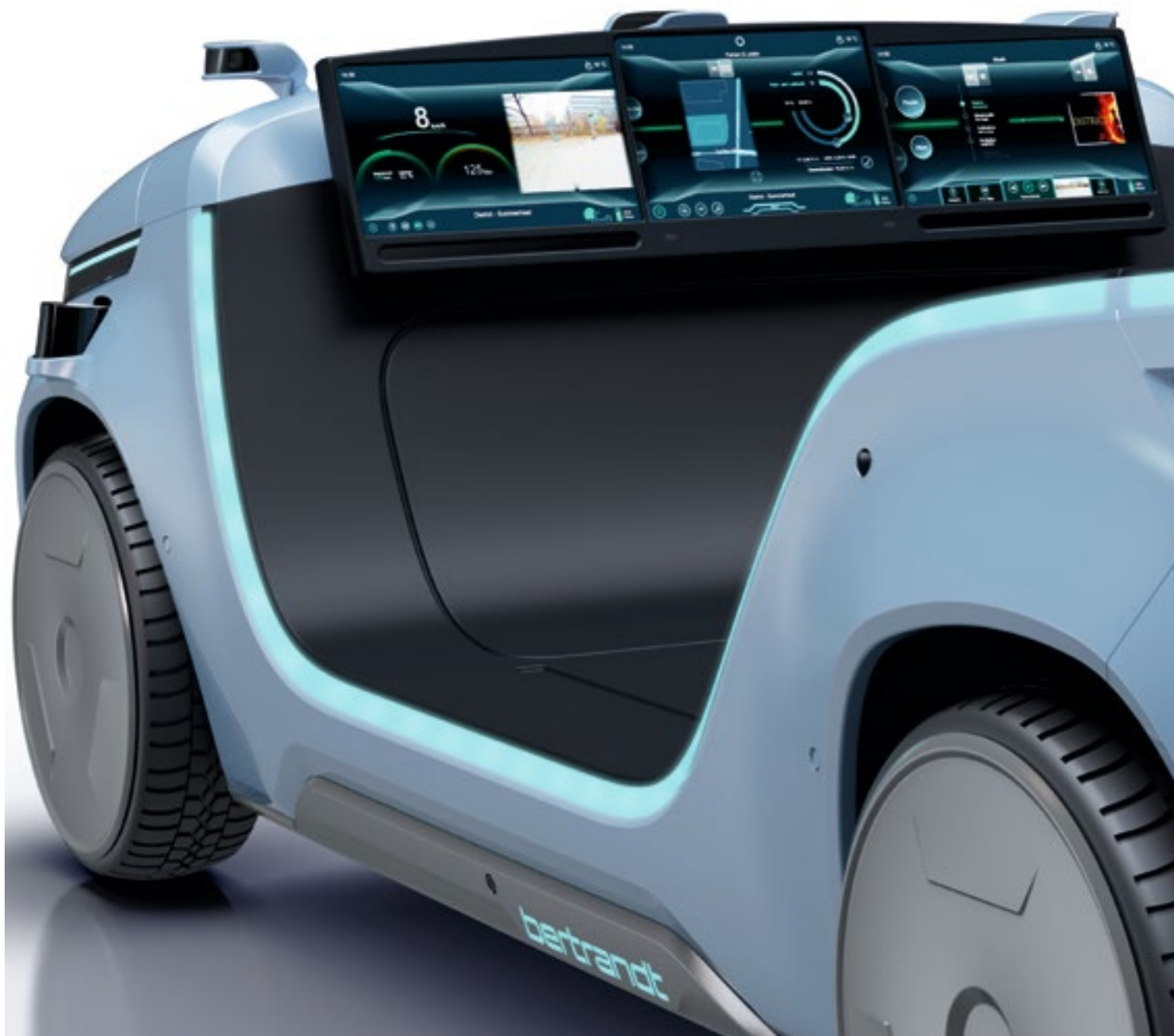


Trends

# Autonomous Driving



# Self-driving cars: the solution to future mobility



**B**ertrandt provides intelligent solutions in the field of autonomous driving which are tailor-made for every customer. HARRI is an example of our specialist expertise in HMI, connectivity and electric mobility.

## DEVELOPING AN INNOVATIVE DISPLAY

Displays and machines are becoming increasingly complex and intelligent. The quality of the human-machine interface is what determines how easy displays are to use. We have developed new methods that do not involve any switches, knobs or touch screens and that will improve the understanding between humans and machines. Our main goal was to develop an innovative display for our own technology demonstrator. The factors we needed to take into consideration were the technical design of displays of this kind and also user issues, such as the evaluation of the interface. One important task was the creation of a display operation concept for our technology demonstrator.

We also built a driving simulator that enabled us to carry out user studies and evaluate our display concepts at an early stage. We fed the evaluation back into the ongoing development process. In addition, we developed an app which allowed users to interact with the car remotely. They could ask

for information about its charging status or send a command to drive to a specific place at a certain time. We also created a completely new HMI which enables us to give innovative answers to questions such as: How does an autonomous vehicle interact with its environment? How does it communicate with pedestrians and cyclists? This completely new design was presented to an industry audience at ELIV, the International Congress for Automotive Electronics, in October. Bertrandt believes that it offers huge potential for developing visual functions that will enable vehicles and pedestrians to interact. >





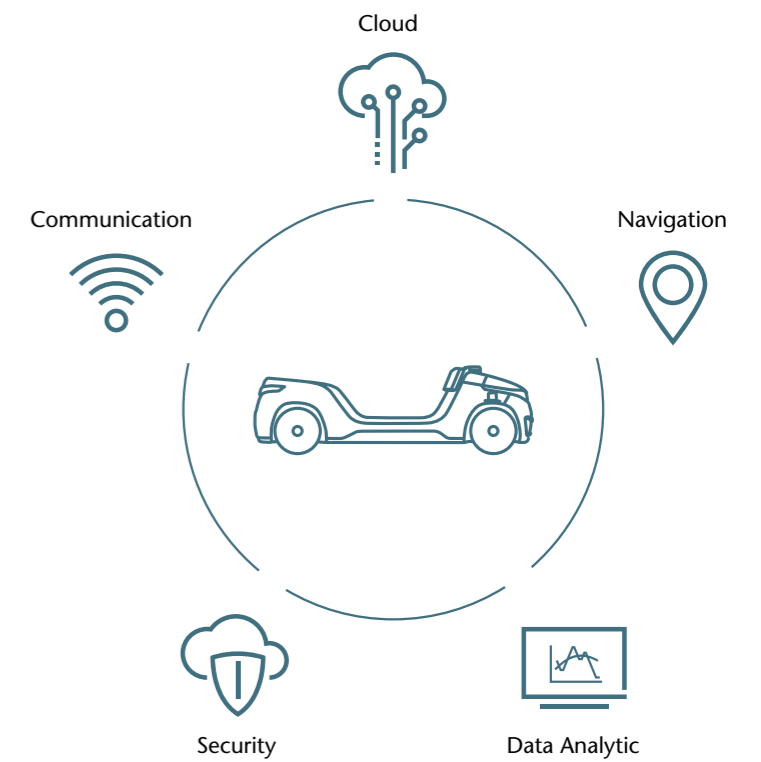
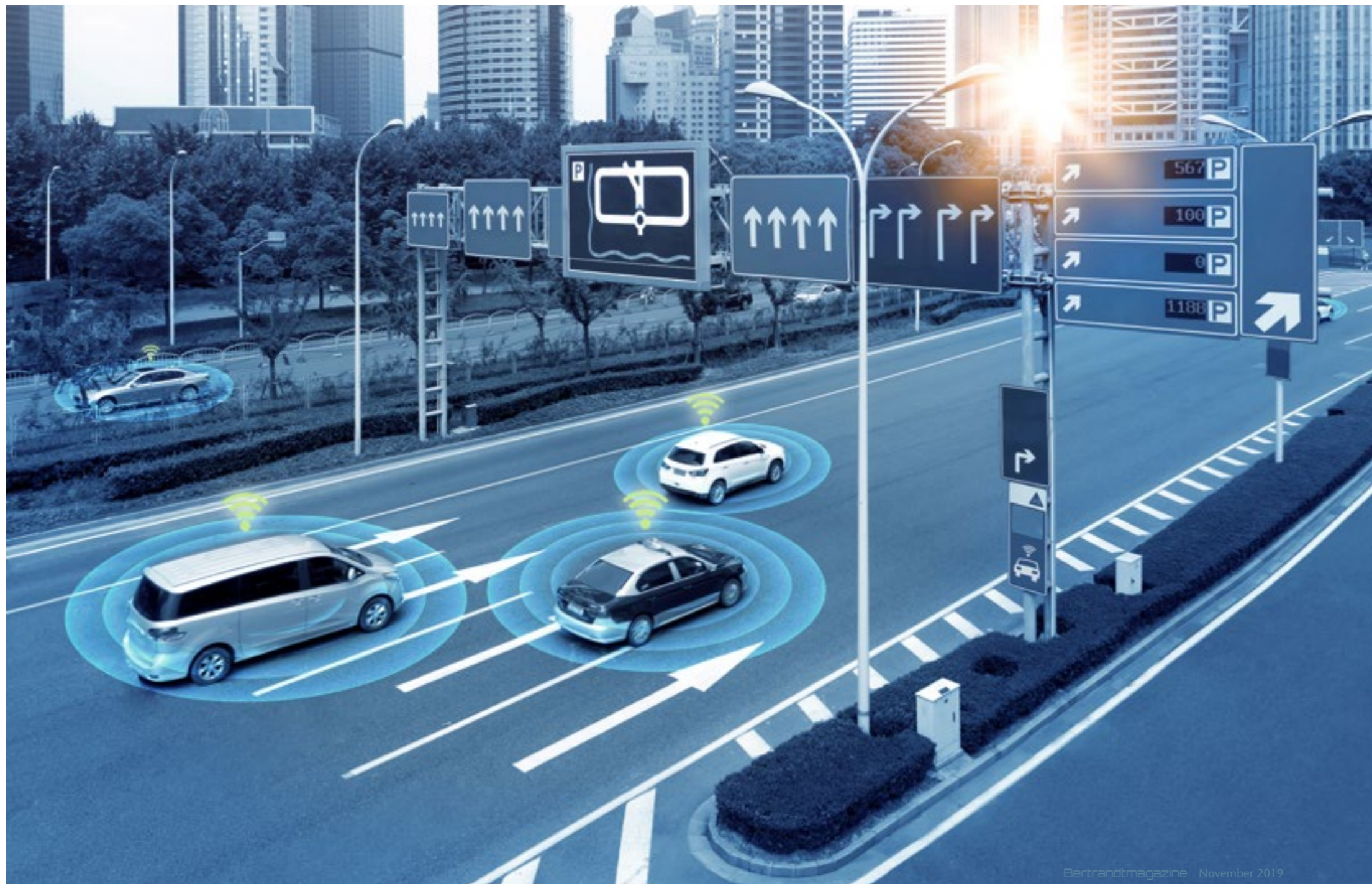
## CONNECTIVITY AND BACK-END SYSTEMS AS THE BASIS FOR THE ARCHITECTURE OF AUTONOMOUS DRIVING

In order to develop the architecture for autonomous driving, we needed to establish secure data transmission paths and design a cloud-based platform. This allows vehicle data recorded by sensors to be stored and evaluated in the Microsoft Azure cloud. We focused on the communication between the car and the back-end systems to process the data needed for autonomous driving, which also enabled us to develop a solution-oriented platform. Our connectivity experts helped us to connect several

cars – in future this may even be a fleet of vehicles – to the Bertrandt cloud. We also established connections to additional devices such as smartphones that can act as an HMI and switch a car safely to autonomous mode after receiving confirmation from the user. The Automotive Analytics and Development Platform which we developed in-house is a solution for analysing sensor data and developing algorithms using artificial intelligence.

There are interfaces in all areas of autonomous driving. The software and functions need information from the back-end systems for the purposes of localisation and environment detection, for example.

The HMI also shows data produced by the back-end on the display in the car, together with status messages about what our technology demonstrator is currently doing or is about to do. The communication channels also have to be open for the charging system and infrastructure which provide information about the car and its charging status. Our modular tool and engineering kit provides a comprehensive scalable solution that can be adapted to meet customers' individual needs. >





### SAFE AUTONOMOUS VEHICLE MOVEMENTS

Planning and implementing autonomous movements is our central concern. We developed an intelligent autonomous driving system that can react independently and make decisions on the basis of information about the environment. One key factor is the development of the software.

The Bertrandt car is currently able to drive fully autonomously in a restricted area using twelve cameras, five lidar systems and ten ultrasound sensors. We have also created the algorithms for the sensors in-house. The autonomous system is capable

of learning using artificial intelligence and is already able to recognise landmark road signs on motorways and stop lines at junctions. The driving scenario can be downloaded via an app. We have also developed our own drive system with the option of drive-by-wire or steer-by-wire which opens up a range of different options. All the level 4 functions are in use and this is a clear demonstration of our engineering expertise.



### EXPANDING OUR EXPERTISE IN ELECTRIC MOBILITY

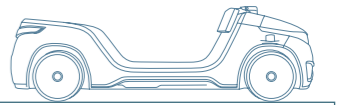
We are developing our own scalable battery system that supplies the car's electrical systems with the necessary energy. The system uses the latest lithium ion cells with a high volumetric and gravimetric energy density, which makes our battery system around 60% lighter and more compact than existing products. It consists of several battery modules, a high-performance battery management system (BMS) and a battery junction box. Each module is made up of several cells and has sensors for monitoring the temperature and voltage. The information is sent to the BMS by cell controllers. Software algorithms in the BMS use the data to ensure that the cells operate within a very narrow temperature and voltage range. The BMS data is subsequently transmitted to the car via the CAN.

Autonomous driving gives rise to specific energy, performance and availability requirements that the car's high-voltage system has to meet. The system is made up of the battery, which provides the energy to drive the vehicle and supply its electrical network, and the power electronics system, which converts this energy into the required form. The battery can be charged from a conventional mains socket via an integrated AC charger or from an external fast charging station. The battery data is sent from the BMS via CAN communications to the domain controller of the technology demonstrator and presented on the interactive display by the HMI.

The connectivity functions and back-end systems send the data to the Bertrandt Automotive Cloud where it can be accessed by smartphone apps, for example. Our in-house software development process and agile development methods enable us to ensure that our battery system complies with the functional safety requirements of ISO 26262 and fulfils the quality specifications of Automotive SPICE.

We are currently working closely on highly automated charging functions. These can involve conductive charging using a robotic arm, innovative plug connectors or inductive charging processes. Another exciting area where a visionary approach is needed is highly dynamic route planning with rapid object detection. Bertrandt is currently working on advanced solutions in this field. //

*Peter Schiekofer, Ehningen*



## HARRI goes USA!

World premiere

CES Las Vegas, 7–10 January 2020





Trends

# Connectivity





# Big data and artificial intelligence come together at Bertrandt



“Data is the new oil in the future of automated driving.”

**B**ertrandt is taking this statement literally. By setting up an interdisciplinary team of highly qualified data scientists from a number of different academic disciplines, Bertrandt is positioning itself as a specialist in the field of big data and artificial intelligence.

## BERTRANDT COGNITION

Bertrandt Cognition is a core business unit within the organisation that specialises in processing large volumes of data and creating artificial intelligence systems using agile development methods. Its goals are to analyse and manage customer data using the very latest data science methodologies. It covers the entire big data value chain, which includes recording and transmitting the data in the car (data ingest), processing and analysing it and presenting and exporting the results (data delivery).

## BIG DATA ANALYTICS

The analysis of big data is a topic which is under discussion throughout the business world. It involves using statistical methods to obtain information from very large volumes of data. Examples of some of these methods are time series analyses, which

evaluate data points from a range of sensors at different times, data mining analyses, which identify structures in the data set such as the repeated occurrence of text modules, and business analytics methodologies. We provide these services to customers in commercial and technical fields.

These very large volumes of data can no longer be effectively processed by off-the-shelf programs such as Microsoft Excel. Bertrandt uses an analysis platform that has been developed in-house on the basis of the Python programming language, which includes the most important methods of statistical data analysis. Parallelisable algorithms have been developed for analysis purposes. These run on high-performance computer clusters, such as Spark, that can process the data much faster than ordinary local computers.

Because of the amount of data involved, which can be as much as several petabytes, special systems are needed to allow the data to be accessed efficiently. Distributed data systems such as HDFS (Hadoop) are used to store the data and enable the algorithms to analyse large volumes of data quickly. High-performance computing instances and GPU-based virtual machines can be used to train neural networks and artificial intelligence systems.

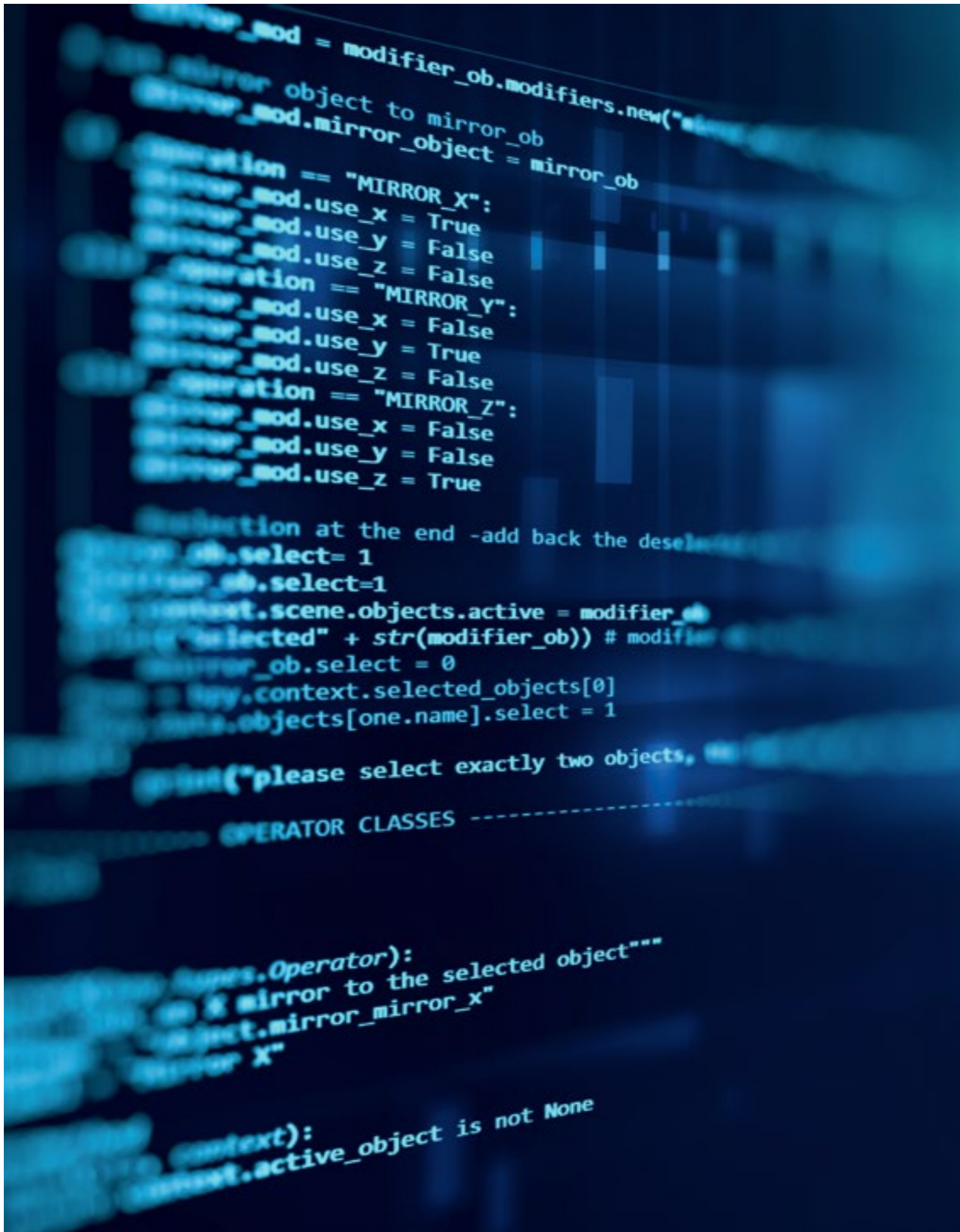
## MANUAL AND AUTOMATED DATA ANNOTATION

Driver assistance systems on SAE level 3 and above function on the basis of a large number of sensors that interact with one another. The functionality of these systems is validated by comparing the measurements from the sensors with annotated data. A large amount of data is needed to ensure that the tests are meaningful.

Bertrandt is currently developing a tool for annotating sensor data. Its main features include an intelligent deployment concept using the SaaS approach, user-friendly operation, scalability and the option of automating the annotation process using algorithms. For Bertrandt the annotation of sensor data is just one part of its overall solution. The challenge begins with capturing data during test drives. The next stages are the high-performance transmission and intelligent management of the data, followed by a wide variety of data analyses. Efficient solutions need to be developed in each of these areas to create a consistent chain of actions and produce time-saving, cost-effective results. //

*Dr Yusuf Erdogan, Rüsselsheim*





## Software testing for a secure future

The Berndt team based in Karlsruhe has extensive experience of software and system testing and automating test processes in the fields of networking and automation. This year the team added ethical hacking to its range of skills. The specialists in Karlsruhe are developing solutions in close cooperation with our customers from a range of industries. These cover areas such as the identification of weak points, optimised solution concepts and recommendations for minimising risks. The Berndt experts provide a highly reliable service and are trusted by our customers, which is a key factor in what is often a sensitive environment.

### NEW SERVICES IN DEMAND

Ethical hackers are security experts who simulate hacking attacks on companies' systems and products. They evaluate whether the system configurations are designed to withstand the attacks. Using penetration tests they identify security loopholes and potential attack locations. They then help to make these areas secure.

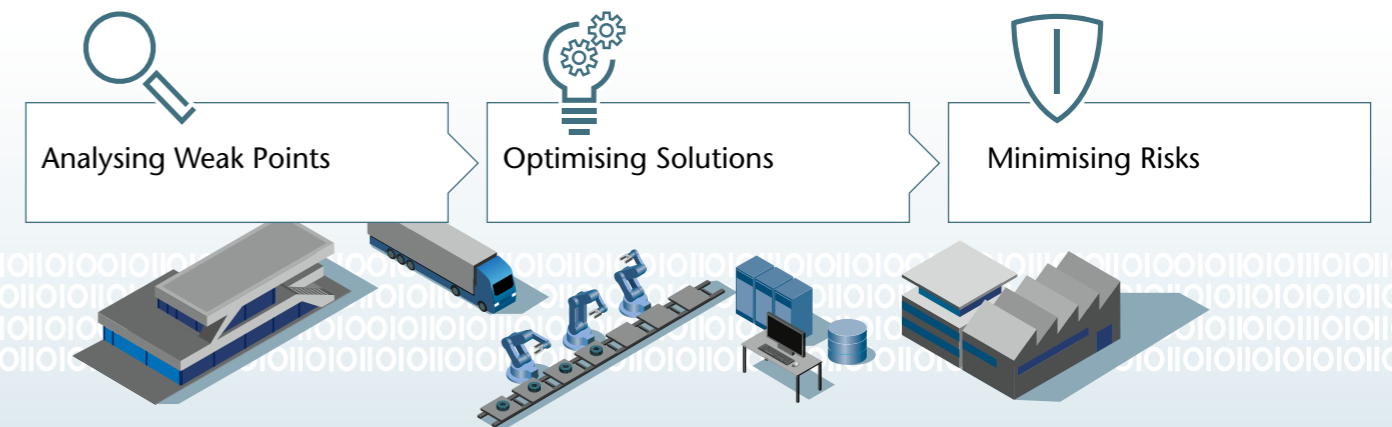
### BASED ON A DETAILED ANALYSIS

The first key step is a comprehensive security analysis as part of the company's security management process. The aim of this is to identify threats using penetration tests and vulnerability scans, determine the probability of an attack occurring, evaluate the potential damage it could cause and define the risks to the company.

### DETECTING WEAK POINTS USING SIMULATED ATTACKS

In principle almost all weak points can be tracked down. The most important ones are, of course, those which allow access to sensitive data. The consequences can include unauthorised modification of configuration settings or sending malware via phishing mails. Risks of this kind are growing and not only in office environments, but also in production networks and in cars, which are increasingly becoming mobile computers. All the latest models have a variety of systems and infotainment functions that are managed by software.

Cyber security is a highly important consideration across all industries in areas ranging from autonomous driving to sensitive production facilities. We are helping to make our digital world more secure. // *Christophe Klein, Florian Schmitt, Karlsruhe*





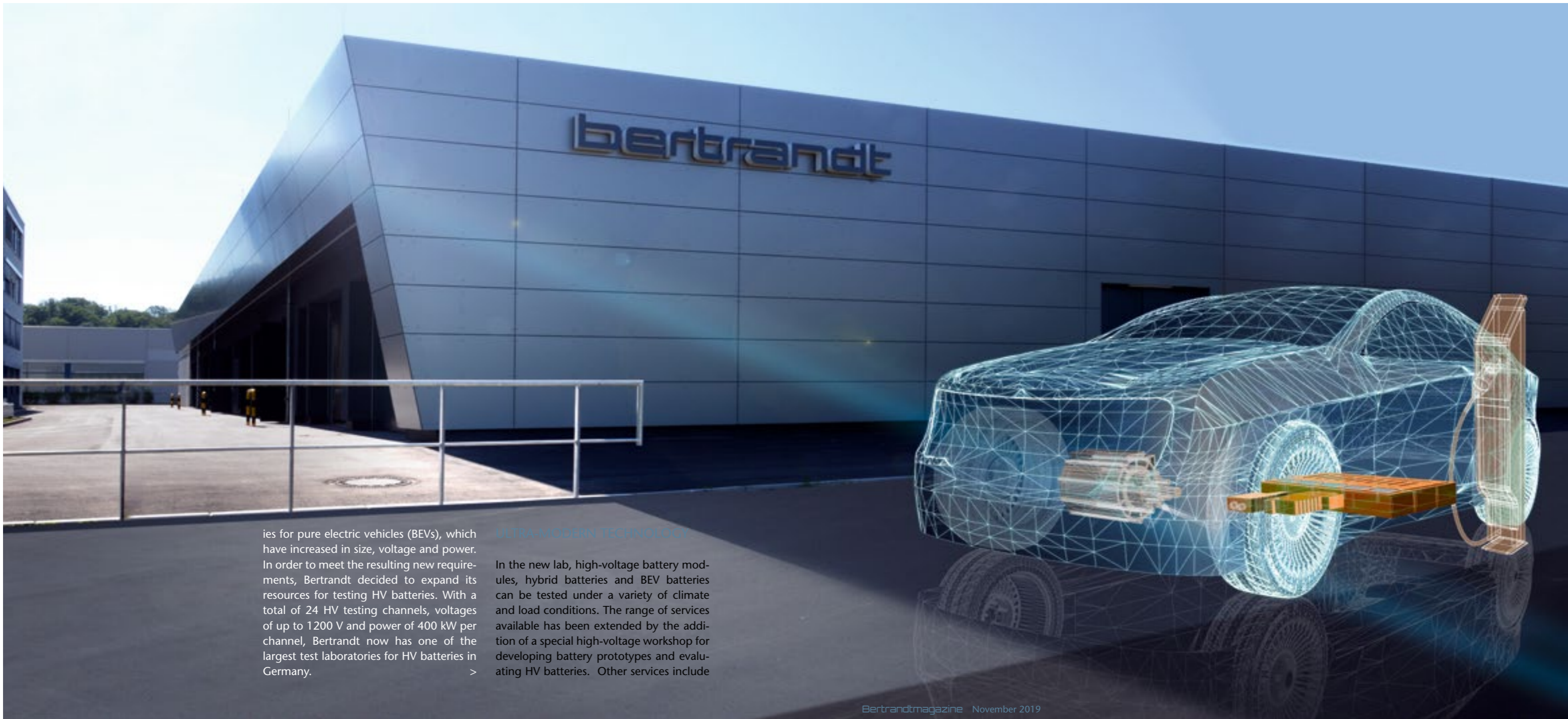


Trends

# Electric Mobility



# High-voltage test centre



ies for pure electric vehicles (BEVs), which have increased in size, voltage and power. In order to meet the resulting new requirements, Bertrandt decided to expand its resources for testing HV batteries. With a total of 24 HV testing channels, voltages of up to 1200 V and power of 400 kW per channel, Bertrandt now has one of the largest test laboratories for HV batteries in Germany. >

#### ULTRA-MODERN TECHNOLOGY

In the new lab, high-voltage battery modules, hybrid batteries and BEV batteries can be tested under a variety of climate and load conditions. The range of services available has been extended by the addition of a special high-voltage workshop for developing battery prototypes and evaluating HV batteries. Other services include



Twelve climate chambers with a volume of 16 m<sup>3</sup>



Battery testers and battery heating/cooling systems



designing battery housings, developing and integrating battery management systems and developing complete electronic systems. Bertrandt has combined its comprehensive existing expertise in the field of electric mobility with ultra-modern technology.

In a building with a very compact and modular design, twelve climate test chambers each with a volume of 16 m<sup>3</sup> and two 1200 V/400 kW HV channels have been installed. The peak charging and discharging currents for each channel are up to 1000 amps. This allows two batteries or one battery with two HV outputs to be tested highly efficiently in one test chamber. It is also possible to link together two HV channels and provide a power supply of up to 800 kW for testing high-power applications.

The climate test chambers can reproduce temperatures in the range of -60°C to +120°C, together with relative humidity of between 10% and 95%. In thermal cycling tests, the chambers can achieve temperature changes of 3K/min to 5K/min. A total of 24 channels are available for heating and cooling batteries with a mixture of water and glycol. The temperature range of these channels is -40°C to +120°C and the speed of the temperature change is between 3 K/min and 5 K/min.



#### VERSATILE TEST CENTRE

The two-storey building was completed in record time. It took only seven months from the ground-breaking ceremony to the installation of the first testing facilities. The building has been designed to make the test processes as efficient and easy as possible. All the testing areas and equipment are on the ground floor and each test room can be accessed from ground level via a roller door. On the basis of Bertrandt's experiences from its existing test centre, the safety systems have been designed to ensure maximum availability. The only items in the test rooms are the climate test chambers. All the other testing facilities, such as battery testers and battery heating/cooling systems, are installed in separate rooms and therefore in different fire compartments. In the event of an incident, the climate chambers and the test room they are located in will function as one fire compartment. This combined with the pressure relief outlets and the option of cooling the batteries externally with water allows possible damage to be restricted to a very small area. The result is that the remainder of the test equipment remains available and we can continue providing a service to our customers.

The monitoring and operating workplaces are located on the second floor, together with the remainder of the technical infrastructure needed for a test centre of this kind. This includes medium-voltage transformers with the accompanying medium-voltage and low-voltage main distribution board, the process water supply, the central process cooling system, the ventilation control centre and, of course, the IT infrastructure.

#### LEADING THE WAY IN ELECTRIC MOBILITY

At Bertrandt's site in Ehningen, the focus in the field of electric mobility is on HV battery development and validation. In order to accommodate the entire development process including the housing design, the layout of the electrical and safety systems, the integration of the battery management system, the development of battery prototypes, the evaluation of HV batteries and finally the validation in the HV test centre, an HV workshop with four set-up and evaluation workplaces was incorporated into the test centre. This is where battery prototypes can be built up to C-sample level and batteries can be prepared for testing and evaluated after the tests have been completed.

With its high-voltage battery test centre, Bertrandt is investing in a new technology and in the electric future of the automotive industry.

//  
Moritz Knebel, Christoph Schelhammer,  
Ehningen



# Renault ALPINE A110





## Renault Alpine A110

Bertrandt provides engineering services during development and production start-up

The Alpine A110 acquired its reputation in the 1960s and the name has lost none of its former glory. The car is still remembered for its many rallying successes and now the legend of French motorsport is enjoying a comeback. Bertrandt has been involved with the challenging development project and the detailed preparations for production start-up since 2013.

### PROJECT CENTRE INCREASES EFFICIENCY

There were several different challenges to be overcome during the development of the new model: achieving a maximum kerb weight of 1080 kg, retaining the typical lines and sporty character of the legendary A110 and also incorporating the comfort and safety features that customers expect from today's premium cars. The objective was to keep the characteristic silhouette, while also combining agility and performance.

In the early phase of the development process, a project centre was set up in Bièvres consisting of the teams from Renault Sport Cars (RSC) and Bertrandt, with the aim of creating a centralised engineering function. This included the project teams from the Alpine engineering department, purchasing, the Dieppe plant and the parts suppliers. Bringing everyone together in one place made it considerably easier to coordinate the work of all the teams.

The specifications drawn up at the start of the project presented a number of challenges. The car was destined for small-scale production and had to be completed within a tight budget and timeframe. The design was the key element in the development of the new model and this was created and validated in advance by the teams from the design centre. >







Renault ALPINE A110

### MEETING AMBITIOUS DEVELOPMENT GOALS

The key criteria in the Alpine requirements specification were light weight, agility, high quality, design excellence and aerodynamics. The team was able to achieve the weight targets for the lightweight body by using aluminium for the underbody (bonded and riveted extrusions) and the bodyshell (bonded and welded pressed parts). The rear side panel is made from one single pressed part to keep waste to a minimum. Designing a side panel in one piece while also fulfilling the geometry and design requirements was a difficult task for everyone involved.

Every detail of the chassis was designed with great care, including the front and rear double wishbone suspension, which opened up new adjustment options, such as wheel camber and suspension kinematics, and led to increased agility and driving pleasure. From a quality perspective, particular attention was paid to the clearances and flush fit of parts. In addition, premium materials such as brushed aluminium and carbon fibre were chosen for the passenger compartment.

In line with the design requirements, LED technology was used for lighting and visibility. The daytime running lights were designed to be reminiscent of the original Alpine with its four headlights.

The configurable digital TFT display, which replaces conventional analogue instruments, the paddles on the steering wheel and the electric parking brake give the interior of the car a modern feel. These new components were developed jointly by the Renault and Bertrandt teams who pooled their technical expertise throughout the course of the project.

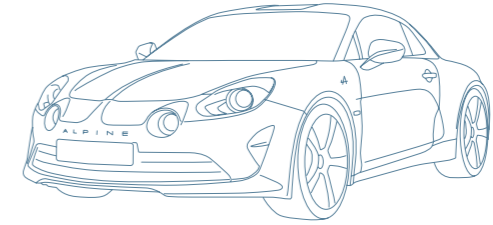
The project strategy involved developing follow-up tools that would allow modifications to be made if required. The strength and the behaviour of the components were assessed using a wide variety of digital and real-life tests. The purpose of the production support services provided by Bertrandt was to ensure from the very beginning of the project that it would be possible to manufacture the components at the plant, which allowed the production start-up for the individual elements to be managed efficiently.

### RAPID START OF INDUSTRIAL PRODUCTION

After the tool go-ahead milestone was reached in December 2015, all the players were brought together as part of a platform at the Renault Sport Cars site in Les Ulis near Paris. This marked the start of the toolmaking phase, with an initial focus on the challenging task of creating the press tool for the side panel.

In March 2016 the first testing and measuring engineers from Bertrandt began work at the Dieppe plant where production was due to start. Their role was to prepare for the acceptance and follow-up of the part geometries, production facilities and assembly processes. Alpine had set up a completely new production process for manufacturing the aluminium body, with semi-automatic production tools for positioning the components and trolleys for transporting the assemblies. The cars are manufactured primarily by hand. >





## In brief: Renault ALPINE A110

### Development of body/exterior

- Body, doors and closures
- Underbody
- Joint sealing
- Architecture
- Dimension and tolerance management
- Lighting and visibility

### Interior

- Passenger compartment

### Powertrain

- Engine peripherals
- Chassis

### Electronics development

- Electric/electronic systems

### Project management

### Quality management

- Managing the quality assurance plan
- Production start-up

Additional vehicle architecture specialists and development engineers and technicians joined the project platform in Dieppe to develop the body. These engineering teams from Renault Sport Cars and Bertrandt took responsibility for managing the start of production. In coordination with the manufacturing team at the Dieppe plant and the development teams in Les Ulis, they ensured the efficiency of the project planning process.

At the same time, the plant underwent a major change with the construction of a new test track. In addition, the paint shop was modernised, the workflow planning was improved and Alpine introduced a sophisticated quality assurance system. The recruitment and training plan was rolled out to bring new team members on board and equip them with the necessary skills. Alpine worked with the engineering teams of Renault Sport Cars, Bertrandt and all the other project partners to put in place an agile management strategy.

### A POSITIVE RESPONSE AND SALES SUCCESS

At the Geneva Motor Show in 2017, during the first road tests and in the press reviews in London, Madrid, Berlin and Rome, the performance of the new model was highly praised. As a result, the go-ahead for the start of production was given in December 2017 for a limited "Première Edition", which sold out in just a few days. The project was a success in every respect and the Alpine is now back with a vengeance.

### CONCLUSION

The project involved a lot of interesting experiences. The cooperation between all the players that developed over the four years of the project is still continuing during the production of the Alpine. Throughout the project, all the teams put every effort into developing innovative solutions to ensure its success.

//

*Sylvie Fourny, France*



# DS 3 CROSSBACK





## DS 3 CROSSBACK

Bertrandt develops an innovative cockpit

The PSA Group commissioned Bertrandt France to develop the instrument panel and centre console for the DS 3 CROSSBACK. The French team also functioned as a service centre and coordinated all the activities on behalf of PSA, from the preliminary design project through to the approval for production.

The DS 3 CROSSBACK is a relatively small SUV and Citroën's aim during the development process was to combine elegance, comfort and the very latest technology. The new model has a characteristic and striking silhouette. The eye-catching design is underlined by a variety of subtle, ultra-modern details, one of which is the instrument panel.

### CLOSE COOPERATION DURING THE DEVELOPMENT PHASE

In order to meet PSA's requirements and comply with its style specifications, it was important for the teams from the various service providers to work closely together from the start of the development phase. An experienced team from Bertrandt's interior department took part in the project and ensured that the cockpit and centre console were technically consistent during all the stages of the process through to the construction of the final tools.

The two major suppliers were also involved in the partnership between the manufacturer and the service providers.

### FROM THE PRELIMINARY DESIGN PROJECT THROUGH TO INDUSTRIAL PRODUCTION

The cockpit was completed by Bertrandt with the support of a range of different departments within PSA. This cooperative approach made it possible to meet all the quality requirements. In addition, the cockpit was delivered on budget and on time with all the agreed components. The first parts were produced to a high standard of quality using the final tools and the first cockpits were assembled all according to schedule. The premium standards specified by the PSA Group and the cooperation between all the teams throughout the entire project resulted in a high-quality cockpit with a unique design. The success of the project was confirmed at the Paris Motor Show in 2018 where the DS 3 CROSSBACK was hailed as the "Best production car" on its official launch. //

*Lionel Venton, Christophe Dorazil, Bruno Rodrigues, Monssef Tabari, Joel Costa, Solenn Mace, Cyril Granchi, Jamel Benayad, David Boismaigre – Bertrandt France*







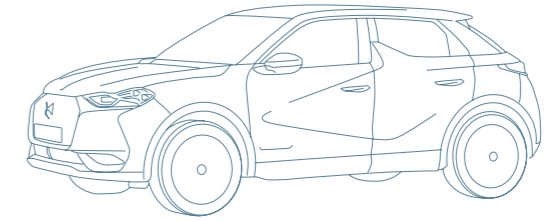
“As a quality specialist, I know that the combination of the instrument panel and centre console is a critical component with regard to its potential for visual and functional faults (irritating noises). That is why it is vital to ensure that the design and the production process for these components are totally reliable. I worked with the team from Bertrandt France very often in this area. I very much appreciated the commitment and fast responses of the team members. In my job it is essential to be able to rely on the technical feedback from the teams. The specialists from Bertrandt demonstrated week after week that we can count on them. Something else worth highlighting is the team spirit on this project. The excellent teamwork made it possible to resolve challenges quickly and to produce good quality components. My conclusion is that the members of the team from Bertrandt France were thorough, efficient and worked well together and with all the other teams. I will be happy to recommend them for other PSA projects.”

**Nathalie SAVIN**, Groupe PSA, Responsable qualité

“The Bertrandt team members worked on the D 34 project from the preliminary design phase onwards and were fully integrated into the project team. The challenge of the DS 3 CROSSBACK project was to make the technology work in the service of the design and to develop an outstanding product which met all the criteria of the DS brand: a spectacular concept with an avantgarde style. The team from Bertrandt France worked with the designers and the suppliers to ensure that all the design requirements were fulfilled and, at the same time, that the components were technically viable and cost-effective. As a result of the reliability of the digital definitions for the creation of the matrices and tools, the very first production parts met the required standard for manufacturing and the quality goals. The professional team from Bertrandt France made an important contribution to the success of the DS 3 CROSSBACK.”

**Pascal Béziat**, Groupe PSA, Directeur du projet





## In brief: DS 3 CROSSBACK

### Design

- Support for the design concept
- Coordinating design and product engineering

### Preliminary design project

- Submitting concepts

### Development

- 3D digitisation of the cockpit
- Complying with geometric requirements
- Drawing up specifications for tenders
- Supplier management
- Approvals

### Start of industrial production with suppliers

- Analysis of the first components produced with the tools
- Evaluation of the first assembly processes and results
- Fault analysis
- Troubleshooting
- Taking corrective measures
- Making changes to tools
- Supplier management
- Coordinating the parameters

“The collaboration with Bertrandt went very smoothly. The design of the cockpit is unusual, stylish and innovative and the industrial production method was highly ambitious. The result meets all our very high quality standards in terms of the materials, the features of the parts, the dimensional accuracy, the clearances and the flush fit of the components. The atmosphere during the various design phases and the start of industrial production was excellent. The Bertrandt teams always responded very quickly to our input. The DS brand is very proud of this wonderful cockpit. Thanks go to everyone who contributed to achieving this result!”

**Alain JOSEPH**, Responsable synthèse clients DS





# Validating the powertrains of the future

The global automotive industry is facing a radical transformation, with the key issue being emissions of CO<sub>2</sub>, nitrogen oxide and particulate matter. In order to reduce the levels of these emissions, new legislation has been introduced throughout the world. The industry must comply with the new emission regulations and also introduce a range of innovative powertrains.

For this reason, Bertrandt is investing more funds in facilities for the validation and type approval of vehicles. The most important project involves building two new vehicle emission test centres in Tappenberg near Wolfsburg and in Freising near Munich. The construction of the centres forms the basis for testing future powertrain concepts. Alternative powertrains such as hybrid and electric drives will in future be tested and validated in accordance with the latest legislation, alongside conventional powertrains running on a variety of fuels. The test centres will specialise in certification, type approval, real driving emissions (RDE) developments and other development services.

The design of the two test centres is identical and they are fully equipped for emission testing for type approval, conformity of production tests and RDE development.

One special feature of both sites is a dynamometer in an altitude chamber which can simulate altitudes of up to 4200 m. It also has a sunlight simulation system that can reproduce different types of sunlight. This chamber is a high-performance system with rated power of 550 kW and a maximum speed of up to 300 km/h. As a result, it can simulate special driving situations such as mountain roads and hot climate testing. This means that car manufacturers do not need to travel to other countries for every individual test, which represents a major improvement in efficiency and sustainability and a reduction in the environmental impact of road testing.

Following a tender process, AVL List GmbH was awarded the contract to act as general contractor for the construction of the buildings and the testing equipment. The investment amounts to a total of more than 80 million euros. The two test centres are currently under construction and will come into operation in August 2020. //

*Matthias Rühl,  
director engineering powertrain/chassis*



- Approximately 80 temperature-controlled parking spaces at temperatures ranging from -25°C to +23°C
- Three all-wheel drive dynamometers each with a power output of 350 kW (-7°C to +35°C)
- One altitude chamber with an all-wheel drive dynamometer with a power output of 550 kW (-25°C to +45°C)
- Complete emission measurement systems for all the relevant global exhaust emission legislation
- Preparations for gas and hydrogen powertrains
- Safety systems for electric vehicles
- Charging infrastructure for electric vehicles
- RDE workshop

THE KEY FACILITIES OF EACH TEST CENTRE INCLUDE



# The latest news from the world of Bertrandt



## Expansion of acoustics competence centre

As more new technologies come onto the market, so acoustics development is becoming increasingly important. Acoustics and sound design are having a major influence on end customers' purchasing decisions in the automotive industry, in particular with regard to electric cars, and also in other industrial sectors. Manufacturers whose products have the best acoustics and lowest levels of vibration or the most impressive sound design will acquire a clear advantage over their competitors. In order to offer customers expert support and flexible, tailor-made services, Bertrandt has further expanded its acoustics facilities. Our specialists in Sassenburg near Wolfsburg can provide specialist consultancy and develop the individual sounds that our customers want. //

*Martin Broesel, Wolfsburg*



## Innovative injection moulding process in the rapid technologies competence centre

The rapid technologies competence centre in Ehningen has installed a new injection moulding machine that uses the MuCell® process. This is an innovative method of injection moulding microcellular foam from thermoplastic materials. The technology is used in particular for components for car engine compartments and interiors, headlights and also lightweight structures. The benefits for customers include the unique design flexibility and potential cost savings that are not available with conventional injection moulding. The new technology, which is only offered by a few specialist companies, allows the material wall thickness to be designed for functionality without having to take the injection moulding process into consideration. The combination of the reduction in density and the design for functionality often results in material and weight savings. //

*Michael Wetzstein, Ehningen*



## FINAL container in the airbag laboratory

An additional testing system for restraint systems has been installed in Bertrandt's airbag laboratory in Ingolstadt: the FINAL (Force INDicated Assessment TOOL) container. This is a substitute environment for testing gas generators which allows them to be evaluated more accurately before they are subsequently used in restraint systems. A gas generator is installed in the FINAL container and then triggered under reproducible conditions. The container is designed to enable the gas generator to inflate a standardised airbag made of typical material which is restricted to a specific volume of 60 litres. This allows the gas to dissipate in a reproducible way and to be adapted to the restraint system using a supplementary opening. The benefits for customers include a more effective design for restraint systems, more data for simulation models and improved quality assurance processes for gas generators. //

*Kai Golowko, Ingolstadt*



# Social responsibility

## Safe journeys

Bertrandt is sponsoring the "Felix" baby ambulance supplied by the Björn Steiger foundation and helping to ensure that premature babies are transported safely. Appropriate care is often not available at the hospitals where these babies are born which means that they have to be moved to specialist centres. A smooth journey in a high-tech environment designed for the needs of premature newborns can save a baby's life. //

## Focusing on careers guidance

Education is the key to living an independent life and opens up interesting prospects for the future. This is the idea behind the Talent Company, which has been established by the Strahlemann Foundation. It is a specialist careers guidance area which is being set up in schools throughout Germany and which brings together everyone involved in providing careers advice and all the related activities. Dedicated teachers, forward-looking companies and a range of training organisations work together to develop a varied and constructive programme designed to meet the students' needs, with a focus on the talents and strengths of the individual students. Bertrandt is supporting the Hermann-von-Helmholz school in Berlin. //

## Helping volunteers

As part of Bertrandt's internal "Working world of the future" project, the company's Regensburg site is not only opening up new opportunities for mobile and flexible working, but is also focusing on health and safety in the workplace. For this reason all the conventional desks have been replaced by height-adjustable models. With the environmental impact in mind, the 50 superfluous desks have been donated to a charity for use by volunteers. //

## Blood donation with the German Red Cross

Several Bertrandt sites organised local blood donation events with the German Red Cross. The company's Wolfsburg site was among them. The idea came from the health management team and the response from employees was very positive, with around 120 taking part. Every day 15,000 units of blood are needed in Germany and the Bertrandt employees' aim in giving blood was to help other people. //

## New inspiration for the future

Bertrandt's sustainability report provides information about the economic, environmental and social development of the company and explains our values and our objectives. It provides a detailed insight into areas such as responsible corporate governance, our employees, the environment, our business partners and society as a whole. //



Bertrandt wherever you are – worldwide



Headquarters  
 Bertrandt AG  
 Birkensee 1  
 71139 Ehningen, Germany  
 Telephone: +49 7034 656-0  
 info@bertrandt.com

You can find more information about our locations at:

<https://www.bertrandt.com/en/company/bertrandt-group/locations/>



The Bertrandt portfolio of services

### Trends

- Digitisation
- Autonomous Driving
- Connectivity
- Electric Mobility
- Vehicle Safety
- IT Services
- Virtualisation/Mixed Reality

- Design Services
- Interior
- Vehicle Body Development
- Powertrain
- Chassis
- Simulation
- Electronics
- Modelling and Rapid Technologies
- Testing
- Engineering Services

### Industries

- Automotive Industry
- Aerospace
- Commercial Vehicles
- Agricultural Machinery
- Motorcycle
- Electrical Industry
- Machines and Production Plants
- Medical Technology
- Energy

Detailed information about Bertrandt's complete portfolio of services is available on our website:

<https://www.bertrandt.com/en/range-of-services/>



You will find details of the events that Bertrandt is attending here:

<https://www.bertrandt.com/en/events/>

