

# bertrandt

CUSTOMER MAGAZINE NO. 20



## DIGITALIZATION

IMPROVING PRODUCTION  
PROCESSES

## SENSOR PERFORMANCE

ENSURING SAFE  
AUTONOMOUS MOBILITY

## BERTRANDT POWERTRAIN SOLUTION CENTER

VALIDATING THE POWERTRAIN  
CONCEPTS OF THE FUTURE



# Editorial

Dear reader,

We are pleased to bring you the latest issue of the Bertrandt customer magazine. In this very challenging economic environment, we have been continuing to work with our customers on a number of exciting and innovative projects. This unprecedented situation is likely to be with us for some time, but we are nevertheless optimistic about the future and we would like to give you some insights into the world of Bertrandt. Here you can discover which of the latest trends we are working on and how we can give you targeted support for your projects.

To ensure that we are well-prepared for the future, we have restructured our organization. This has involved continuing to expand our portfolio of services and combining our automotive activities into four divisions. In addition, our technical experts are working very closely together across all our sites. With dedicated key account managers, we can offer you all of our services from a single point of contact.

In this issue we will be concentrating on a key trend that is revolutionizing many industries: digitalization. Our focus is on providing our customers with targeted, customized support using appropriate methodologies and tools as they move toward implementing the digital factory.

In addition, we are working to develop and enhance autonomous systems. As safety regulations become ever more stringent, new approaches and improvements are constantly needed. Our HARRI innovation platform has already enabled us to demonstrate our expertise in the field of sensor performance. We have also been able to transfer the expertise that we have acquired to other areas where autonomous systems are used. For example, we have equipped a conventional drone with additional sensors to create our SALLI platform.

Last but not least, we would like to present the Bertrandt Powertrain Solution Center, which we have established at two sites in Wolfsburg and Munich. Our test center is designed to validate the powertrain concepts of the future, both conventional and alternative. Take a look and find out how we can help you.

We hope you enjoy reading this issue of our magazine.

With kind regards  
The Bertrandt Management Board

Hans-Gerd Claus

Michael Lücke

Markus Ruf



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New emissions legislation is being introduced worldwide. At the same time, different types of drive systems are becoming established. With the completion of the Bertrandt Powertrain Solution Center (BPSC) at our Munich and Wolfsburg sites, we can support our customers in precisely this field as a response to the increasing and ever more complex testing requirements.

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# All Our Services from a Single Source

WE ARE RESTRUCTURING TO PROVIDE YOU WITH THE BEST POSSIBLE SUPPORT

Over recent years the demands that our customers have placed on us as a development partner have been constantly changing. To enable us to work effectively and efficiently with our customers in the future, we have restructured our organization.

The latest trends for digitalization and electric mobility are placing new demands on the expertise and the services of companies across the whole of the automotive industry. For us as a development partner, examples of this include the need to provide software development skills and offer automated and virtual validation solutions. Furthermore, we are increasingly taking on complex projects covering the entire value added process. These large-scale projects require us to pool a wide variety of skills and make available flexible capacity at different sites. For this reason, we have restructured our organization. We are taking greater responsibility, increasing our expertise, grouping our competencies and providing capacity that can be scaled up or down across sites in different countries. We have transformed the Bertrandt Group into a solution provider specializing in every aspect of the latest technological trends.

## SIMPLE AND EFFICIENT ACCESS TO OUR ENTIRE SERVICE PORTFOLIO

We are paving the way for future developments and adopting the approach of a single point of contact for all our services. In order to achieve this, we have made three key

changes. Firstly, we are pooling our technological expertise in the automotive sector in divisions with specialist units. Secondly, we have a network of technical experts who will work together across all our sites and across international borders. Thirdly, we are creating a single point of contact for our customers as part of our key account management function, so that you as a customer can access our entire portfolio of services simply and efficiently.

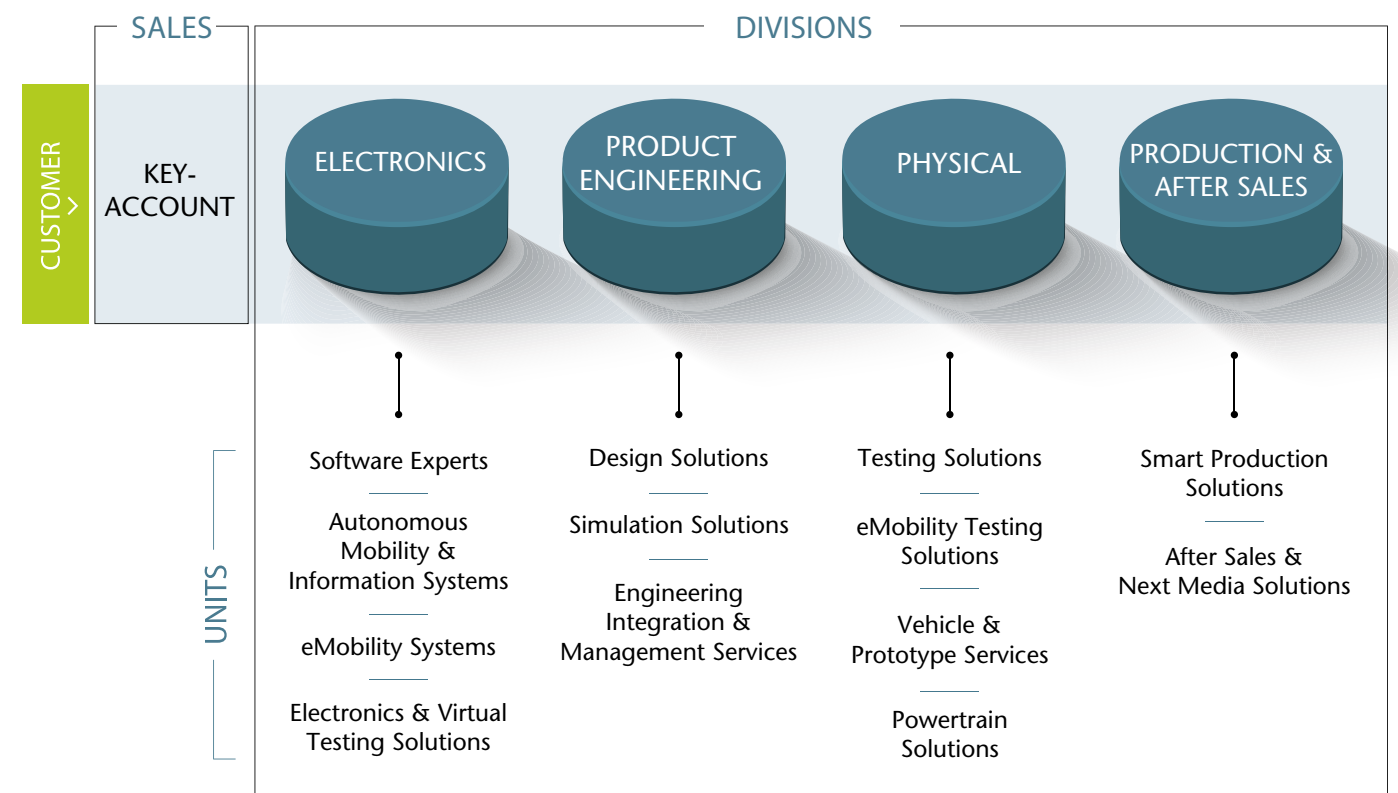
## THE BENEFITS OF OUR NEW ORGANIZATION FOR YOU

- Increased technological competence as a result of an expert organization consisting of divisions and units
- Dedicated key account managers
- International network with more than 50 sites
- Scalable project management functions for complete development projects

## SECURITY AND QUALITY, PROXIMITY AND RELIABILITY REMAIN UNCHANGED

Against the background of all these innovations, it is important for us to retain our existing strengths. We stand for security and quality. This includes certified process quality, data security and confidentiality, and highly professional, trustworthy processing of your sensitive data. Quality, adherence to deadlines, reliable collaboration and proximity to our customers remain our top priorities.

WE HAVE BROUGHT TOGETHER OUR BROAD PORTFOLIO OF SERVICES INTO FOUR DIVISIONS WITH SPECIALIST UNITS.





# Efficient processes as the basis

DIGITAL PRODUCTION PLANNING: WE PROVIDE  
SMART SOLUTIONS FOR OUR CUSTOMERS



**The whole world is talking about digitalization – and so are we at Bertrandt! Our focus is on sustainably improving our customers' production processes. We provide methods and tools from a process perspective, apply them individually and in a targeted manner, and support our customers on the path towards data-controlled production.**

There is no doubt: digitalization is not a vision for the future, it is a reality. And every company, regardless of its size, needs to face its challenges. It offers many advantages for production: more flexibility, shorter time to market, and greater process stability due to better process transparency.

The interconnection of production planning with the factory helps our customers to keep an eye on the increasing requirements, such as greater cost pressure, higher logistics performance, and different product variants, and to continuously optimize them. It is not decisive whether digitalization is initiated in the actual production processes or in the planning and design of new production plant. What is decisive is identifying a starting point that offers clear, real, and sustainable added value.

#### WITH PROCESS KNOW-HOW AND TECHNOLOGY COMPETENCE

As soon as a customer decides to digitalize their production processes, they will require tools that bring together and evaluate the data generated by the company. The following lines of action can be derived from this. "Our customers generally come to us with a concrete challenge. This usually involves, for example, process or product requirements, the targeted evaluation of data, or a new machine or factory that needs to be integrated into existing processes," says Dr. Michael Brodmann, Unit Manager Smart Production Solutions. For a digitalization project, we offer our customers a broad range of methodological know-how in factory and production planning combined with expertise in transferring planning processes into a digital process chain. We can provide comprehensive support for any manufacturing company, regardless of its size, throughout the entire project: from initial advice to the optimum solution and implementation.

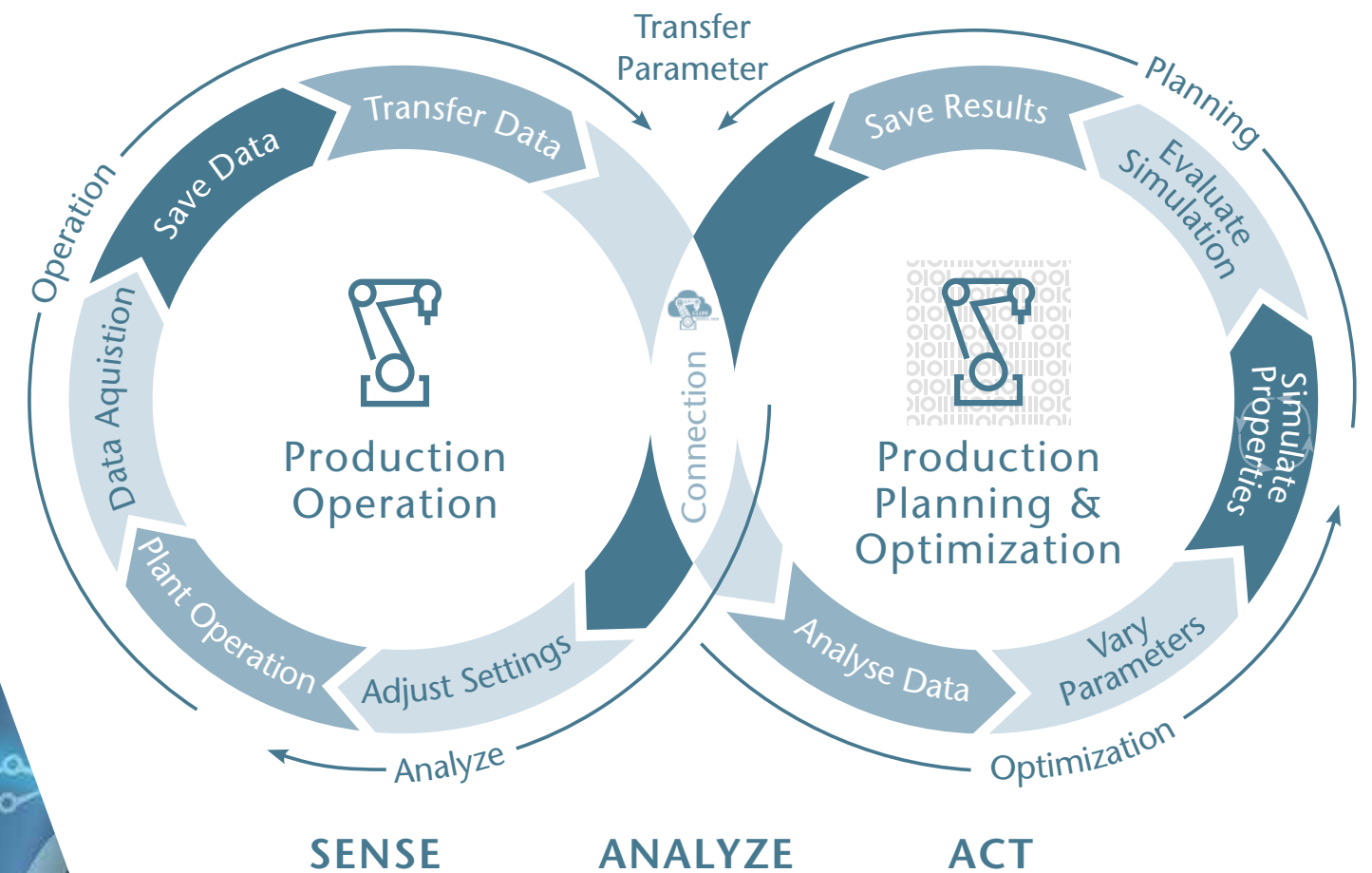
#### SCENARIO 1: DIGITAL OPTIMIZATION OF PRODUCTION PROCESSES

Digitalization projects in production plants require, as their starting point, an analysis of the processes and potentials involved. Possible optimizations are collected and defined using existing process data. The tools for application-related data processing and enrichment are then used in order to finally initiate the optimization process in the factory. The tools for this are made available in the Digital Factory (more on this on page 16-19). This connects digital methods, models, and simulation and calculation tools to form a network. For example, the first step towards digital production planning at a mechanical engineering company might be as follows: the company would like to automatically digitize layout data in a PDF format and convert them into a CAD program. Furthermore, in the future all layouts should be digitally available in the cloud. For this purpose, an inter-departmental data management process is established in order to make all data available at any time and therefore to enable optimization or adjustments to be performed while the factory is operating.

#### SCENARIO 2: DIGITAL PLANNING PROCESS FOR THE NEW FACTORY

When a new factory is being designed, a digital twin can be used to virtually represent, simulate, and optimize the shop floor, machines, and production processes even during the planning phase. This is possible because the entire process or material flow can be seen in the evaluation of the data. This means that, even before construction begins, all the planning premises relating to the machines and processes can be checked and validated and any necessary changes can be made. In a first step, it can certainly be productive to first digitally represent (smaller) partial aspects which can then be digitally merged gradually.





### THE LINKING OF PRODUCTION PLANNING AND THE FACTORY

The decisive added value offered by digitalization in production planning is created when the real factory is linked with its digital twin. As a result, data can be collected from the factory in a targeted manner at any time and can be fed into a simulation for checking or optimization before being finally implemented in practice – an endless cycle of production, optimization, planning, and implementation. This interconnection is the prerequisite for successively trans-

ferring planning processes into a digital process chain and continuously monitoring and evaluating individual processes. Linking the entire factory and all processes with each other is a long-term task. One challenge is creating heterogeneous tool landscapes. It is often the case, for example, that machines operate well by themselves but not so well when they are working together with others. In such cases, even a small digitalization step in production planning and the factory will achieve progress. Digitalization processes ensure more transparency, thus resulting in an efficient factory process and high-quality products.



# “Digitalization?!” Easier than expected!”

Depending on the size of the company, there are many approaches towards optimizing production planning. We support our customers in implementing them. Michael Brodmann and Alex März – experts in the field of production planning at Bertrand – report on how digital production planning can sustainably create added value.

## MANY MANUFACTURING COMPANIES HAVE STILL NOT TAKEN THEIR FIRST STEP TOWARDS DIGITALIZATION IN PRODUCTION PLANNING. WHAT HAS PREVENTED THEM SO FAR?

**Brodmann:** The term digitalization alone is a problem: it all sounds so overwhelming, it can mean anything, and it dominates everything. It frightens people off and does not help in developing a concept of how and where to begin the process of digitalization and production planning.

**März:** What we see at many of our customers is that they have a factory, a planning process, and a production plan, but they have no idea about where they can implement digitalization. In order for them to take this first step, it is important for them to identify a concrete issue as a starting point.

## AND WHERE DO YOU SEE STARTING POINTS?

**Brodmann:** When we talk about the digitalization of production planning, we mean the planning and implementation of production plants, as well as process planning and optimization. Here, we can find many different starting points or processes that we can solve and sustainably optimize with a digitalization step. We also take a close look at the supply chain, as this is part of the complete factory process.

## CAN YOU GIVE US AN EXAMPLE FROM YOUR EVERYDAY WORK?

**März:** One of our projects is to produce digital assembly instructions for new plant and equipment. In the past, the customer was not able to create such photographic instructions until the plant was ready for operation and the new product had already been produced. They now want the digital assembly instructions to be already available before the first component is assembled. The solution is to generate the instructions directly from the CAD data in the future. This reduces the previously unavoidable delays in starting up the machine. This is a small project related to an individual process that achieves definite added value with regard to both the costs and the process, and it shows how easy digitalization can be.

**Brodmann:** With projects like this, whether they are small or large, we support companies in identifying useful approaches in production planning, which we then implement. Our message is that everyone should keep in mind what the overall goal of digitalization is for them. They can then approach this goal step by step.

## IN THE END, IS IT ALWAYS A MATTER OF ACQUIRING THE DATA?

**Brodmann:** Yes, data is the most important part of digitalization. But there is more to it than that: we need to process both the analogue and digital data in such a way that they can be used in the first place.

**März:** Just think of the statement “Data is the new oil”. What can you actually do with crude oil? You first have to break it down into its components, in order, for example, to produce plastic from it. It’s the same with data. You first have to break

the data down, enrich it, and then combine it with other data in order to make an overall statement possible. To do this, you need methods and models as well as the user and the application. We provide the technical solution to this with CLIFE\* – our digital twin solution.

## DO YOU HAVE AN EXAMPLE?

**März:** Many customers had to stop their production lines and processes during the coronavirus lockdown. When they restarted them, they had huge problems and high start-up costs. It became apparent that their process transparency was insufficient and there was a lack of knowledge about how restarting a factory actually works. Such a problem can be remedied or even directly avoided on the basis of data generated when the factory is started up for the first time. This is done by means of data analysis, simulation, and optimization.

## HOW DO YOU IMPLEMENT DIGITALIZATION IN PRODUCTION PLANNING?

**Brodmann:** When we transfer planning processes into the digital world, we can apply our know-how in planning and methods. In addition, we also provide our expertise in using existing and new tools to digitally simulate a process chain for the entire planning process. We advise and support our customers in choosing the right project that offers maximum added value for them individually.

Michael Brodmann




\*You can read more about CLIFE on page 20-21.



Alex März



The background of the slide is a complex digital interface with a blue and black color scheme. It features a central circular graphic with a gear-like border and a robotic arm in the center. A hand is shown on the right side, with a finger pointing towards the interface. The interface is filled with various technical symbols, lines, and text, including "WORLD SEARCHING OPERATION ON 07-07-20770" at the top left, "ROTATION-BALANCE-SPEED" below it, and "CAM:R2" near the central gear. Other visible text includes "MONITORING: LRES", "HOLD", "R", "ZONE 1", and "COMPASS".

# The digital factory – Fit for the future

OPTIMUM PLANNING, VISUALIZATION,  
AND VALIDATION





**Will a machine function as planned? Can the installation engineer carry out the required tasks? Has the new factory building been designed to provide the ideal setting for the logistics processes? Even the best traditional factory and production planning methods will never be able to anticipate all possible eventualities and problems. The digital factory provides digital models, methods and tools to optimize and validate the planning process. This ensures that there are no obstacles in the way of its success.**

Production planning and factory design are the key applications for the digital factory. Specialist tools are used to represent the products, production facilities, and buildings in virtual form and to bring together all the relevant data. This allows the workflows to be visualized during the process of designing and optimizing them.

#### **CENTRAL FEATURE OF PRODUCTION PLANNING**

If consistent use is made of the models, methods, and tools, the many benefits of the digital factory for planning and manufacturing can be exploited to the full. The planning process is accelerated and faults are kept to a minimum, even before a factory building is constructed, a product goes into manufacturing or major investments are made in machinery. This makes the planning process more reliable and keeps costs low, because retrospective changes, which may be caused, for example, by the fact that a machine does not fit perfectly in the building or that obstacles such as pillars or pipes have been overlooked, are no longer needed.

#### **FOR BUSINESSES OF ANY SIZE**

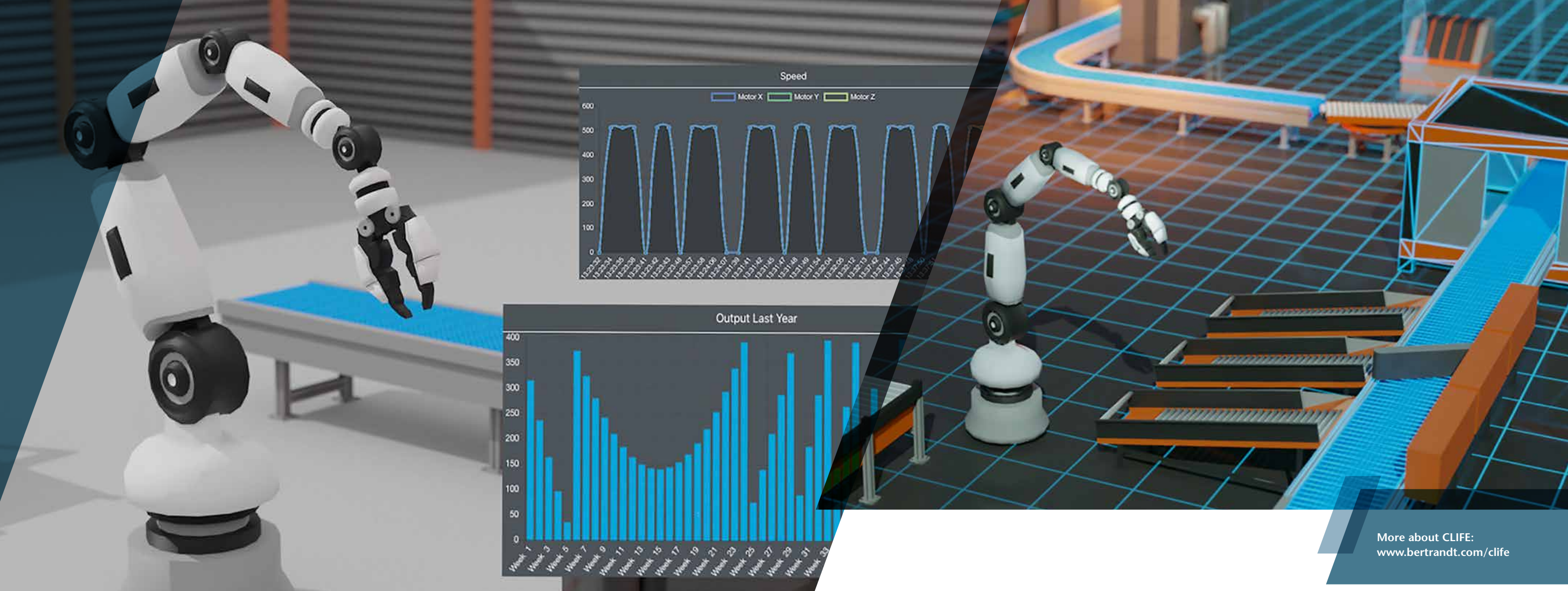
Our digitalization experts work together with our customers' teams to exploit the full potential and added value of the digital factory and to identify appropriate departments and processes. Regardless of the size of their company, we help our customers to make efficient use of tools and we take responsibility for the complete planning and implementation of projects. For example, if a new production line or factory is being constructed, we can create a digital representation of all the assumptions made during the planning process with the help of CAD models and details of robot and employee movements. This enables us to evaluate the plan and make any necessary changes or improvements.

#### **DEVELOPING NEW PRODUCTS**

The same applies to the process of creating a new product. A typical example of a testing and optimization issue on the route from planning to production is whether the product can be manufactured using a standard tool or whether special tools are needed. Potential quality problems can also be detected in advance and the causes can be identified and resolved. Specific goals in this context include shortening the prototyping period, validating manufacturability, minimizing rejects, and improving tool changeover times.

"In our experience, it is not generally necessary to transform an entire plant into a digital factory. Instead, we make targeted use of digital models, methods, and tools for specific processes, solutions, and improvements," says Nils Sothmann, Lead Expert for Production Planning at Bertrandt.





More about CLIFE:  
[www.bertrandt.com/clife](http://www.bertrandt.com/clife)

# With the digital twin to the Smart Factory

OUR SOLUTION CALLED CLIFE ENABLES AN INDIVIDUAL, DIGITAL DATA EVALUATION OF YOUR FACTORY, PRODUCTION OR LOGISTICS

The smooth running of a process in all areas of the factory, production, and logistics requires seamless interaction between the various individual components involved. Due to the increasing amount of data being generated and the heterogeneous interfaces of the different systems, the evaluation of the processes, which is still being carried out by hand in most cases, is becoming more and more difficult. What is more, such manual evaluation takes time and the error rate is relatively high.

#### INDIVIDUAL COMPILATION OF THE DATA

This is precisely where our digital twin solution called CLIFE comes into its own. It optimizes the process by centrally aggregating all of the data of a system and displaying, storing, and evaluating the data in a user-specific way with exact positioning. "Our tool offers the possibility to perfectly distribute the most important information to different users. A manager, for example, can use CLIFE to gain an overview of all the factories, while an operator can follow the live status of the machines, and a maintenance engineer can see at a glance whether maintenance is required. With our CLIFE digital twin solution, our customers can make the right decisions at the earliest possible point in time, thus continuously optimizing their production processes," says Catherine de Beule, responsible for CLIFE.

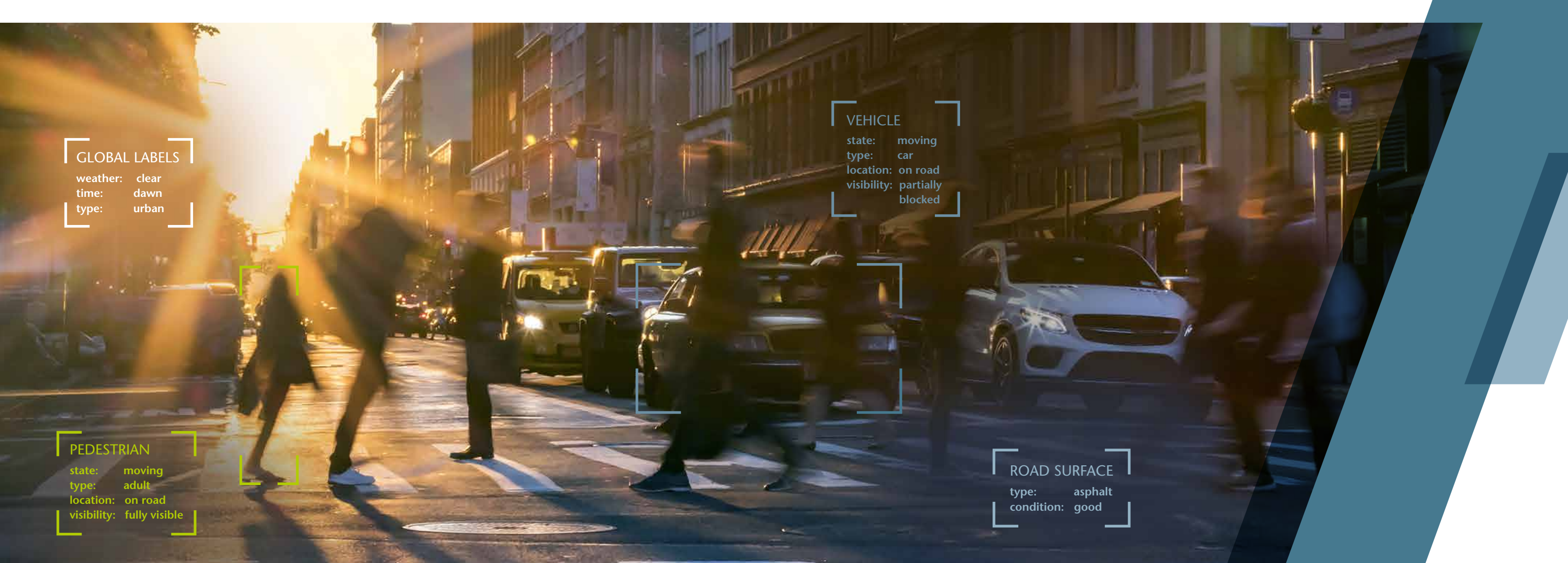
#### LIVE ACCESS WORLDWIDE

The core component of CLIFE is an intuitively operated and interactive 3D view as a digital twin, which can also represent robots or fleet movements at any time with precise positioning. Data from different sources are visualized clearly and with a high level of performance, allowing fields of action to be directly derived. If faults occur, messages with all relevant machine states are automatically sent to the persons responsible, who can then take action quickly and comprehensively. The main data and key figures can be individually accessed live and worldwide. CLIFE is also compatible with all operating systems and can therefore be used immediately with any terminal device, such as a PC, smartphone, tablet, etc.

#### COOPERATION WITH EXPERTS

We work together with Bertrandt experts from the field of Smart Production Solutions, who are specialized in new possibilities for efficiency, automated processes, and smart systems. Furthermore, we are cooperating with TCW, a management consultancy specializing in the optimization of products and processes and the implementation of business models. While CLIFE provides the data and makes simulations possible, our partners apply their know-how to optimize the processes in the smart factory. Together, we are creating the establishment of modern smart factories for the manufacturing industry.





**GLOBAL LABELS**

weather: clear  
time: dawn  
type: urban

**VEHICLE**

state: moving  
type: car  
location: on road  
visibility: partially blocked

**PEDESTRIAN**

state: moving  
type: adult  
location: on road  
visibility: fully visible

**ROAD SURFACE**

type: asphalt  
condition: good

# All the data under control

**BERTRANDT DATA LABELER USES AI ALGORITHMS FOR THE AUTOMATIC ANNOTATION OF CAMERA DATA**

During the testing of the current generation of assistance systems, around 100 TB of data are recorded per vehicle per day. Manual annotation of the raw data from the sensors is no longer cost-effective. Our user-friendly Bertrandt Data Labeler provides high-performance management and analysis of this quantity of data – independent of the project size and location.

The functionality of driver assistance systems on SAE Level 3 and higher is based on the interaction of numerous sensors.

This functionality is validated by comparing the measurements from the sensors with the underlying “true information”, also called “ground truth information”. A very large quantity of data is necessary in order to achieve the validation quality required. Usually, this amounts to several hundred million camera images – typically 10,000 hours of measurement driving at a data rate of 30 images/s. Due to the strict requirements regarding data quality and security, generating this information has until now been the job of trained staff who manually annotate the raw data from the sensors. But with ever-increasing amounts of data and algorithms that work better and better in combination with cheaper computing power, this approach will be neither time-efficient nor cost-effective in the future.

**LOCALIZING TRAFFIC SIGNS AND ROAD USERS WITH OUR OWN SOFTWARE**

We have developed user-friendly, configurable, and high-performance cloud-based software that automates the annotation of camera data to the greatest possible extent: the Bertrandt Data Labeler. It utilizes machine learning algorithms. The main priority is the accuracy of these machine learning algorithms to ensure that objects such as traffic signs or road users are safely and reliably localized and classified on an image or image sequence. Particularly suitable for this application are so-called F-RCNNs (Faster Region-based CNNs), supplemented by various backbone networks such as ResNet or Inception. For that reason, it was precisely this combination that was also used for the Bertrandt Data Labeler.

**SAVING TIME AND COSTS WITH PRE-TRAINED NETWORKS**

“With regard to the training concept of the available neural network, our labeling tool is designed in such a way that a

completely new training session is initiated or an already existing model can be “retrained”. The use of already existing, pre-trained networks offers the advantage that a much smaller quantity of annotated data is required in order to learn the new features. This saves our customers time and costs. Our neural networks are trained in a cloud environment with hardware designed specifically for this purpose. The main features, such as high computing power with dedicated, latest-generation graphics cards and the link to scalable cloud storage systems, ensure high-performance and time-efficient learning,” says Dr. Yusuf Erdogan, Head of Data Science & Development at Bertrandt.

**CUSTOMER-SPECIFIC TRAINING**

The training statuses obtained in this way can be recorded on a customer-specific basis. In the future, they will provide a more efficient application by additionally training new features. This eliminates the need for re-learning with already known features. When training has been completed, new data can be annotated fully automatically.



# Virtual test support in real time

We have expanded our virtual test support services. Our customers can now observe the testing of their components from the convenience of their workplace or home office. This offers many advantages. Gregor Axt, Head of Department Component Testing and Environmental Simulation, and Christian Rode, Head of Department in the field of Validation, talk about these new possibilities.

## HOW DOES DIGITAL TEST SUPPORT WORK?

**Rode:** "It is important for our customers to be able to personally accompany the testing of their product. In order to make this easy for them in an age of digitalization, we offer a live stream of the testing equipment and the test itself using an HD webcam. The analysis of the components after the test is also interactive, via live images with audio transmission. The customer can tell us directly what they would like to see – just as if they were actually there. Images in greater detail which show an assessment of deviations or damage are also possible."

## IN WHICH AREAS IS THIS SERVICE AVAILABLE?

**Rode:** "So far, we have been offering virtual tests in the areas of vehicle safety, fatigue strength, and air conditioning for the automotive and aviation sectors. We will be happy to expand this range of services in accordance with our customers' wishes."

## HOW DO YOU PROVIDE SUPPORT FOR LONG-TERM TESTS?

**Axt:** "Long-term tests can also be supported digitally."

For the testing of vehicle seats, for example, we provide visual remote monitoring. The customer can observe the test from the convenience of their own workplace and can carry out a visual assessment of the components. In addition, other parameters such as the time remaining until completion of the test or other measured values can be individually provided as required. A further advantage is that our engineers can inspect the testing equipment at any time – including weekends and holidays – and can directly intervene if necessary. If a problem should occur, the equipment would not simply stop without being noticed and delay the test."

## IS DIGITAL TEST SUPPORT ALSO POSSIBLE FOR TESTS AT EXTREME TEMPERATURES?

**Axt:** "We have special cameras for climate tests which are installed in the climate chambers and which work reliably at extreme temperatures. This enables us to remotely observe even sensitive and long-term climate tests and to make adjustments if necessary."

## THE TESTS ARE RECORDED. DOES THE CUSTOMER THEN HAVE ACCESS TO THESE RECORDINGS AFTERWARDS?

**Axt:** "Bertrandt makes the recorded tests available to its customers on an access-protected cloud platform. Our customers have access to this digital platform at any time and from any location. They can then watch the tests as often as they like, for example together with other colleagues."



Gregor Axt



Christian Rode

## DOES THE CUSTOMER NEED SPECIAL TERMINAL DEVICES IN ORDER TO FOLLOW THE TEST?

**Axt:** "The tests can be followed from any terminal device. The access data for the cloud platform are provided by us."

## HOW WOULD YOU SUMMARISE THE ADVANTAGES OF OUR SERVICE?

**Rode:** "First of all, this interaction ensures more efficient coordination than sending photos. Photos might not be meaningful enough to allow further specific conclusions to be drawn from them. Secondly, projects can be digitally presented throughout countries and across borders. So there is no need for business trips, which means that working time can be used more efficiently and the environment is protected. And last but not least, it also supports social distancing during the pandemic."





# From the roads into the air

SENSOR PERFORMANCE FOR  
SAFE AUTONOMOUS MOBILITY





GERMAN  
INNO  
VATION  
AWARD '20  
WINNER

#### HARRI WINS GERMAN INNOVATION AWARD

In mid 2020, HARRI was presented with the German Innovation Award by the German Design Council, shortly after the innovation platform had celebrated its world premiere at CES in Las Vegas.

#### HARRI TRAVELS INDEPENDENTLY

HARRI is equipped with lidar sensors that can measure the distance to other objects, and these enable it to find its way about independently. This technology is fundamental to autonomous driving in the automotive industry and to the resulting levels of road safety, particularly in extreme weather conditions. We can now also apply our expertise to other types of autonomous systems, for example in drones.

Safety plays a crucial role in the design of autonomous systems, and sensors are required to meet increasingly high standards. We make use of innovative test processes to ensure that sensors in autonomous vehicles offer the highest possible levels of performance. With the help of HARRI – our innovation platform – we have already demonstrated our expertise in the field of sensor performance. In the future, we will be able to apply the knowledge that we have acquired here to other areas where autonomous systems are used.

The HARRI innovation platform is an excellent example of how all the latest trends – digitalization, autonomous driving, connectivity, and electric mobility – can be combined in one vehicle. “HARRI was developed entirely in-house on the basis of a domain/system structure with all the accompanying interfaces and functions. It highlights our expertise in areas such as vehicle development and design, charging processes and infrastructures, software, connectivity and back-end systems, HMI, high-voltage batteries, and validation. Our solutions are aimed not only at established companies in the automotive industry but also at new players in the mobility market from fields such as telecommunications, consumer electronics, charging infrastructures, and IT,” explains Hans-Gerd Claus, Member of the Board, Engineering.





### SALLI FLIES INDEPENDENTLY

Lidar sensors also make a significant contribution to autonomous flight systems and are becoming more and more widespread in this area. Bertrandt has fitted a conventional drone with additional sensors to enable it to find predefined targets independently. The resulting platform has been given the name SALLI. "Because of the safety issues involved in autonomous systems, the lidar, radar, and camera technologies now have to meet much higher standards. Drones are increasingly being used in a variety of fields, including logistics and maintenance. We have successfully transferred our expertise and experience from autonomous cars to drones and other autonomous flight systems," says Dr Kolja C. Moreth, Senior Account Manager at Bertrandt.

### TESTS IN EXTREME SITUATIONS

Among the safety-related requirements are sensors with a high resolution, compliance with safety standards, and potential for industrialization in order to reduce costs. We have state-of-the-art testing facilities in this areas that allow us to test sensors in accordance with the latest standards and the relevant statutory regulations in a range of extreme situations, such as rain or fog. Using the results of these tests we can carry out in-depth analyses that will form the basis for future developments.



This is SALLI – a conventional drone fitted with additional sensors to enable it to find predefined targets independently.



# On the right track

## HOW WE ARE USING ARTIFICIAL INTELLIGENCE TO TEST FURTHER DEVELOPMENT POSSIBILITIES FOR THE LANE KEEPING ASSIST SYSTEM

The further advancement of autonomous driving is one of our most important tasks, which is why we are working on software development for driver assistance systems. In this context, we compared a classic algorithm that we had developed as part of an innovation project for our customer Renault with an algorithm based on artificial intelligence in the form of neural networks, with the aim of highlighting their advantages.

In the field of driver assistance systems, we and our electronics department in France are focusing on the comfort and safety requirements of functions such as Parking Assist, Emergency Braking, Emergency Steering, and Lane Keeping Assist systems in accordance with Euro NCAP. We used the Lane Keeping Assist system, which we had developed as part of an innovation project for our customer Renault, as the basis in order to work out possible advantages of neural networks for the lane keeping function.

### DEVELOPMENT OF A MONITORING SYSTEM WITH A CONTROLLER

The lane keeping function has a functional architecture with a monitoring system and a controller. The monitoring system is responsible for activating and deactivating the assistance intervention. Among other things, it takes the position of all vehicles into consideration. In addition, the system recognizes whether drivers have their hands on the steering wheel or not. The controller has the job of controlling the steering angle, taking into account steerability, vehicle dynamics, and ride comfort. Within the framework of this study, we integrated a neural network in parallel with the originally developed controller in order to stabilize the motion of the vehicle by making corrections to the steering angle. For the purpose of training this algorithm, our experts had access to a large database with driving data collected from various test tracks that came from the project for Renault.



Image courtesy of Renault



Image courtesy of Renault



#### REDUCING DEVELOPMENT TIME AND CUTTING COSTS

Further advantages of the use of artificial intelligence are the optimization of software development time, reduced costs, and more efficient support for our customers. However, neural networks are not reproducible algorithms. Therefore, our aim over the next few years will be to find a reliable method for validating this type of system and therefore to guarantee a level of safety that is comparable with that of current standards.

Image courtesy of Renault



#### APPLICATION OF ARTIFICIAL INTELLIGENCE SUPPORTS ACCEPTANCE OF DRIVER ASSISTANCE SYSTEMS

By using neural networks, we were able to create a comfort and individualization component that has not previously existed in this form in driver assistance systems. Due to the neural networks, the algorithms of the assistance systems are adapted to the driver's behavior, who then experiences a huge amount of support – in contrast to conventional automatic assistance systems in which the system behavior deviates too greatly from the driver's behavior and therefore results in insecurity among drivers. For that reason, the application of artificial intelligence increases the driver's acceptance of driver assistance systems.



# Let there be light

## DEVELOPMENT AND PRODUCTION OF THE LED HEADLIGHTS AND LED AUXILIARY REAR LIGHTS FOR THE PORSCHE 935

Creating a special design – that was the focus during the development of the high-performance LED headlights and LED auxiliary rear lights for the Porsche 935. Our extensive know-how in the field of light and visibility and our many years of experience enabled us to develop an innovative high-performance lighting system in cooperation with Porsche Motorsport.

The subject of light and visibility has been a component of our service portfolio for many years. Whether it involves concept development, lighting or thermal design, the production of samples and models, or environmental testing

– we take on the management of the entire project and provide support from the initial idea to series production. The focus is on innovation and design. A very good example is the development of the high-performance LED headlights and the LED auxiliary rear lights for the Porsche 935 in the motorsport sector.

### SMALL SERIES WITH BIG CHALLENGES

Our job was to develop and produce a small series. “The particular lighting challenge for the headlights was to implement the bi-function of the main light and the direction indicator from the same reflectors. The rear light also used a single light guide for the brake light, tail light, and direction indicator functions. In the end, we succeeded in generating a huge amount of luminous flux with excellent homogeneity in a small installation space,” says David Maisenbacher, Team Leader Light and Visibility at Bertrandt.

## TECHNICAL DETAILS OF THE LIGHTING SYSTEM:

### HEADLIGHTS:

- 48 white and 16 yellow high-power LEDs per headlight
- 13,200 lumens headlights
- 400 m range
- Cooling by air flow through the headlights (active when stationary, passive when moving)
- 1 kg per headlight

### AUXILIARY REAR LIGHT:

- 3 red and 1 yellow high-power LED per rear light
- Waterproof integration into the carbon endplate without a separate light housing
- Passive cooling by a heat sink embedded in the endplate
- 0.25 kg per rear light (without endplate)



Image courtesy of Porsche

As this is an exclusive supercar, the quality requirements went far beyond those of standard motorsport lighting.

Image courtesy of Porsche



# The whole world in one place

BERTRANDT POWERTRAIN SOLUTION CENTER:  
VALIDATING THE POWERTRAIN  
CONCEPTS OF THE FUTURE





The automotive industry throughout the world is facing a pivotal transformation, with the emissions of CO<sub>2</sub>, nitrogen oxides, and particulates as key focal points. The aim is to reduce their levels overall to meet new emissions legislation worldwide. At the same time, different types of drive systems are becoming established. With the completion of the Bertrandt Powertrain Solution Center (BPSC) at our Munich and Wolfsburg sites, we can support our customers in precisely this field as a response to the increasing and ever more complex testing requirements.

#### VALIDATING CONVENTIONAL AND ALTERNATIVE POWERTRAINS

In the future, the BPSC will be used for testing and validating not only conventional powertrains with a variety of fuels, but also alternative powertrain concepts such as hybrid, electric,

and hydrogen drive systems in compliance with the latest legal requirements. "The strategic location of the BPSC in northern and southern Germany, in Wolfsburg and Munich, ensures that we are always in close proximity to our customers. The testing centers are identical and we have the same quality and technical facilities available at both sites," says Matthias Rühl, Managing Director Powertrain Validation. The main focus of the testing centers is on development, homologation, and type testing, as well as Real Driving Emissions (RDE) and CoP tests. Appointment as an official technical service by the Federal Motor Transport Authority (KBA) is being sought. We offer a comprehensive range of services from a single source, including emissions measurements and type testing, standardized testing procedures, and special tests, such as altitude and climate tests. With our state-of-the-art equipment and perfectly coordinated processes, we offer top quality, reliability, and cost efficiency.



All-wheel climate chassis dynamometer with altitude chamber (-25°C / +45°C)



SHED chamber

Conditioning area

#### WHAT WE CAN OFFER YOU:

As a certified and independent testing facility, we can provide you with a service that is tailored to your needs – from A to Z. Depending on your requirements, we can support you with individual solutions or with a complete package of services.

- Consulting – We provide advice in accordance with your requirements
- Project management – Cost monitoring, coordination of milestones and the project team
- Logistics – We take responsibility for the complete transfer of your test items
- Test planning and preparation – Individual and efficient testing procedures, equipping the vehicle with the necessary measuring systems; if required, implementation of special measuring equipment and superstructures
- Commissioning – Commissioning of the test vehicle complete with its measuring equipment; if necessary, creation of appropriate experiments to comply with testing requirements
- Implementation – We carry out all type testing and ensure that it is in compliance with worldwide legal requirements
- Test evaluation – Transparent presentation of the measurement results in your preferred format





The entire Powertrain Solution Center is fitted with state-of-the-art technical equipment – and this includes our all-wheel climate chassis dynamometer with or without an altitude chamber, our SHED chamber, and our workshop areas. The technical details can be accessed by scanning the QR code.





# From the test rig to the road

## CERTIFIED EVALUATION OF REAL DRIVING EMISSIONS

Legislation to control emissions is being constantly tightened, which means that additional measuring activities and increased documentation requirements are necessary. As an independent and certified partner, we provide RDE tests according to the latest legal specifications.

Governments have recently introduced additional documentation requirements for emission control strategies. Furthermore, the rules for granting exemption permits have been tightened, thus making additional measurement activities necessary. Before a vehicle can be registered, it must have reliable Real Driving Emissions (RDE) documentation according to the latest legal requirements and specifications. RDE tests can be used to reliably measure a vehicle's emissions and therefore also its impact on the environment.

”

We provide a comprehensive and professional service in the field of RDE from a single source. As a certified and independent partner, we can test our customers' vehicles for international road traffic with state-of-the-art equipment and many years of know-how.

*Christian Eberle, expert in the field of Real Driving Emissions at Bertrand*

### ALL ADVANTAGES AT A GLANCE:

- Full-service package
- Certified partner
- Provision of a high-tech portable emissions measurement system (PEMS) on short notice
- Analysis and results certification on the basis of the latest legal requirements
- Complete validation or individual evaluation
- Time and cost savings – all from a single source
- No coordination effort required



## 5 STEPS OF THE RDE TEST

### 1. TESTING ACCORDING TO INTERNATIONAL LEGISLATION

A major challenge in RDE tests is to take into consideration the different country-specific conditions and legislation as well as the companies' own specifications and testing criteria. We support our customers in the analysis of "RDE and beyond" test drives with the aid of a testing catalogue, systematic test analysis, and BES/AES plausibility testing, and transfers potential new requirements directly to current and future development projects.

### 2. CONSTRUCTION STATE DOCUMENTATION AND MEASURING SYSTEM INSTALLATION

A certified RDE test cannot take place until all the components installed in the vehicle have been legally approved. We check whether this is the case and, if necessary, will remove components and install new ones. In the next step, the vehicle is prepared for the RDE tests and fitted with a portable emissions measurement system (PEMS).

### 3. TESTS ON CERTIFIED HIGH-TECH DYNAMOMETERS AND ON THE ROAD

On the high-tech and certified chassis dynamometers at our BPSC (page 38-43), tests with various cycles and further

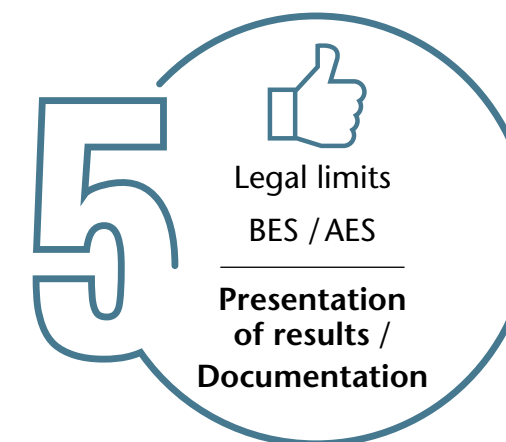
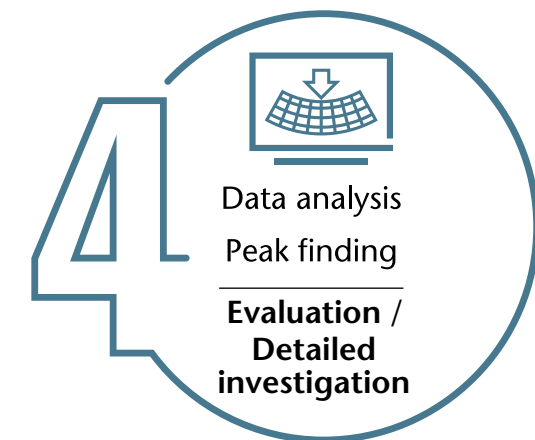
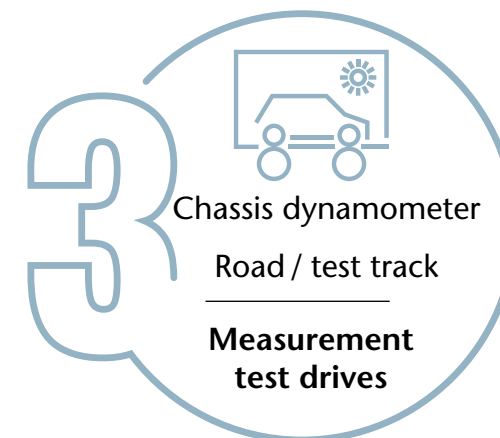
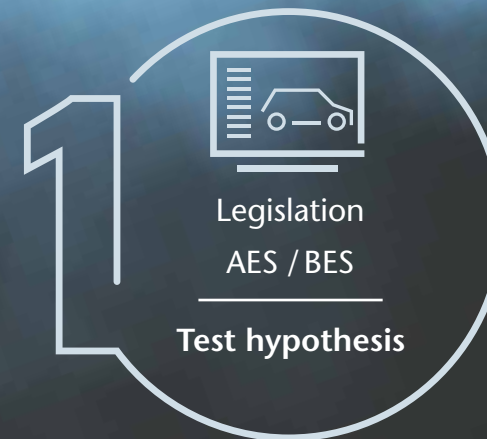
requirements of the testing catalogue are carried out and the vehicle's emissions are measured. The vehicle is subsequently tested on the road under real driving conditions and from a wide variety of aspects.

### 4. EVALUATION OF THE DYNAMOMETER TESTS AND ROAD TESTS

An extensive data analysis of the measurement results is performed. The values measured in the laboratory and the road test measurements obtained under real conditions are evaluated in accordance with the legal requirements. In addition, any abnormal results are examined to determine their cause and a detailed analysis is carried out.

### 5. CREATION OF THE REGISTRATION DOCUMENTS

At the end of the series of measurements, our customer is provided with documentation of the results. For the measurement results of a type approval, Bertrandt, as an independent and certified partner, creates the registration documents for the vehicle and, if requested to do so by the customer, will submit these directly to the Federal Motor Transport Authority (KBA).





# Bertrandt World

BERTRANDT WHEREVER YOU ARE



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