ASAP

2020

ANNUAL REPORT

CONTENT

Michael Neisen, CEO of the ASAP Group

INTERVIEW

2020 FOR THE ASAP GROUP

How would you summarise 2020 for the ASAP Group?

In short, it is safe to say that 2020 was definitely unlike any previous year. Following record revenue for the ASAP Group in the financial year 2019, we began 2020 with a positive outlook, despite the huge challenges already facing the automotive industry as a whole. However, as the coronavirus pandemic and the resulting lockdown began to take hold in the spring, clients then started to reduce their budgets and postpone projects that were due to start. On top of that, there were also, naturally, concerns for the health of our colleagues and uncertainty caused by this new situation in which we all found ourselves. Although our strategic focus on future-oriented technologies allowed us to mitigate the negative impact on the corporate group, 2020 nevertheless proved to be one of the most difficult years, if not the most difficult, in our company's history. At the same time, I am certain that, as a young company, we have been able to learn a lot from this past year of crisis that we can take into the future and will emerge stronger as a result.

What impact has the coronavirus pandemic had on the ASAP Group so far?

From a business perspective, the ASAP Group has managed 2020 well under the circumstances. Our annual turnover of 100 million euro shows lateral movement compared to last year, clearly highlighting ASAP's strong market position. Nevertheless, we have noted a significant decline in profits as a consequence of the coronavirus pandemic. Generating new business also proved difficult, in no small part due to the lack of opportunities to meet in person. In 2020, we naturally focused on the rapid implementation of health protection measures and the economic stability of the corporate group. We have therefore taken advantage of all offers of state support. We moved a high proportion of our staff to short-time work in the second and third quarters, and we expect to still have short-time work in certain areas in 2021. I would like to thank the entire ASAP team for the trust and understanding they have shown for these business decisions, and for maintaining productivity for our clients throughout. Over the course of the year, the topics of digitalization and new work have gained significant momentum. Across the group, decisions were quickly made about the transition to digital processes and, where tasks allowed, remote working.

The entire automotive industry found 2020 challenging, but do you have any personal ASAP highlights?

Throughout the whole ASAP Group, the solidarity and communality among all colleagues really shone through in this challenging year, particularly as this came in spite of the lack of in-person contact caused by the lockdown and working remotely. That was a particular highlight for me, because these factors have always been an important part of our company culture and form the basis for our success. I also consider our strategy meeting with Wolf-Henning Scheider, CEO of ZF Friedrichshafen AG, as a positive milestone. This was at the start of the second quarter and resulted in a renewed strengthening of our collaboration for the future. The ASAP Group also celebrated numerous awards this year, including being named a TOP Employer, an Innovation Leader in the SME sector and a Leading Employer.

From a technology perspective, 2020 also offered some highlights. For example, in the field of e-mobility, we have once again expanded our testing capacity for e-powertrains and HV batteries at several ASAP sites. Despite all the challenges 2020 posed, we were able to record solid growth in the fields of e-mobility, electronics and software development. In addition, we have further developed the consistency of our testing and integration services. Particular highlights also included the testing systems for service life analyses of power electronics that we developed in house, the development of a laboratory test bench for charge protection, and our successes integrating artificial intelligence into virtual validation. Furthermore, over the course of the year there were naturally numerous milestones on the project side. For example, we have continued and restarted work on various major projects for OEM clients and commenced work on a large project focused on a new generation of fully autonomous driving shuttles.

How would you evaluate the collaboration with ZF Friedrichshafen AG in terms of the strategic aspects of the partnership since it began in 2018?

Since ZF Friedrichshafen AG's investment in 2018, we have continuously strengthened our collaboration. Together, we have clearly defined the key focuses of our strategic partnership – the areas of ADAS/AD and e-mobility. ZF Friedrichshafen AG have always been very positive and welcoming, right from the beginning, and over the last two years we have become very familiar with the business, learning much more about its overall size and decentralized approach. We made clear once again just how important this strategic partnership is to us in late 2020, as we founded a new ASAP Engineering GmbH site on Lake Constance. Although the coronavirus pandemic delayed certain strategic decisions, we were also able to collaborate on numerous projects which were launched successfully over the course of the year. On particular focus at present is projects concerning the development of fully autonomous shuttles as well as testing e-powertrain components.

Do you feel the current business model puts the ASAP Group in a good position, or are you planning any changes in strategic direction?

In general, I'm happy with the ASAP Group's direction and I would say that we are very well positioned for the future. From the beginning, we have focused on and continuously invested in future-oriented technologies. That we were able to navigate 2020 successfully, in spite of all of the restrictions caused by the coronavirus pandemic, confirms that we are following the right strategy. In the coming years, we will have more serious discussions around the idea of best-cost countries and look into establishing our own sites and making partners abroad in order to continue to ensure that we remain competitive. In addition, we will continue to consistently expand our services in the fields of electronics development, testing and integration, and software development, and will focus on further client diversification.

Are you able to give us an idea of what is to come over the next few years?

Looking to the next few years, we will continue to focus on connecting all ASAP offices so that we are

able to share knowledge in our daily work and thus develop the best possible solutions for our clients. New work is another topic that is steadily becoming more important and we are always working to make ASAP more attractive as an employer – an area in which we've already had great success, as proven by our numerous awards. In the field of technology, we will continue with our usual focus on future-oriented technologies for the automotive industry, and the ASAP Group will continue to take a "quality over quantity" approach. In 2021, we will look in particular at expanding the infrastructure at our sites in Ingolstadt and Wolfsburg and committing fresh investment to our testing capacity for e-mobility. We will also network our service areas using our positioning within the VW group in order to deliver the greatest possible benefits to our clients, as well as strengthening collaboration with our strategic partner ZF Friedrichshafen AG.

2020

FACTS | FIGURES | DATA

100 Mio.

Euro – the turnover recorded by the ASAP Group in 2020, staying stable at the previous year's level.

10 Mio.

Euro – the ASAP Group's investment in new technological areas, maintaining the level set in 2019.

451

the number of customers the ASAP Group worked with in 2020.

5

times the ASAP Group has received the award ‚Germany's TOP Employers'. ASAP achieved the fifth place out of 45 in the category ‚Automotive and Suppliers'.

22

The ASAP Group's position on the Automobilwoche ranking of the 25 development service providers with the highest global turnover in 2020.

1.250

employees currently work for the corporate group across 11 locations.

148

The number of technical pieces and news articles from ASAP published in specialist automotive magazines.

36

nationalities are represented within the ASAP Group's workforce.

4

For the fourth time in a row, the ASAP Group was identified as a ‚Leading Innovator' in the German Mittelstand.

ZF AND ASAP – TWO YEARS OF STRATEGIC PARTNERSHIP

AN INTERVIEW WITH DR DIRK WALLISER, SENIOR VICE PRESIDENT CORPORATE RESEARCH & DEVELOPMENT AT ZF FRIEDRICHSHAFEN AG

You have been a ZF Friedrichshafen AG shareholder representative at ASAP Holding GmbH since the start of 2020. How do you assess the cooperation from a strategic perspective since joining in 2018?

In 2018, ZF acquired a stake in ASAP in light of two strategic points. We wanted to expand our expertise in the fields of automated to autonomous driving and e-mobility further, so that we could better meet constantly growing customer demand in these areas. Nothing much has changed in this regard. The ASAP Group is a very important partner for us, especially where complete vehicle integration is concerned, and we and we have a trusting working relationship.

What do you see as focus areas for the future of your strategic collaboration?

As an established development partner, ASAP has extensive levels of expertise in the fields of ADAS/AD, e-mobility, electronics development and software development, right through to integration into the vehicle. At ZF, we see the focus of our cooperation in the validation of ADAS/AD and e-mobility solutions – using both test bench and in-vehicle testing. Furthermore, working in close collaboration with ZF development locations around the world, ASAP will be able to offer its customers a global range of services in the future.

Do you think the Covid-19 pandemic will affect the cooperation in any way? If so, what do you think are the particular challenges for the two companies?

Generally speaking, the Covid-19 pandemic hasn't had any effect on the collaboration between ZF and ASAP. At ZF, we're examining how we conduct our projects overall. This meant that some things did not develop as quickly as we had planned this year, but we're making up for it bit by bit.

What do you think are the ASAP Group's particular strengths and what benefits does this bring to the collaboration?

I've already touched on their areas of strength. What's equally important for us is that ASAP, as an experienced development partner, understands the project aims of a large development organisation and implements them with its partners. We also benefit a great deal from their speed and flexibility under competitive conditions, as well as their excellent results.

Do you think that, with its range of services and accompanying business model, the ASAP Group is well positioned for the future?

As far as we can tell, we feel that ASAP is very well positioned for the future. This is mainly based on their strong primary focus on the right-hand side of the V-model – that is, on system integration and validation. I also see potential in expanding its focus on the left-hand side of the V-model, as well as services in the field of the software-defined car.

The automotive world is subject to the digital transformation, while the ongoing global pandemic is taking its toll on the entire economy. What advice would you give the ASAP Group for the future of your collaboration?

In my view, the most important basis for ASAP's future success is maintaining its strengths with a clear focus on future technologies, flexibility and speed – all the while keeping a firm eye on the industry and the customer.

Dr. Dirk Walliser

Now, a more personal question – people at the ASAP Group are united by their shared love of cars. What is it you love so much about cars?

I am utterly convinced that, with smart technologies and our combined strengths, we can overcome the challenges of climate change and seize the opportunities of digitalisation. I want to have a hand in ensuring that individual mobility and smart cars have a lasting role to play.

HIGHLIGHTS 2020

◀ BACK

FLEXIBLE AND SCALABLE MODEL DEVELOPMENT

MIGRATION TO AGILE MODEL DEVELOPMENT FOR SAE LEVEL 4

Secure, autonomous navigation in urban traffic and dynamic responses to complex situations are just a couple of elements of our vision for the future of autonomous driving. To that end, the demand has soared for driver-assistance systems and the corresponding software in vehicles, and with this the development challenges have also increased. This creates a need for more complex software, developed in shorter cycles. This is why, in ongoing series operation, the ASAP Group is migrating model development for validating newly developed functions for its customers to a more flexible and scalable process. The result is more robust, higher-quality models, the ability to use improvements immediately, to rapidly react to changes and, above all, massive time savings.

"Autonomous mobility is coming – faster than you think!" This is the bottom line of a current study from business consultancy Roland Berger [1]. It has been forecast that, by 2030, some 17 million autonomous private vehicles will be on Europe's roads and the number of manually controlled private vehicles will

have reduced from the current 285 million to 170 million [2]. The experts are in agreement: The future will usher in fully autonomous, connected electric vehicles – and vastly increase the importance of the electronics and software used in vehicles [3].
By 2025, the proportion of the costs for these components in vehicles will increase by 19 per cent in comparison to the other components [3]. In order to be able to validate the increasing complexity of these functions at an early stage, testing specifically in the area of software in the loop (SIL) and hardware in the loop (HIL), hereinafter collectively referred to as XIL, has become even more important. As a development partner to the automotive industry, the ASAP Group not only develops electronics and software, but also is migrating the entire development process of XIL models for our customers in ongoing series operation. These models can therefore be used more flexibly, are modularly expandable and available faster.

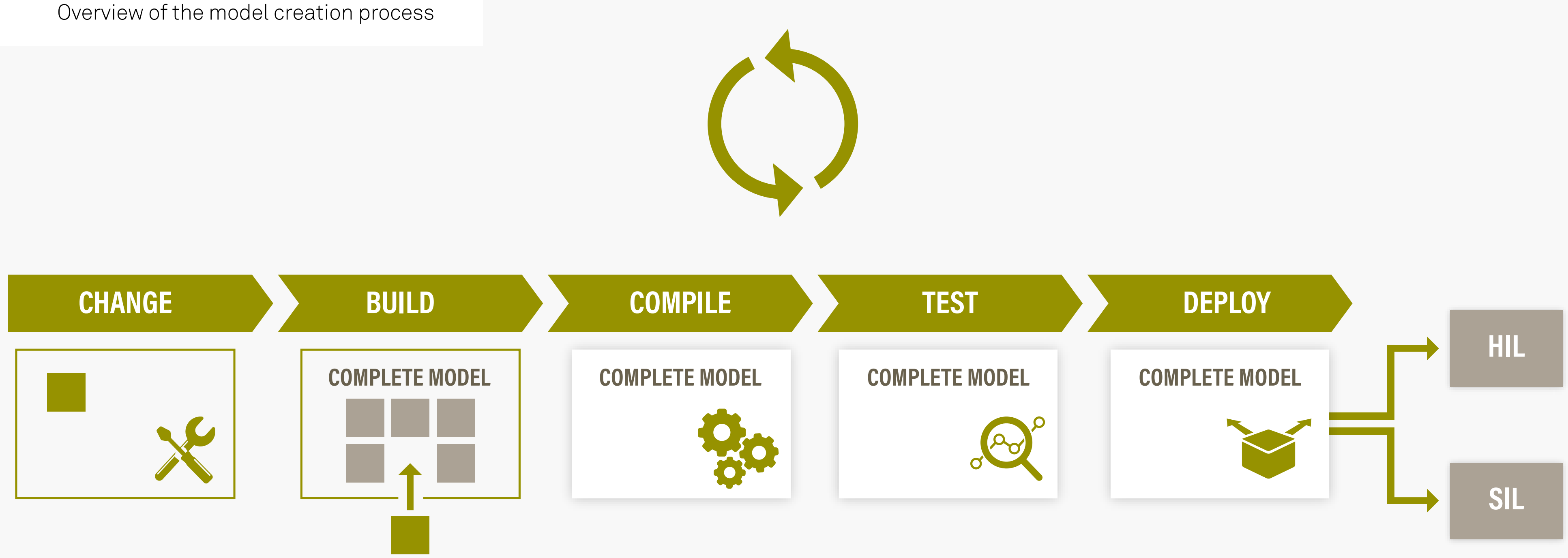
Shorter software development cycles require flexible modelling concepts

Environmental models for verifying components and causal loops must be able to be realistically simulate all control units, bus systems and vehicle behaviour not physically integrated in the test system. As the control units' level of maturity increases, so too does the complexity of these models. The variety and complexity of the software to be modelled is increasing as a result, in particular in relation to autonomous driving functions. Standard model development processes to date have relied on inflexible, monolithic model structures. The smallest changes to models, such as changes to correct defects or introduce optimisations or expansions, require the model creation process to be completed for the overall model: the changes in the simulation software are implemented by constructing the model at code level (build), converting into machine code for the test system (compile) and delivering the test system (deploy). Tests to review the model quality need to be performed at several stages of the progress. Until now, concepts have therefore involved very time-intensive modelling processes for the smallest changes; in addition, these processes are mostly only partially automated and heavily based on the individual experience of the modeller. This limits the reaction times for implementing new requirements and expansions in the models. Fast reaction times are, however, required by the increasingly short development cycles of software for control units and their integration. Furthermore, a model must be flexibly implemented for the specific target platform for the SIL or HIL tests and the various vehicle derivatives and their respective control device components. Thus, the derivability or switchability of the model is necessary, so that one completely independent model does not need to be created and maintained for each platform. These challenges highlight the need for fundamental change in the development process and the modelling activities it entails.

Modularity replaces monolithic model

The architecture of the models and the associated creation processes have been adapted with a view to providing greater flexibility and scalability, as well as a reduction in the complexity and number of models needed to achieve the desired change. Instead of having to run through the build and compile steps for the entire model for every developmental change, the developers are relying on a modular design. Construction in individual containers and skilled application of their interfaces allows individual changes to be implemented, with developers only having to perform the above-named steps for the respective container. In addition, the compile step to integrate the containers in the overall structure is markedly less complex. For example, a causal loop for autonomous navigation can be subdivided into sensors, motors and brakes, steering functions, display functions as well as the bus systems involved in an overall model comprising 60 to 70 modules that can be individually and flexibly changed. Creating the model on a computer is also significantly faster. Build times of a monolithically constructed model, and of the described causal loop described above, generally significantly exceed 12 hours. By adopting a modular construction concept, this can be reduced to one to four hours, depending on the complexity of the changes. New requirements can therefore be implemented and made available significantly faster for the next development level of the control unit, so that the

Overview of the model creation process



models are available to the required functional extent when the new control unit software arrives. This parallel, anticipative process means that improvements for the customer can be used immediately and allow the development to continue uninterrupted. For the migration the required program is set up at the customer, a new computer structure is established, existing tools are merged with new tools, interfaces are set up and training carried out. To ensure such an interdisciplinary project runs smoothly, the ASAP developers harness synergies within the Group, for example from the areas of electronics development, verification systems or software development.

Continuous improvement through continuous integration and continuous testing

Models are delivered faster and with greater scalability through embedding in the areas of continuous integration and continuous testing. Changes to the models are automatically integrated into the overall model after their implementation, as a result of which improvements are able to be used immediately. In addition, automatic validation of the newly integrated module and the overall model is carried out in the process chain, so that the models satisfy the highest quality requirements on delivery to the target platform. The basic functions of the model, such as the state chain of functions, are automatically tested on a test system built by ASAP before each delivery of the model. The communication between the control units within a causal loop are retested after every modular change, no matter how small. Thus, the overall model is continually tested. Even automated measures to correct errors in the newly created model are compared with the previous model, with their effectiveness tested through targeted configuration of test parameters and the insertion of test routines. This further increases the quality and robustness of the model. In the final step, the newest tested model is automatically delivered to the target platform with continuous deployment. In summary: This method keeps the time period from implementing a change to delivering a newly tested model with additional functions to a minimum and also provides easy scalability on additional platforms. This results in enormous time savings.

Use of the model in closed loop testing

In a current project ASAP is providing model creation for the development of chassis functions and AD functions. This includes radar sensors, motors and brakes, and bus communication between all participating components. The models are continuously made available as XIL models and serve various vehicle models including all options for optional extras. In order to replicate the behavioural logic, i.e. the response of the control units to incoming signals, the first step is to define all relevant components in the causal loop. Signals that are not relevant because they have no effect upon the causal loop are represented by static restbus simulations. Dynamic components of the causal loop are simulated as realistically as possible.

An overall model of this type is comprised of a number of smaller modules. As a result, changes to corresponding modules, as described above, can be implemented in a targeted and thus faster manner within the overall model. Finally, the model with additional characteristics is automatically verified in a closed loop test system before integration. Closed-loop means that a real integrated control device network and the simulated environment interact with each other, with their behaviour influencing each other. The closed-loop test system for this project was designed, built and deployed to customers by developers at the ASAP Group from the Test Systems department. The test system can verify the entire causal loop, or, if required, just individual components. After the vehicle brief is input, the test system automatically recognises the vehicle's make and model, and adapts the model coding accordingly. Looking at the enormous challenges involved in developing vehicle components and functions, short development cycles, permanent cost pressure and increasingly complex products, migrating to a flexible development process is particularly advantageous and represents a significant contribution to realising the transport solutions of the future.

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[2] Prognose der Anzahl zugelassener Personenkraftwagen (Pkw) in Europa nach Art der Fahrzeugnutzung im Zeitraum der Jahre 2018 bis 2030: https://de.statista.com/statistik/daten/studie/875082/umfrage/prognostizierter-pkw-bestand-in-europa-nach-art-der-pkw-nutzung/

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CLOSED-LOOP TEST SYSTEMS FOR ADAS

TURNKEY TEST SYSTEMS FOR AUTOMATED VALIDATION OF DRIVER-ASSISTANCE SYSTEMS

Our vision of the future of autonomous driving includes benefits that include dynamic vehicle response to complex situations, increased safety in road traffic and more besides. However, this vision of the future also entails a considerable increase in the demand for driver-assistance systems and corresponding in-vehicle software and sensor technology. This increases the challenges in the development phase, as with more complex software required in ever-shorter development cycles. The ASAP Group is, therefore, taking responsibility for designing and implementing turnkey test systems for the automated validation of driver-assistance systems, up to SAE level 5, on behalf of its customers.

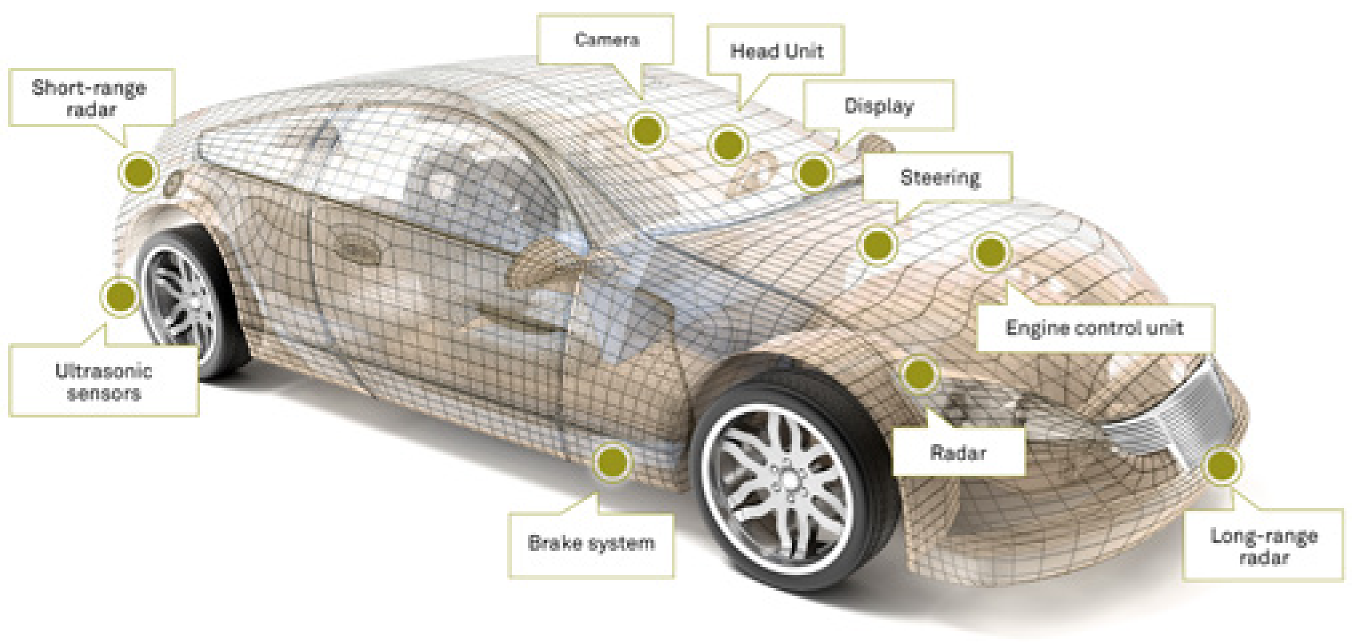
In recent years, the number of public test tracks for autonomous vehicles has increased across the globe [1]. This is an important step in the progression of autonomous driving, as final approval for highly automated driving functions can only be given once they have been assessed over several million test kilometers. However, when we consider that one test vehicle or driver can only cover around 1,000 kilometres a day, and that it is almost impossible to test such extreme scenarios as encountering stationary vehicles at a speed of 200 kph in reality, one thing becomes clear: as the development phases become shorter, real-world test drives alone are insufficient when it comes to obtaining approvals for these increasingly diverse and complex driving functions. As a development partner for the automotive industry, the ASAP Group designs and implements turnkey test systems for its customers. These systems automatically validate driver-assistance systems for autonomous driving up to level 5.

Requirements for test systems for ADAS functions

The need to assess highly automated driving functions over several million test kilometres lies in their high complexity. Let's look at an example. If an autonomous vehicle is to navigate city traffic successfully, it must recognise other road users and objects, such as road signs, and react to them appropriately. Upon detection, the engine and brake control unit must adjust the speed according to the traffic situation and the driver should be informed immediately and clearly of these changes. This means that, in order for the function to work properly, it must be ensured that the corresponding sensors are angled in such a manner that they cover 100 percent of the vehicle's environment at all times. Objects must also be detected correctly and reported immediately to the driver, and control units within a causal loop must communicate properly. In order to be able to validate such functions at an early stage, software-in-the-loop (SiL) tests are becoming increasingly important, as are hardware-in-the-loop (HiL) tests. The models used in these tests play a central role: they reproduce the ECU under development, its behavioural logic, the appropriate environmental logic, the rest of the causal loops surrounding it and the interaction with other ECUs, as well as different vehicle variants and target platforms. These models make it possible to validate new driving functions in automated processes on SiL platforms and test benches. In contrast to the use of SiL systems, which will have to clock up a large proportion of the necessary test kilometres in the future, the use of composite test benches with real hardware and corresponding data feed-in is mandatory for autonomous driving functions to obtain approvals. Such test systems are subject to very strict requirements, which correlates with the complexity of the functions being examined.

For one thing, the developers must ensure that the test system, that is to say the sensors used in the virtual vehicle, receive information during virtual test drives – for example, that a driver ahead is braking or there is an object in the vehicle's path a few metres ahead. This requires the aforementioned models and a virtual test environment. In addition, the test system must then provide feedback regarding the environment recorded by the sensors to the control units, meaning it must be set up as a closed-loop system. In this context, 'closed loop' means that the real-world ECU network and the simulated environment interact with each other. If, for example, the control units accelerate virtually to a certain speed, the simulated environment must change accordingly and provide the corresponding control units and sensors with feedback on factors such as the gradient angle of the road, the speed of the wheels and so on. The sensors also need to feed environmental feedback directly into the control unit, so that it can react to the situation immediately. To achieve this, the developers have to disconnect the real sensor from the control unit and provide the control units with a direct simulation. However, the greatest challenge in developing a closed-loop test system for highly automated driving functions lies in the timing. The models used must provide the vehicle environment sensors with a coherent overall picture for tests and calculations to produce meaningful results. Amalgamating the entire sensor system at the same time – so that it produces a coherent scenario – means the test bench must provide all information in a time-synchronised (deterministic) manner. If, for example, we verify an automated motorway driving system by simulating a journey on the motorway, travelling at 130 kph, during which a vehicle on the right changes into the test vehicle's lane at 90 kph, all the recorded environmental data – speed, distances, road signs and road layout – must be fed back to the control unit simultaneously and directly as an overall image so that it can create a coherent fusion of the data. Only then, by interacting with all other control units in the causal loop, can the correct function (braking, in this example) be implemented to keep the driver safe.

Numerous control units come are connected in the causal loop of highly automated driving functions – such as adaptive cruise control (ACC)



Designing and implementing a closed-loop test system

The concept for a closed-loop test bench begins with electrical and mechanical planning. This involves selecting suitable measurement technology and simulation hardware and defining general conditions, such as the required voltage. All the components are then mapped out – in addition to measurement technology and vehicle electronics, the required interfaces are installed and all control units in the causal loop of the func-tions to be validated are integrated. In the case of highly automated driving functions, causal loops include a large number of control units, including cameras, radars, ultrasonic sensors, engine control units, head units, the braking system and more besides. During the planning phase, the developers examine each component of a causal loop individually. In this step, they ascertain whether the control unit needs to be physically installed in the test bench, whether a simulation is sufficient or whether it might be necessary to switch. Switching between real and simulated

ECUs provides greater flexibility in test bench examination. This means that the causal loop can be initially examined using the simulation in the development phase before later moving on to use prototypes or the final control unit. In addition, integrating simulated ECUs offers advantages in the early development phase, as it can serve to exclude possible sources of error. For this reason, ECUs that do not play a major role in the causal loop but still have to be present are always simulated. The next major challenge in developing the test system is ensuring all control units can communicate with each other. This communication must be reproduced accurately and the required communication lines between the control units must also be wired correctly within the test system. Explained using the above example of our motorway user, the communication lines ensure that the vehicle environment sensors detect the much slower vehicle changing into the test vehicle's lane from the right and immediately transmit this information to the corresponding control unit, from where the signal is sent to the braking system. If the development of the test bench has progressed far enough that the above planning stages have all been considered and the overall system has been reproduced completely, the developers must re-examine what measurement technology and measuring points are required. Since all the components integrated in the test bench remain under development, changes are usually still required even at this later stage – and can be implemented if necessary. This allows the design of the testing system to remain flexible enough to be adapted to the customer's individual requirements until just before completion.

Models for use within the test bench

At the same time as concept development begins for the closed-loop test bench, the model preparation team begins working closely with the test systems department to create the models described above, which will later be used for validation with the test bench. Environmental models for verifying components and causal loops must be able to simulate all control units, bus systems and vehicle behaviour not physically integrated into the test system realistically. As the control units' level of maturity increases, so too does the complexity of these models. In an ongoing project, ASAP Group experts are creating the models required to develop ADAS functions for SiL and HiL tests to be used on a wide variety of vehicle models, including all options for special equipment. In the model for validating autonomous navigation through city traffic, for example, the control unit itself, its behavioural logic is reproduced along with the appropriate environmental logic, the surrounding causal loops and the interaction with other control units, plus different vehicle variants and target platforms. In order to replicate the behavioural logic – that is, the control unit's response to incoming signals – the first step is to define all relevant components in the causal loop. Signals that are not relevant because they have no effect upon the causal loop are represented by a static restbus simulation. Dynamic components of the causal loop are simulated as realistically as possible. This type of model consists of approximately 60 to 70 small modules. If changes become necessary in the development phase, they can be implemented quickly on the specific module in question within the overall model. Finally, the model with additional characteristics is automatically verified in a closed loop test bench before integration.

24/7 use after commissioning

Before the tests are carried out on the test bench, the developers activate it on the customer's premises. First, they check the entire system with regard to the functionality of the electrical system, among other aspects. They then activate the control units, examining how they communicate with other control units and ensuring they are accessible for diagnostics. The diagnostic values are then analysed for a final check of the entire test system. Once successfully commissioned, the closed-loop test bench offers various advantages for developing highly automated driving functions. On the one hand, the use of test automation means that functional validation is not dependent on manual input – which means that validation can proceed cost-effectively 24/7, with all results automatically documented. On the other hand, the test bench makes it possible to reproduce specific errors so that functions can be examined for the selected most frequent sources of errors. This reproducibility also enables developers to continuously re-test control units under exactly the same conditions. Compared to real-world driving experiments, the test bench allows functions to be validated comprehensively and in much greater depth over a large number of parameter spaces. The test bench offers the option of testing each control unit at an individual test station, as well as validation in the causal loop's networked system. In comparison with real-world driving experiments, using a test bench tests functions in a safe environment. If, for example, the sensors or how the data is processed by the driving functions were to fail during a test using the test bench, it will not cause expensive damage to the car or test environment as it would under real test conditions. Overall, test bench validation reduces the need for real-world driving experiments using expensive prototypes to a minimum, cutting both the time required and costs involved in validation. As a result, there is nothing to prevent developers driving the millions of test kilometres required to develop the highly automated driving functions of tomorrow.

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BACK

TWO IS BETTER THAN ONE!

DIGITAL TWINS SAVE TIME AND MONEY IN E-VEHICLE DEVELOPMENT

For e-vehicles, range plays just as important a role as performance. This is why one of the ASAP Group's current projects is focused on using digital twins to forecast e-vehicles' range and operating state early in the development process. To make use of these digital twins, the automotive industry's development partner has created a virtual test environment in which a variety of scenarios can be simulated during virtual test drives. The result? A significant reduction in the cost and effort associated with testing, prototyping and product optimisation.

Rapid advancements in the field of e-vehicle range are essential to the widespread success of electromobility. Solutions in this search for success include driving functions such as the predictive efficiency assistant. This ensures reduced consumption in hybrid vehicles by providing specific recommendations for the most efficient driving style, which in turn increases range. ASAP handles the complex development of such functions, which require extensive validation, with the digital twins method. During development and testing, virtually depicting functions and components can

save a considerable amount of time and money.

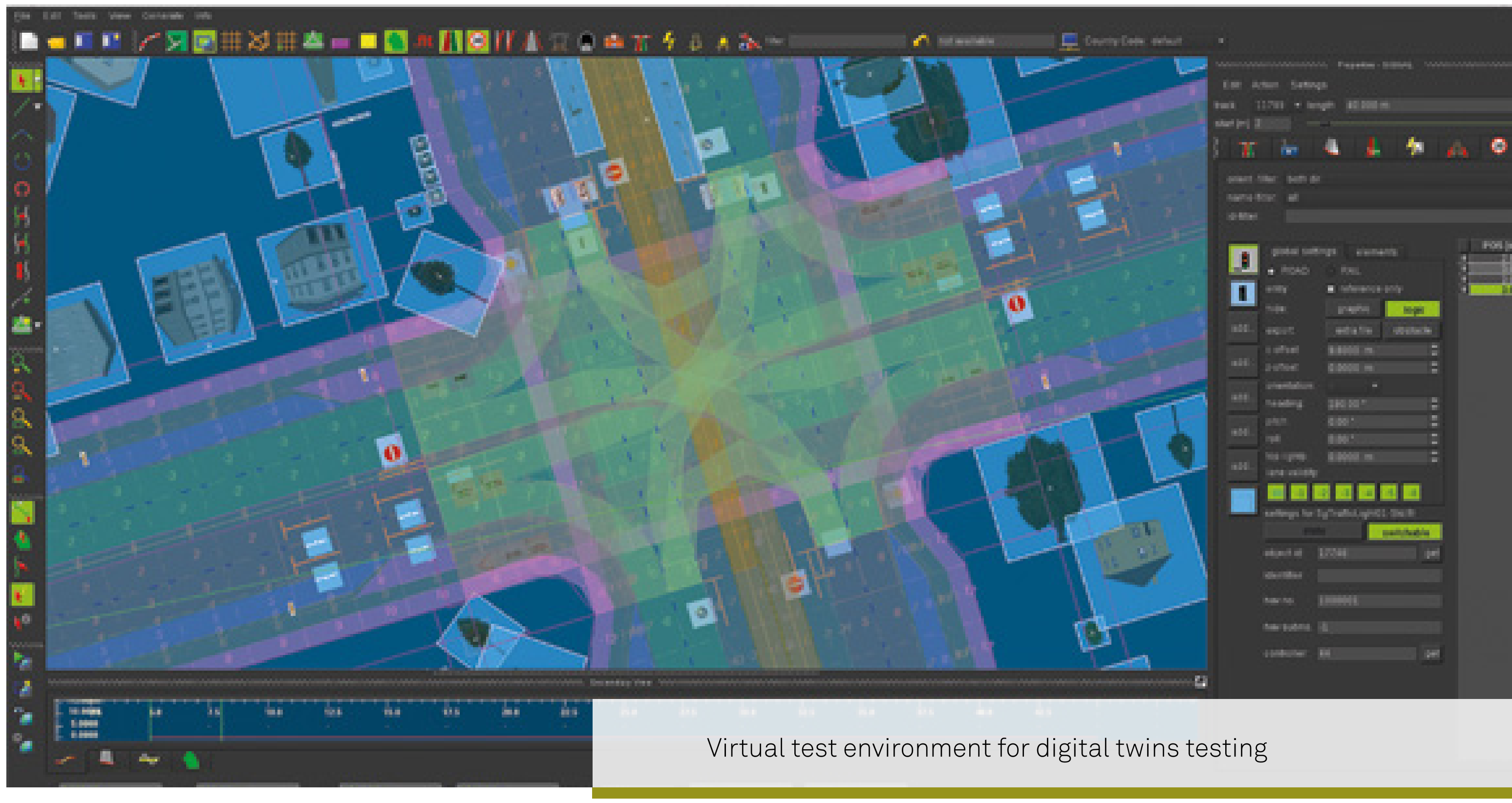
Virtual validation using digital twins

Today, forecasting and analysis of electrical consumption behaviour is mainly carried out using long-defined measurement methods in order to generate characteristic diagrams and lookup tables. This requires test drives or predefined test runs on test benches to have been conducted in real life. However, these methods reach their limits with testing and development in the field of e-mobility. Real-world test runs forecast range based on static models, without considering the environment, surroundings or coupled dynamic effects in the electric powertrain. It is not possible to make changes to test specifications during testing on a real-world test bench. Analyses of disturbances such as sensor inaccuracies, measurement noise or manufacturing and assembly tolerances can only be carried out by increasing the measurement work required and cannot be reproduced. These measures therefore do not allow for a fully comprehensive validation process within a reasonable time frame, particularly when forecasting range for e-vehicles, where a large variety of influencing factors must be considered [1].

This is why ASAP implements virtual validation using digital twins, which allows test specifications to be adapted whenever necessary. There are numerous benefits to using digital twins. For example, the virtual depictions facilitate optimal coordination between the individual development phases, as they ensure that data is constantly available. In turn, this data makes it possible to optimise the depicted components and functions continuously throughout all process stages. In addition, digital twins offer us a glimpse into the proverbial crystal ball. Before the first hardware or prototypes exist in real life, we can test new components or functions with them virtually. This enables ASAP to learn about how components or functions react in specific situations before they actually occur. Potential errors and their causes can therefore be corrected early in development. As a result, setting up and using digital twins significantly reduces the cost and effort involved in testing, prototyping and product optimization.

Virtual representation of an electric powertrain

In a current project, ASAP has created digital twins for all components in an electric powertrain. This means that virtual representations of the HV wiring harness, the HV power electronics and battery, as well as the electric motor are all available for testing. Digital twins meet a wide range of requirements so that they can be used to test all kinds of criteria. They can map the mechanics and electrics of a test object, as well as its thermals and service life. When creating the virtual representations, ASAP benefits from its deep knowledge of the whole e-vehicle development process – beginning with system design and simulation, followed by system and component development, verification and validation and vehicle integration, right through to test drives and application. By leveraging synergies arising from modelling and simulation, ASAP is able to enhance every phase of an electric powertrain's development



Virtual test environment for digital twins testing

process through its use of virtual component modelling, measurement technology and calculation methods. These virtual representations become increasingly precise with each new test and development step: thanks to machine learning techniques, they use previous experiences to constantly optimize themselves.

Advantages of digital twins in e-vehicle development

In their current project, ASAP experts are using digital twins to answer questions on range and operating state forecasts without real-world test runs. To this end, they have created a virtual test environment where they can take into account factors including various environmental influences, road conditions and road signs. Our experts run, or rather simulate, a variety of scenarios on virtual test drives in this test environment, which is where the digital twins come into play. Through simulated observation of load and driving profiles, tests are carried out on the virtual representation to identify mechanical and thermal hotspots in the vehicle. In doing so, we can determine the range or the ideal, lossless operating state for the whole system, and thus in turn, the optimal charge time for the HV battery. ASAP can therefore answer the question of whether the HV battery is in a thermal operating state that would benefit from charging, or whether the course to a defined destination can be amended to recover energy through recuperation. This enables ASAP to identify the best possible powertrain concept, as well as the optimal charging and operating strategy for an e-vehicle – all without travelling even a single kilometre in reality. Compared to testing on a real-world test bench, which would take several days in this case, this virtual testing only takes a few minutes [2].

However, ASAP does not just use electric powertrain digital twins for range and operating state forecasting, but also in all subsequent e-vehicle development phases – from design to prototype development, all the way through to testing. For example, at the start of development, calculation tools are used to design e-motors which meet their weight and performance specifications. Digital components are also used in soft-ware development, such as to carry out calculations for complex driving functions. When compared to traditional development methods, the advantages of model-based software development can be seen in the higher accuracy of the calculation methods. As the digital twins continuously improve over the course of the development process, these methods are based on well-founded models. In the prototyping phase, ASAP developers use digital twins to determine the optimal positioning for components such as HV wiring harnesses. They use the digital twins to identify mechanical loads or thermal contact points for control devices in the vehicle – that is, positions that are not suitable for the HV wiring harness. Fewer prototypes are therefore needed, which saves considerable time and money in the prototyping phase. The digital twins are thoroughly validated in component testing for e-vehicles and are later used to validate sensor data when the vehicle is being driven. They can also be used to run tests which would not be feasible under real-world conditions – for example, testing virtual sensors that calculate the temperature of an e-vehicle's motor based on current and voltage. Another example is validating functions such as person recognition. These cannot be ensured using real validation methods without the risk of error, as there are an endless number of situations and parameters that need to be considered. Again, ASAP is able to overcome this challenge by using digital twins in virtual environments. The virtual representations also simplify and accelerate e-motor temperature runs during service life tests. While it takes several weeks to run various driving profiles on real test benches, and the e-motors must then be inspected for any potential damage, results are available in just a few minutes when the driving profiles are simulated using digital twins [3].

The future of digital twins

In light of the advantages they offer to function and component development, digital twins will be essential if rapid progress is to be made in the coming years, particularly in the field of e-mobility. Their value will only increase in future. Databases with specific model and material data, as well as the use of this data for virtual validation, will enable a significant leading edge in development. ASAP is already gradually building relevant databases so that data on electrics, mechanics and thermals required for the virtual representations, for example, will be available more quickly in future. As a development partner to the automotive industry, ASAP is able to leverage its expertise in both real and virtual testing. Thanks to their extensive service portfolio in the field of robustness validation, a lot of data that can be used to create digital twins is available right from the outset and does not have to be obtained through a costly series of tests. If, for example, a digital twin is to be validated with a virtual shaker test, ASAP is able to draw on the measurement data from previous, real-world service life tests to access the required marginal data. Considering the tremendous challenges in component and function development, such as short development times, constant cost pressure and increasingly complex products, a bright future lies ahead for the use of digital twins.

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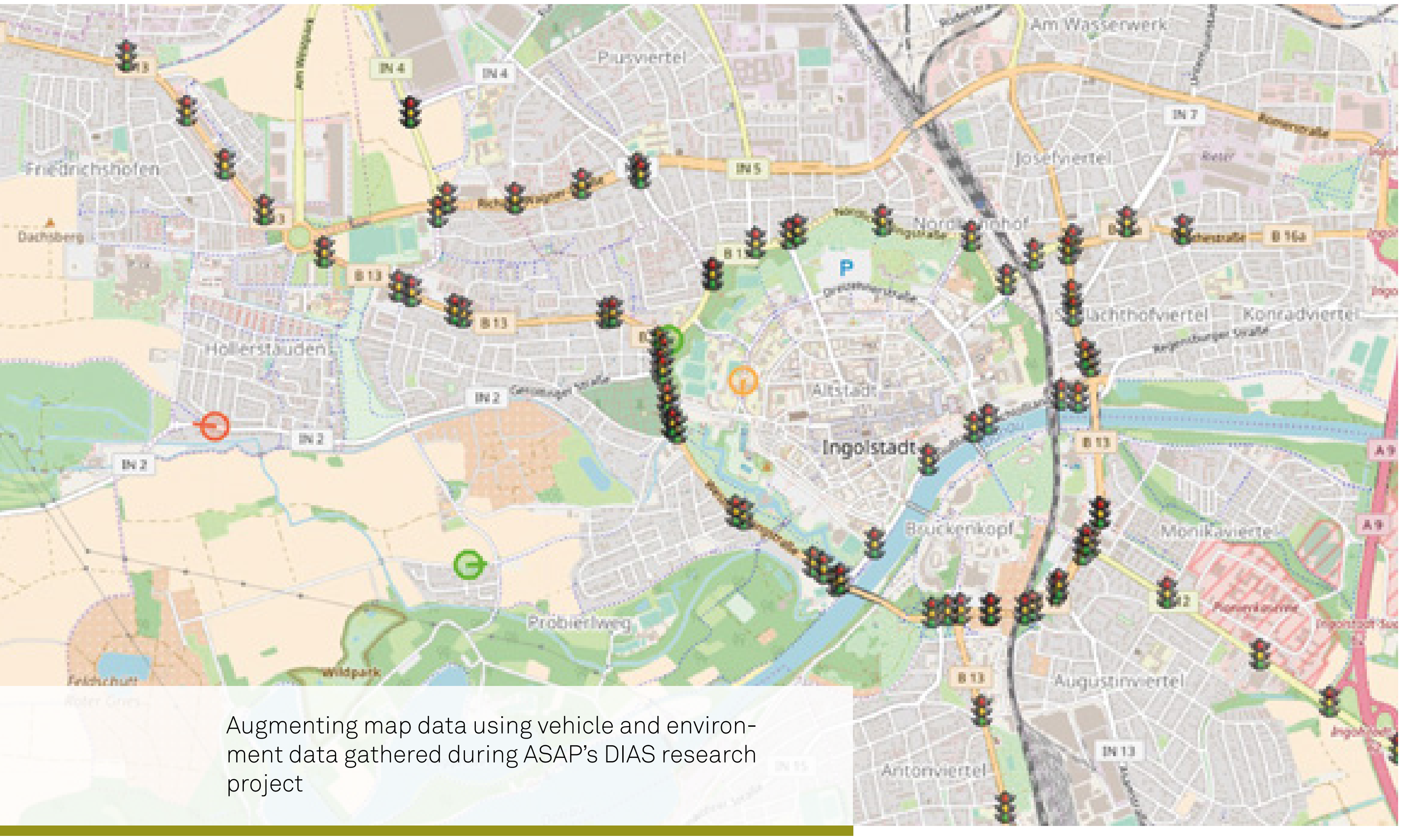
BACK

PARTICIPATION IN THE SAVE RESEARCH PROJECT

VIRTUAL TEST FIELD FOR FUNCTIONAL AND ROAD SAFETY IN AUTOMATED AND CONNECTED DRIVING

Since 2018, ASAP has taken part in the SAVe research project, which examines functional and road safety in automated and connected driving. The joint project has been supported by the German Federal Ministry of Transport and Digital Infrastructure (BMVI) with funding in the amount of € 3.89 million. It is focused on increasing social acceptance of autonomous driving and establishing a virtual test field in the form of a virtual model of the city of Ingolstadt and the surrounding region, including static, geometric and dynamic data. In addition to contributing its expertise in the areas of autonomous driving and artificial intelligence, ASAP is also drawing on its own findings from an internal research project on the development of new mobility services.



Augmenting map data using vehicle and environment data gathered during ASAP's DIAS research project

The validation of autonomous driving functions poses new challenges for the automotive industry, in that at least one million test kilometres must be covered with them before approval can be granted. This is the reason why ASAP – a project partner since day one – is supporting the SAVe research project, in collaboration with nine other companies and institutions. "We at ASAP have always had a clear focus on the automotive industry's most cuttingedge technologies – including autonomous driving," explains Robert Werner, COO at ASAP's Ingolstadt site. "By participating in the SAVe project, we and our project partners want to make decisive advances in autonomous driving." Among other things, the project will create a virtual test field in the form of a model of the city of Ingolstadt, which will make it possible to validate autonomous driving functions and develop future vehicle and traffic infrastructure. The project also investigates how traffic flows can be optimised and controlled according to requirements. On the one hand, ASAP is playing an active role in the field of collecting real environmental data by recording the surroundings, the movement of road users – such as the direction cars and bicycles are travelling in – and deviations from normal behaviour, such as driving on the wrong side of the road, on certain stretches of road within Ingolstadt. On the other hand, ASAP also is involved in creating the environment models required for the virtual test field, which uses the data collected in the real world is used.

Internal research project to develop new mobility services

In their work on the SAVe project, the developers also draw on findings from ASAP's internal 'Digital Automotive Services' (DIAS) research project, which explores the use of artificial intelligence methods, big data and cloud computing technologies in the development of new mobility services. ASAP equipped its own vehicle fleet at the Ingolstadt and Munich sites with intelligent sensors and put the necessary IT infrastructure in place to support the project. The swarm data gathered in this way provides insight into the potential use-ful applications of algorithms in the field of machine learning and object recognition. Furthermore, big data technologies can be evaluated and analysed with regard to their application in customer projects in the future. The aim of the DIAS project is to be able to offer customer-specific digital services and functions throughout the vehicle. The development project provides a decision-making basis for algorithms and IT infrastructures in the field of connected cars. It covers various fields of research, one of which is analysing the potential applications of technologies such as big data and cloud computing. Generating new insights by combining data from different vehicles, such as extrapolating realistic driver models from the speed profiles of different drivers, is another area of research. Moreover, work is underway to develop location-based services by augmenting map data with additional vehicle and environment data. The DIAS project also addresses the use of artificial intelligence methods that enable the vehicle to recognise objects such as signs, other vehicles and pedestrians as well as complex traffic situations. This allows new points of interest (POI) to be automatically mapped and displayed in the relevant applications, such as fleet management systems. Also examined is the degree of confidence that can be assigned to the POIs identified, i.e., how trustworthy the information obtained is. This helps to determine, for example, how often a set of roadworks must be recognised to trigger either automatic mapping or the removal of the POI.

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“EVERY DIGITALISATION STRATEGY REQUIRES OPENNESS FOR CHANGE”

COMMENTARY ON DIGITALISATION FROM ANDREE HÜNDLING, HEAD OF ENGINEERING SERVICE AND COMMUNICATION SERVICE AT ASAP

“What is digitalisation? Ask ten different people this question and you’ll get ten different answers. For me, the terms processes, methods and tools (PMT) go hand in hand with digitalisation within companies, as do communication and networking. In my eyes, these are core points for implementing any digitalisation strategy. In the course of the digitalisation process, we aim to create consistent processes and automate worksteps as far as possible. With this in mind, the first step in a digitalisation should always be process mapping and analysis. Work processes, efficient methods and user-oriented tools need to be closely networked to successfully optimise the identified areas of activity. When it comes to accepting digital changes, one point that is often underestimated is communication – both between people within the company regarding which changes have been made and between the tools and all available data in the work process. The central goal must be to transform the current world of work and move away from the dominant digital heteronomy of emails, chats, workflows and tasks in all manner of non-networked, stand-alone tools – and towards digital autonomy. By this, I also mean companies should progress towards technological sovereignty, such as in relation to their own development, production, system and customer data and their intelligent networking. In the automotive industry in particular, megatrends such as connectivity and autonomous driving require rapid advances in digitalisation

Andree Hündling

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so that they can keep pace with the new challenges in the development and validation of future technological complexity. At ASAP, our focus on digitalisation is to benefit the mobility of the future. When it comes to implementing digitalisation projects, experts from ASAP's Engineering Service and Software Development department are on hand for our customers throughout, from the initial idea all the way through to rollout. Working together with our customer, we develop target-oriented procedures and tool-supported solutions throughout the entire product process. We act as a developer and consultant, working on the processes, methods and tools that form the basis of any successful digitalisation project. We offer our customers a comprehensive service portfolio, ranging from initial surveys, GAP anal-yses and creating use cases to overseeing PMT developing, validation and rollout with the associated change communication. My next commentary in this series on digitalisation will take a closer look at digital engineering, focusing on integrated PLM in the automotive context."

NEWS FROM THE ASAP GROUP

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ADJUSTMENTS MADE TO ORGANISATIONAL STRUCTURE

GROWTH NECESSITATES EXECUTIVE BOARD REORGANISATION

At the beginning of 2020, the ASAP Group adjusted its organisational structure by expanding the key accounts at management level. In acknowledgement of both its strategic partner, ZF Friedrichshafen AG, and the growth at our Munich site, ASAP has redefined the responsibilities shared by the two managing directors at its Ingolstadt location. Effective immediately, Robert Werner takes charge of the BMW AG key account and assumes responsibility for the XA (Autonomous Driving) department at ZF Friedrichshafen AG. He will also serve as manager of ASAP's Munich site. Responsibility for the AUDI AG key account and ZF Friedrichshafen AG's Division E (e-Mobility) now lies with Christian Schweiger.

The ASAP Group has redefined the responsibilities shared by Robert Werner and Christian Schweiger, the two managing directors at its Ingolstadt location. "This adjustment allows us to sharpen the responsibility distribution in our top management and key account structures," explains Schweiger. "In the future, our structures will be even clearer for our customers, with only one responsible contact person in each instance." The ASAP Group's objective for 2020 is to expand its cooperation with OEMs, system suppliers and its strategic partner, ZF Friedrichshafen AG. "This decision was the next logical step for further growth in light of the very positive development of our Munich site," adds Werner. "By adjusting our key account structure, we are strategically well positioned to further develop our cooperation in connection with BMW AG." Last year, the ASAP Group won several new major projects for its Munich location. In addition to investing in its eleven locations, as a development partner to the automotive industry, ASAP is focused on the further developing its technological expertise – especially in relation to the automotive megatrends of e-mobility, autonomous driving and connectivity.

NEW COMPANY ESTABLISHED

ASAP ENGINEERING GMBH BODENSEE

A new year, a new company – the ASAP Group, a development partner to the automotive industry, founded a new company, ASAP Engineering GmbH Bodensee, on 1 January 2021. After opening an office in Tettnang near Friedrichshafen at the end of 2019, this is a clear step closer on the part of the corporate group to its strategic partner, ZF Friedrichshafen AG. Their cooperation places is focused on advancing pioneering technologies, above all e-mobility and autonomous driving.

In founding ASAP Engineering GmbH Bodensee, the ASAP Group is making clear its intention to further intensify its strategic partnership with ZF Friedrichshafen AG. "We want to be in a position to provide quick and smooth support to both our strategic partner and our customers in their projects," says Michael Nielsen, CEO of the ASAP Group. "Physical proximity is essential, making the continued expansion and increased import ance of our location near Friedrichshafen the next logical steps for our future corporate development." Martin Ott, COO at ASAP's Weissach site, will become Managing Director of the new company, in addition to his existing duties, with immediate effect. "Establishing ASAP Engineering GmbH Bodensee puts us in the best strategic position to develop our cooperation with ZF Friedrichshafen AG further," he explains. "We are already involved in many of our strategic partner's projects, in particular supporting them with our electronics development, software development and engineering services."

'NEW WORK' IN AUTO-MOTIVE ENGINEERING

HOW 'NEW WORK' HAS TRANSFORMED OUR WORKING LIVES

Digitalisation, connectivity, artificial intelligence – three things that are changing not just the way we manufacture cars, but also our day-to-day work to develop them. The concept of 'New Work' has been with us for some time and replaced outdated structures. For example, virtual vehicle development, internal research projects and, in pilot projects, holo-conferences have become part of everyday business at ASAP.

Doing work that we really, really want is one of the key factors of the 'New Work' concept coined by social philosopher Frithjof Bergmann. More and more companies nowadays are focused on retaining their staff for the long term, particularly in view of the current shortage of skilled workers. One approach is ensuring the right employees are assigned to the right projects so that everyone can tackle fulfilling tasks. Other essential elements are the right working environment and attractive conditions, which above all include a healthy work-life balance and the ability to reconcile work and family. [1]

The new way of working

In addition to factors such as flat hierarchies and shorter decision-making procedures, attractive working conditions also include a more flexibly structured workplace. We achieve this through decentralised office spaces. For example, ASAP has opened a new certified office in Stuttgart, despite having a larger site in Weissach, only 30 kilometres away. This significantly shortens commutes for Stuttgart-based employees and ensures they can use public transport. Such infrastructural elements play a part in making us an attractive employer, just like our challenging projects and the cultural aspects of our area. ASAP gives consideration to what its employees need in order to provide a healthy work-life balance. Here are two examples. First, there's software developer Katharina, who spends two months in Australia every winter. Then, there's her colleague, Martin, a project manager in electronic development, who was able to live his dream and travel the world for 14 months – he just packed his bags and off he went, having already planned for his return to work with his manager before he left. "Knowing that I had a guaranteed job waiting for me when I got back was really reassuring at the time," he says. Working at our company locations is already very flexible, as there's always the possibility to work remotely. In contrast to the option of working from home, we don't stipulate a fixed location, meaning employees are free to choose where they work.

Scope to create innovative solutions

For this new way of working, however, it's not just the basic conditions but also the tasks themselves that are crucial. Enabling every employee to work on challenging, exciting projects is hugely important. Especially for a development partner to the automotive industry such as ASAP, in practice this means affording employees the freedom they need to generate creative solutions and innovations, helping them play their role in shaping the mobility of the future. We have created internal development projects, in which employees are free to conduct their own research and tinker independent of customer projects for this exact purpose. In one project, engineers and PhD students are converting an Audi A7 for autonomous driving. To do so, they are developing algorithms to help them understand the technologies involved in autonomous driving and thus test highly complex functions in future, both in reality and in simulations. Another internal development project involves researching how new mobility solutions for future smart cities can be realised using artificial intelligence, big data and cloud computing technologies. The company has equipped its own vehicle fleet with smart sensors to collect the necessary swarm data for the project. This gives our employees the opportunity to play an active role in shaping the mobility of the future.

Continuous change

Everyday projects and the processes associated with them are also constantly changing. Indeed, especially in an industry like automotive engineering, issues such as digitalisation, connectivity or even artificial intelli-gence are in a constant state of flux. At ASAP, we are already successfully using artificial intelligence (AI) methods in software development, life cycle testing and environmental simulations, as well as in vehicle function validation. In the context of development, the benefits of AI include the high degree of assurance and a greater depth of testing it offers. It also reduces number of physical prototypes, meaning shorter development times and cost savings.
AR/VR technologies, for example, ensure that we can exploit synergies more quickly and more intensively today by having employees from different locations work together simultaneously in holo-conferences. At ASAP, we are using VR in pilot projects to bring developers from different locations together in a single virtual space where they can collaborate on the development of a new design concept in real time. At the same time, the use of AR/VR technologies is increasingly shifting vehicle development itself into the virtual world. This allows ASAP to create virtual concept

vehicles we can use in detailed design and layout testing. By transferring all tessellated design data into VR precisely, developers can not only use VR headsets to 'sit' inside concept vehicles, but they can also use them to carry out static and dynamic load tests. Expensive prototypes, complex coordination and long waiting times are now a thing of the past. Thanks to the ability to build virtual component libraries and integrate haptic feedback, these virtual methods also offer potential for optimising the vehicle development of the future even further.

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CONSTRUCTION UNDERWAY AT ASAP'S WOLFSBURG SITE

TWO NEW OFFICES AND AN ADDITIONAL TESTING HALL UNDER CONSTRUCTION

Builders have broken ground and started construction work on on a new building at the ASAP Group's Wolfsburg site. The corporate group is expected to complete the 750m² expansion of its trialling and testing centre in Wolfsburg with the addition of a new testing hall by October 2021. The focus is expanding e-mobility testing capacities. ASAP has also moved into two additional offices, with a total area of 700m², at the beginning of the year in order to meet the high floor space requirements. Since the first building in Wolfsburg opened in 2016, the number of employees on the site has doubled.

More space for automotive progress – 2019 showed the Wolfsburg site's largest growth to date so, at the beginning of 2020, the ASAP Group moved into two new offices on the premises to accommodate it. In addition, the corporate group is investing in the construction of another building, due to be completed by the end of 2021, directly adjacent to the main building first occupied in 2016. Vehicle laboratories, work-shops and project rooms will be built on around 750m² of hall space, serving to expand the trialling and testing centre as a means to broaden development and testing capabilities in the e-mobility field. This will provide more space for the areas of functional and enduring testing of e-drive systems and HV batteries. Moreover, this expansion is ASAP's response to customer demand in relation to commissioning and vehicle updates, to which part of the new hall space will be dedicated. "In recent years, growth has been strong at the Wolfsburg site and we have continuously expanded our service areas, focusing on cutting-edge technologies such as e-mobility, autonomous driving and connectivity," explains Martens. "This renewed expansion of our infrastructure allows us to lay the foundations for continuing this positive development and, at the same time, state clearly what an important customer Volkswagen is to us."

CONTINUOUS INVESTMENTS WITH FOCUS E-MOBILITY

LOOKING BACK ON THE 2020 FINANCIAL YEAR

In the 2020 financial year, the ASAP Group once again made investments in the amount of € 10 million. Despite the challenges we faced in 2020, investment in productive areas of the corporate group was almost identical to that in the previous year, which saw the highest investment in the company's history to date. As a development partner to the automotive industry, ASAP is again emphasising that its focus remains on driving forward the development of cutting-edge technologies – primarily e-mobility.

In spite of the challenging conditions that arose in 2020, the ASAP Group has reported that it kept investment in technological fields at the same level as in 2019. More than 90 percent of the € 10 million invested can be attributed to the continuous expansion of ASAP's market position in the field of e-mobility validation. ASAP also continued to expand its development and testing capacities for e-drive technologies in 2020. ASAP's main areas of expertise in the field of e-mobility are the verification and validation of powertrain components, such as electric engines, power electronics, vehicle integration and the commissioning of purely electric (BEV) and plug-in hybrid (PEHV) vehicles. With continuous investment in this area, the corporate group can ensure it provides an even greater range of services. "The ASAP Group has always focused on cutting-edge technologies in the automotive industry," explains Michael Neisen, CEO of the ASAP Group. "The Group's continued progression over the past few years, customer feedback and our recent economic development serve as confirmation of our strategic approach. By consistently implementing our internal strategic programme here at ASAP, we have been able to consolidate our technical and strategic positions in relation to megatrends, expand our expertise in these areas and further expand our position as a development partner for the mobility of the future. In order to secure ASAP Group's market position and future growth, we have continued to invest in technological fields, even in 2020 – a year in which the coronavirus pandemic posed economic difficulties."

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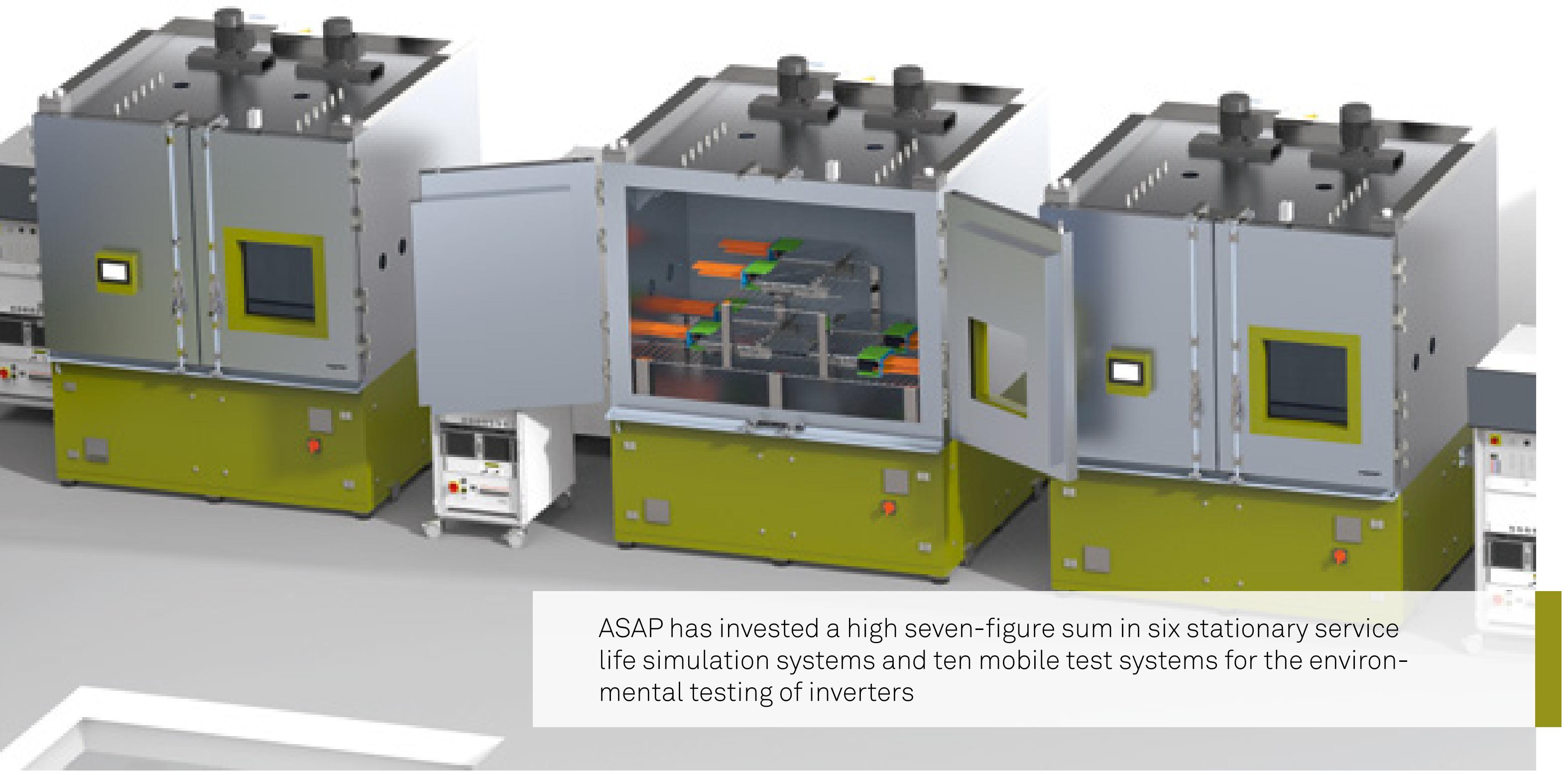
WIDE RANGE OF SERVICES FOR TESTING

ASAP EXPANDS TESTING CAPACITIES

The ASAP Group has been a partner to OEMs and their suppliers in the validation of high-performance e-drives for many years. Following the expansion of the ISO/ICE 17025-accredited test laboratory in Ingolstadt in 2018 and the construction of the Sachsenheim testing centre in 2019, the corporate group further expanded its capacities and range of services offered in the field of e-drive testing at the start of 2020. The trialling and testing centre at ASAP's Ingolstadt site now includes six test benches for power electronics and four additional test benches for electric drive systems. After recording the highest investment in company history last year, the corporate group also kicked 2020 off by making a significant investment, once again making it clear that the ASAP Group's focus remains on developing cutting-edge technologies – above all in the fields of e-mobility and autonomous driving.

ASAP continues to expand its development competencies and capacities in the field of electromobility: the consortium has expanded the trialling and testing centre at the Ingolstadt site by adding ten test benches for endurance testing on power electronics and electric drive systems. "Investing a seven-figure sum in additional e-mobility testing capacities follows on seamlessly from 2019, the year in which we recorded our highest investment to date in technological development concerning automotive industry megatrends," explains Christian Schweiger, COO at ASAP's Ingolstadt site. "We are once again emphasising our focus on cutting-edge technologies. The considerable interest shown in our existing e-mobility test systems is confirmation of this approach."

Two test benches for power electronics endurance testing were to be installed by the end of Q1 2020, followed by four more before the end of July. Four additional test benches have already been available since March, facilitating the simultaneous testing of up to 24 electric drive systems. This rapid implementation is made possible by leveraging synergies within the corporate group. ASAP experts develop test systems and take responsibility for all related tasks, including mechanical and electrical planning, drawing up a safety concept, residual bus networking and simulation, and developing the necessary test automations.



ASAP has invested a high seven-figure sum in six stationary service life simulation systems and ten mobile test systems for the environmental testing of inverters

VALIDATING POWER ELECTRONICS

16 NEW TEST BENCHES, DEVELOPED IN-HOUSE

The ASAP Group is working in close collaboration with its customers to develop the mobility solutions of the future, and has placed a particular focus on e-mobility from the outset. In order to provide a more extensive range of services, and due to growing demand from OEMs and system suppliers, ASAP has invested in 16 new systems for inverter testing. ASAP's Test Systems division is responsible for designing, planning and, for the most part, producing these systems.

The ASAP Group has again increased its capacity and range of services in e-drive testing by commissioning ten more test benches for endurance testing of power electronics and electric drive systems in 2020. In addition, two new e-axle test benches were to be installed at the Sachsenheim site by February 2021. "We see ourselves as a development partner and are in a position to offer our customers considerable added value. This is thanks to our extended range of services," explains Christian Schweiger, COO at ASAP's Ingolstadt site. "On the one hand, our customers require fewer interfaces to coordinate with us effectively. On the other hand, this is a great way for us to reduce development time and costs."

Validating power electronics – everything from one source

In order to provide a more extensive range of services, and due to increasing demand from OEMs and system suppliers, ASAP has installed additional systems for inverter and power electronics testing at its Ingolstadt location. The company has invested a high seven-figure sum in six stationary service life simulation systems and ten mobile test systems for the environmental inverter testing. These new test systems were completed at the end of 2020. By leveraging internal synergies, the corporate group can quickly adapt to current market needs and scale up the number of testing systems where needed. In interdisciplinary, cross-departmental cooperation with the trialling and testing centre, ASAP's Test Systems division is responsible for designing, planning and producing the test systems. These test systems for inverter validation allow ASAP to enter the market. Customers can now benefit from the tried and tested concepts that have already been successful internally.

Comprehensive package to validate robustness

Generally speaking, ASAP's range of services in the e-mobility field covers the entire development process, from system design and simulation through to system and component development. ASAP experts are also responsible for subsequent development steps, from verification and validation to vehicle integration, road testing and application. ASAP also offers consultancy, project management and process management ser-vices to accompany the entire development process, which guarantees that all development steps are integrated seamlessly. This means that, when it comes to robustness validation of inverters, testing is not limited to mounting test pieces on test benches and supervising the process. Instead, the company offers its customers a comprehensive package that, alongside the testing itself, includes project management, software and measurement technology support, data analysis, diagnostics and adjustment design.

BACK

AWARD-WINNING

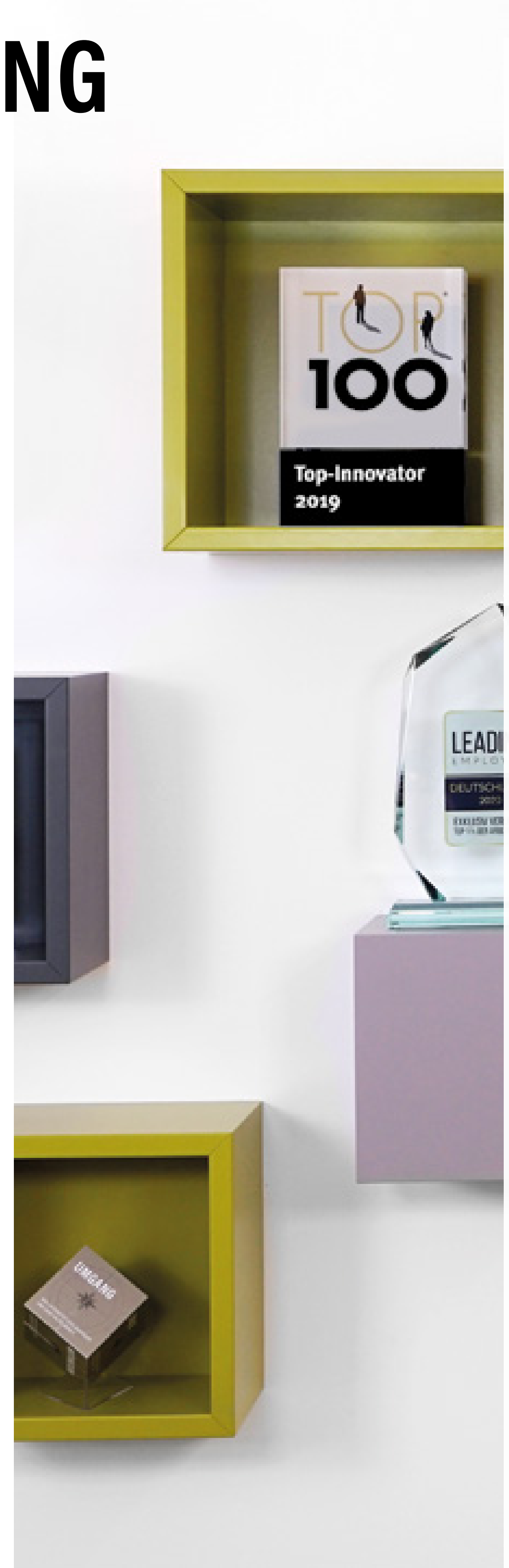
ASAP LEADS THE WAY

Germany's Best Employer

Does the image match reality? Where ASAP is concerned, it certainly does – which is why the Group received the 'Germany's Best Employer' seal of quality this year. In cooperation with WELT, the Cologne-based analysis institute ServiceValue GmbH conducted large nationwide surveys to determine just how attractive German companies are in the eyes of the German public. With an average mean score of 2.72, our company was deemed to be a 'very attractive' employer.

Top Employer

Excellent working conditions at the ASAP Group: The corporate group was once again named one of Germany's 'Top Employers' in 2020, winning this coveted award for the fifth successive year. The winners were selected by German news magazine Focus in conjunction with Statista and the professional networking platforms Xing and Kununu.



MINT-Minded Company

The ASAP Group has been named a 'MINT Minded Company' for the sixth year in succession in recognition of its commitment to promoting young STEM talent. The initiative honours companies that show particular dedication to promoting young STEM talent and specialists. By signing a 10-point declaration, the companies that qualify for the award lead the way in emphasising the necessity to shine a spotlight on STEM specialists and their expertise, as well as their role in safeguarding Germany's existence and continued development as an attractive business location.

Leading Employer

The ASAP Group received the 'Leading Employer' award this year, placing it among the top 1% of German employers. More than 100,000 companies were considered for this award. The selection process analysed some eight million datasets, making 'Leading Employers' the most comprehensive employer evaluation system of its kind in the world.

Leading Innovator

This year, ASAP was named among the ‚Leading Innovators' in the German Mittelstand for the fourth time. In the independent TOP 100 selection process, ASAP placed particularly highly in the 'Innovative Processes and Organisation' category. TOP 100 uses transparent, accountable and science-based methods to determine the most innovative companies among German SMEs. Success at the TOP 100 awards is based not on a company's individual inventions, but rather their innovation management activities and the success of their innovations.

CERTIFIED

A FOCUS ON QUALITY AND OUR CUSTOMERS

Certified quality

Quality and customer focus are integral elements of the ASAP philosophy and decisive factors in ASAP's success. Bureau Veritas has certified the corporate group's quality management system in accordance with DIN EN ISO 9001:2015. In addition, as the operator of the central IT and information security systems within the ASAP Group, ASAP Holding GmbH has been certified by DEKRA in accordance with ISO/IEC 27001:2013.

Accredited testing and trialling centres

The ASAP testing and trialling centres in Ingolstadt and Wolfsburg have been certified by DAkkS, Germa-ny's national accreditation body, as complying with DIN EN ISO/IEC 17025:2005. In addition, the testing and trialling centres have passed audits according to current automotive and industrial standards, including: LV 124; VW 80000 and 80101; DC 10611, 10612 and 10615; GS 95003-x and 95024-x; DIN EN 60 068 2-x and DIN ISO 16750.

IMPRINT

Publisher
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Photos
Page 05 shutterstock_1033428202_ HAKINMHAN
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