





A Trip Through Autoland Saxony

How Felix discovered that the future of the automobile starts right here at his very doorstep. ...Felix whispers as a greeting. Then he casts a critical glance inside the DKW F1, built almost 90 years ago in Zwickau, Saxony. Every couple of weeks, Felix is drawn from the West Saxon University of Applied Sciences Zwickau to the August Horch Museum – and he always lingers for the longest time with "his" DKW oldtimer. Some of Felix' fellow students claim he's having conversations with the vintage car; so far, Felix hasn't denied it ...

YESTERDAY IN "AUTOLAND SAXONY:"

Hey Oldster,

what's up?

"Coswiga" – the first passenger car from Saxony, built in Coswig in 1900 . AUDI is born in Saxony – in 1910 founded by the auto pioneer August Horch (under the Latin version of his last name) in Zwickau. In 1932 , Horch, Audi, DKW, and Wanderer joined forces in the Chemnitz-based "Auto-Union." It's trademark – the four interlocked rings. Steering wheel on the left, gearshift lever in the center – what most car drivers take for granted today began its global success story in Saxony (Audi Factory) in 1921 . The mass-produced front-wheeldrive was launched for the first time ever in 1931 in the DKW F1 from Saxony. Lightweight construction with thermosetting plastics – In 1955 , Germany's first vehicle with a massproduced plastic body was the Sachsenring P70 (later known as "Trabant"). The renaissance of "Autoland Saxony" was launched by VW in 1990 – with the founding of the VW Sachsen GmbH in Zwickau (today, also with production sites in Chemnitz and Dresden). A cordial welcome! Other global players have also been focusing on Saxony: Porsche as of 2002 , BMW as of 2005 , Daimler (Accumotive: production of li-ion batteries) since 2009 .

WELCOME TO "AUTOLAND SAXONY"

Motor vehicles made in "Autoland Saxony" have been providing people with mobility for more than 100 years now. It was here that such innovations as the left-hand drive

and the frontwheel drive began their international success story. With six vehicle, engine, and battery plants operated by BMW, Daimler, Porsche, and Volkswagen as well as about 780 branch suppliers, equipment and service providers, Saxony is one of Germany's top auto locations today. Approximately every eighth car built in Germany comes from Saxony.



FRICIE, ENGINE, AND BU

Come and hop in: www.autoland.saxony.com - Or scan the QR code. And off you go!

Initially, it had only been a vague idea. But then, Felix couldn't think of anything else anymore: The automobile of the future – which technologies and value chains would it require? How far along is the development?

> Is "Autoland Saxony" also helping define the future of the automobile?

Felix, the prospective industrial engineer, began his investigations; he burnt the midnight oil while sitting in front of the computer. Dropped everything, started anew. Just a theoretical paper alone would not suffice, Felix knows that. He wants, he must - see, touch, grasp. It'll revolve around concrete value chains - around new materials, alternative drives, and automated driving. And it'll revolve around producing cars at low cost, while also saving resources. The automobile of the future "made in Saxony" became his project. His Diplom degree project. At the bicycle stand in front of the museum, Jenny suddenly stands beside him, his former roommate in their shared apartment. "Hi Felix! I thought your Diplom project is the automobile of the future. What on earth are you looking for among these veterans?" Jenny with her mocking undertone! Felix smiles. "Inspiration as an engineer. Did you know, for example, that the DKW F1 was the world's first mass-produced passenger car with front-wheel drive? And it came from Saxony!"



95,000 employees in Saxony's automobile industry

That was precisely

in 1931. But do you also know

what Saxony's vehicle technology

has to offer today? That everything a car needs is produced here, in our region?



The automobile industry is also the driving force of Saxony's manufacturing industry. Its approximately 95,000 employees, of whom more than 80 % work in the supply industry, generate more than one quarter of Saxony's industrial production. From A like alternator to Z like Z-axle, automotive suppliers in Saxony are capable of developing and manufacturing virtually all the components and parts required for a vehicle as well as the requisite production equipment.



Saxony is in the "pole position" also when it comes to the second automobile revolution. The region is currently evolving into Europe's largest and most modern production site for electric vehicles. And when it comes to such future topics as highly automated / autonomous driving, lightweight construction in an efficient mix of materials as well as intelligent transport systems, "Autoland Saxony" is one of the top locations as well.





Jenny and Felix sit together for a few more hours, drinking red wine while looking at Zwickau Cathedral. Of course, they don't just talk about vehicle technology "made in Saxony" - but that's also a topic of their discussion. After all, they haven't seen each other for quite a while ... Jenny has received a number of job offers after having completed her Diplom studies of vehicle engineering: From Stuttgart, from Wolfsburg, from Munich. All places which evoke associations with Felix - because isn't that where the automobile of the future is built? In the end, though, Jenny had finally decided in favor of Volkswagen in Zwickau - which some of their friends didn't understand at all; even Felix had his doubts. But Jenny's decisions have always been very deliberate and well thought out.



THE SPECIALISTS OF TOMORROW

are trained and educated in "Autoland Saxony" not only in Zwickau.





Source: Saxony Economic Development Corp. (Wirtschaftsförderung Sachsen GmbH)

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Chemnitz, Reichenhainer Straße, the University of Technology. Finally! Felix is quite exhausted even though he hasn't been in the saddle for the entire route - such an e-bike really has its own weight. And this is precisely the challenge that has been accepted by Europe's largest center for lightweight construction research, MERGE, at Chemnitz University of Technology. More than 100 researchers and technicians are working on solutions for weight optimization particularly in vehicle construction this saves raw materials and energy. At the end of the day, Felix knows how innovative lightweight components can be produced in a cost and resource effective manner. And how many lightweight materials are actually available for cars. This is something that Felix definitely wants to pursue even further when he'll visit the lightweight campus at Dresden University of Technology and the production of carbon parts at the BMW Plant Leipzig during the next few days.



LIGHTER MASS PRODUCTION

Lightweight construction is important for the fuel saving "automobile of the future." But the production of components made of composite materials is complex and expensive. Finding a solution for



this problem is the objective of Europe's largest lightweight construction cluster "MERGE" at Chemnitz' University. Here, 100 experts from the sectors mechanical engineering, mathematics, electrical engineering, physics, chemistry, and information science pool their knowledge. Production processes for the processing of metals, plastics, and textiles that are carried out separately are to be consolidated into a mass-producible and resource-efficient technology. A system demonstrator called "MERGE up!" shows exemplary developments – for example, car rims made of fiber plastic aluminum foam that are 50 percent lighter or a lightweight seat in multi-material design. All components are manufactured with hybrid procedures that are suitable for large-batch mass production. Guaranteed!

MATERIAL MIX WITH AN EYE ON THE APPLICATION

Not even a one-hour car ride away from MERGE is the location of Saxony's second large lightweight construction center: The Institute of Lightweight Engineering and Polymer Technology (ILK) at Dresden University of Technology. Here, the aim is to develop innovative lightweight structures and to bring them to mass production. One of the research

highlights is compact, has a cuddly front end, and is called FiF. FiF is a "functionally integrative vehicle system carrier" and stands for a van in the urban or intracorporate sector. The exciting thing about the FiF is its innovative textilethermoplastic construction. The supporting vehicle structure was reduced to six highly integrated structural parts. The vehicle is also permeated with a sensor network that is integrated into the textile components and assumes the data communication within the FiF.



In Freiberg developers have directed their attention towards the lightest of all construction metals - magnesium. The Freiberg University dedicates itself to the development of forming technologies for magnesium flat products. They are in great demand as an inexpensive lightweight material for the realization of modern construction concepts. A globally unique industrial-scale prototype system serves as a base for the investigation of casting and strip rolling technologies for the production of magnesium sheets. In order to tap the material's enormous potential even better, another pilot plant for the production of magnesium wire was established.





IDEAS FOR THE AUTOMOBILE OF TOMORROW

are created by numerous R&D facilities in "Autoland Saxony."



Recipe for an Indestructible Sandwich

The development of mass-producible lightweight solutions for vehicle structures which protect passengers during a collision – this is the reason why the three Universities of Technology in Chemnitz, Dresden, and Freiberg have consolidated their forces. The joint project is entitled "hybCrash – Pilot Production Technologies for Heavily Loaded Hybrid Multilayer Crash Structures." The ambitious goal: Developing THE perfect recipe for an indestructible sandwich made of a basic textile structure, a plastic reinforcement for stability and strength as well as a light metal layer serving as flexible protection during an accident. And all this even more inexpensive in mass production than conventional components, please. Possible? Yes! – When the three lightweight construction universities in Saxony combine and consolidate their individual competences. But there is more to come: "hybCrash" is just the beginning of the cooperation. In October 2017, the Universities of Chemnitz, Dresden, and Freiberg jointly founded the "Lightweight Construction Alliance for Saxony."

LIGHT IN CARS, HARD TO **RECYCLE**

Carbon fibers or carbon fiber-reinforced plastics (CFRP) have become an indispensable part of automotive lightweight construction today. So it's about time that someone tackles the sustainable production



and recycling of these innovative materials. The processing of carbon fiber waste and its reuse as a base material for high quality fiber composite components are in the focus of the research conducted at the Saxon Textile Research Institute e. V. (STFI) in Chemnitz. The institute's own in-house "Center for Textile Lightweight Engineering" develops and tests innovative technologies which will permit the production of the most diverse nonwoven materials from CFRP waste and their subsequent reintegration into components by the institute's industrial partners. Towards this end, the Chemnitz researchers want to create a value creation chain which can be

> implemented at an industrial scale and is capable of feeding not only waste from production processes, but also the components themselves at the end of their service life back into the materials cycle in a sustainable manner.



FIRST MASS PRODUCTION OF CFRP COMPONENTS

The BMW Plant Leipzig (opened in 2005) is one of the most modern and sustainable automobile factories worldwide – with a current staff of approx. 5,300 employees. More than 1,000 cars roll off the assembly line every day, of which 180 are vehicles of the BMW i3 and i8 model series. The latter excel not only with their alternative drive systems, but also with their car bodies made of the lightweight material CFRP. For the first time ever, a large-batch production was implemented for passenger compartments made of CFRP which is revolutionizing automobile production of the next generation.

DAIMLER'S PREMIUM E-BATTERY FACTORY

The German Federal Chancellor was in Kamenz, as was Saxony's Minister President, and of course also Daimler's CEO. The reason for this summit meeting in May 2017: The festive cornerstone ceremony for one of the largest and most modern battery factories on the entire globe. With an investment of about 500 million euros, the Daimler subsidiary Accumotive is already building its second factory for lithium-ion batteries. With that, the production and logistics space in Kamenz increases fourfold. In the new factory, all-electric battery products are made, for example, for the smart. The spring of 2019 marked the start of the batteries' volume production for the Mercedes-Benz EQC. Daimler's utility vehicles such as the Vito Van, Sprinter, eCanter, or Fuso also rely on batteries from Saxony. No wonder that the corporate staff more than doubled within a short period of time – to a current number of more than 1,600 employees.



Yesterday he had still been in Leipzig. Today he's leaving for the opposite corner of Saxony. Felix would've loved to have appeared with the e-bike for his appointment at the battery producer Accumotive in Kamenz. But this trip is just too long for an e-bike ride which is why he gets on board a train again. At the Daimler subsidiary Accumotive, lithium-ion batteries have been produced for automobile applications since 2010. That "his" automobile of the future would be an e-vehicle has been crystal clear to Felix right from the start. The fact that a large corporation like Daimler "orders" its batteries in Saxony excites him.



HYDROGEN INSTEAD OF ELECTRICITY



Many institutes conduct research on alternative drive and propulsion systems. If the specific focus is on fuel cell drive systems, then one ends up with only a handful of institutions. Among them is Chemnitz University of Technology which has put the topic of fuel cell drive systems center stage already since 2010. The scientists at the Professorship of Advanced Powertrains (ALF) are convinced that vehicles powered by fuel cells can score a lot of points with increased mileage and shorter "recharging" times. What's still missing, though, are inexpensive processes that are suitable for the mass production of the requisite components. To change this situation, the researchers at Chemnitz University of Technology have pooled their competences together with other Saxon partners in the "HZwo – Driving Saxony" network. One of the development projects focused on a bipolar plate for passenger car fuel cells which can be mass-produced at low cost with industrial scale production processes.

In the afternoon, he drives to Dresden. After having visited Volkswagen's "Transparent Factory," he stays overnight with a friend before he'll head to other appointments in and around Saxony's state capital the next day. 'Awesome how short distances are here,' Felix muses during his train ride to Dresden, 'and how much one can learn about the automobile of the future within only a couple of days!' This evening, it's actually Jenny who calls him.

FASTER WITH NETWORKS

More innovative, more flexible, more cost-efficient - those who want to stand out from today's competition better look for reliable partners. For example, in the Saxony Automotive Supplier Network (AMZ).





VW AND SAXONY: (ELECTRO)MOBILE TOGETHER

The VW Group has been committed to Saxony for about 30 years now. The Volkswagen Sachsen GmbH employs about 10,000 people in its Vehicle Plant Zwickau, its Engine Plant Chemnitz, and in the "Transparent Factory" Dresden. Within the scope of its e-mobility campaign, VW also relies on the unique competences available in "Autoland Saxony:" With an investment sum of 1 billion euros, the Zwickau plant is being turned into Europe's largest and most efficient e-vehicle production site. It is the first complete trans-

formation of a large automobile factory on the entire globe. In the future, the plant will build exclusively e-vehicles for Volkswagen and other brands of the corporate group, and the annual production capacity will amount to 330,000 vehicles. The first mass-produced vehicles of the new VW ID family will roll off the assembly line in Zwickau at the end of 2019. Another part of VW's concept for the future is Dresden's "Transparent Factory" which has been repositioned as a "Showcase for Electromobility." Since April 2017, the e-Golf has been produced here. A start-up incubator for mobility services is also integrated into the "Transparent Factory."

SUN ROOF AND LANTERN PARKING IN A DIFFERENT WAY

An e-vehicle has to fill-up as well. Making electromobility really suitable for everyday use calls for clever ideas when it comes to increased energy efficiency and flexible recharging. Here as well, Saxony is on the right track. For example, the global technology leader for large-format OPV solar foils, Dresden's Heliatek GmbH, is developing a solar-active car roof system together with the automotive supplier Webasto. Dresden's Solarwatt GmbH which supplies, for example, complete solar carports for private users also



gets the sunshine into the (e)tank. The company is, thus, BMW's official partner in the e-mobility sector. The Leipziger Leuchten GmbH develops and produces power charging modules which permit the retrofitting of street lights into charging stations. And the experts of the EA Systems Dresden GmbH plan and implement the integration of electromobility into complex grid infrastructures. Towards this end, they have developed both a holistic simulation software for energy systems and the "easyCharge" charging stations with intelligent charging capacity control. Two days later - back in Zwickau - Felix is on his feet again early. In an exhilarated mood, he once again rides in the direction of Chemnitz, sometimes whistling in all of his exuberance, and completely without a driver assistance system. This actually becomes a topic of discussion just a bit later, when Felix is allowed to visit the Intenta GmbH in Chemnitz. Here, software components are developed specifically for driver assistance systems, and tested on the road; (Auto)Land Saxony granted a special permit so that it's possible. Felix is impressed, but also still a little bit skeptical. Sure, highly automated driving will be available for cars in the foreseeable future. But completely without a driver? Perhaps this will become clearer after his visits to the IAV and NAVENTIK corporations to which he now really has to be on his way.



A PRIME LOCATION FOR START-UPS

Saxony actively supports start-ups – with a wide range of founder and idea contests and multifaceted technology funding.



SMART ASSISTANT DRIVERS FROM CHEMNITZ

"Chemnitz was to have been a stopover in my career for a maximum of three years. That was what I had promised my wife when my fellow student Basel Fardi and I came here to earn our doctoral degrees at Chemnitz University of Technology in 2000. Since then, almost 20 years have passed and we've found Chemnitz to be the place where we want to work and live with our families."

Dr. Heiko Cramer, Co-Founder and Head of the Automotive Division, Intenta GmbH Chemnitz

"Chemnitz University of Technology provided the best possible conditions in our research fields. When Intenta was founded in 2011, it never occurred to us to go anywhere else, but to stay in Chemnitz. The region has much to offer; particularly for start-ups in the high tech sector. We were supported by the university, the start-up network Saxeed, and the Technology Center Chemnitz. And the funding instruments pro-

vided by the Federal State of Saxony helped us as well. We've never regretted our decision in favor of Chemnitz and we're bringing our software – in particular, solutions for automatic environment recognition – for driver assistance systems into mass production from here. With great success! We were able to grow from six to 160 employees within only five years."

Dr. Basel Fardi, Co-Founder and Head of the SmartSensor Division, Intenta GmbH Chemnitz

TRAFFIC REPORT FROM SAXONY -CARS WITHOUT DRIVER ON THE ROAD



IAV GmbH's Chemnitz / Stollberg site specializes in the development of highly automated assistance systems and the implementation of field tests. The engineering services provider has already tested a number of experimental vehicles with great success under regular traffic conditions - for example, on the federal expressway A4 between Chemnitz and Dresden. The Chemnitz researchers share this experience in Saxon pilot projects:

The focus of the Leipzig-based ABSOLUT project is on the development of highly automated vehicles and their use on a municipal test track. The initiative "Synchronized Mobility 2023" unites a total of 40 partners in Saxony under its roof and will establish, for example, several test corridors for networked urban mobility in Dresden.



WHEN VEHICLES "REALLY" TALK TO ONE ANOTHER

... then the communications engineers have taken the decisive step towards realizing the vision of autonomous driving. Sensors cannot see what is behind the curve; passenger cars need to be able to communicate with one another and with traffic control systems. This calls for technologies that can transmit large data volumes in real time. The researchers at Dresden University of Technology's "5G Lab Germany" are leaders in this field. Together with such industrial partners as Nokia, Deutsche Telekom, Ericsson, Bosch, Telemotive as well as BMW and Volkswagen, they are working on the mobile communication standard of the future.

KEEPING AN EYE ON EVERYTHING EVEN IN THE DENSEST URBAN TRAFFIC

Ok – (semi-)autonomous driving on federal expressways works already. In other words, in well-structured environments in which there are only white lines and no persons or traffic lights at all. But in dense urban traffic with many interactors, vehicle localization is often impaired which, in turn, hinders the navigation. Right here, the Chemnitz-based start-up NAVENTIK comes into play: The company, a spin-off of Chemnitz University of Technology, has developed a software for the precise environmental recognition of vehicles in urban areas. This software identifies sources of interference and error, analyzes them, and compensates them. In addition, the software also permits the use of other sensor data from the car to determine the location. It is, thus, possible to localize a position even if the direct signal from the satellites is interrupted. The result: With NAVENTIK software, autonomous vehicles keep an eye on everything in urban traffic.





"AUTOLAND SAXONY" MEETS "SILICON SAXONY"

A vibrant automotive venue and Europe's largest microelectronics / ICT cluster - a powerful team heading for the automobile future.





SMART, SMARTER, **SAXONY!**

If manufacturing experts want to know how to design the "smart" production of tomorrow, then they'll find pioneering answers in Saxony: For example, at the Fraunhofer IWU institute's "Research Factory Resource-Efficient Production" in Chemnitz. Technological developments for the conservation of resources in production, for the emissionneutral factory, and for human-machine collaboration are being tested here together with such industrial partners as VW. In the "Industrial IoT Testbed" at the Dresden University of Applied Sciences, entrepreneurs can test how they can transfer their production into a highly automated, flexible, and integrated one. The Dresden start-up Wandelbots GmbH develops solutions which make the interaction-based "programming" of industrial robots as easy as can be.

PORSCHE - LEIPZIG PLANT 5.0

50 % of all the Porsche vehicles bear the label of origin "Made in Saxony:" In addition to the sports sedan Panamera, Porsche's bestseller, the compact SUV Macan, is also produced in Leipzig. Since its founding 19 years ago, the Porsche Leipzig Plant has been one of the most modern and most sustainable automobile factories on the entire globe – with a high degree of automation. In so doing, the about 4,300 employees truly pursue the principle of a "lean" factory: A flexible work organization, a logistics concept with a maximum materials lead time of one day as well as a high assembling complexity. In March 2019, Porsche launched what is already the fifth expansion stage in Leipzig – on its way towards a plant for all-electric vehicles. Yet for the sports car manufacturer, Saxony is more than just a production venue. With an eye on the potentials of digitalization and on the development and testing of innovative driver assistance systems, Porsche cooperates in research and education with such universities in Saxony as Chemnitz University of Technology or the Zwickau University of Applied Sciences. In addition, Porsche supports the SpinLab Leipzig, the start-up incubator of the HHL Leipzig Graduate School of Management.



SOLUTIONS FOR SMART PRODUCTION

With a 200-year tradition, Saxony is the cradle of German machine construction. And today, it is home to efficient and successful partners in automation.





Well, now do you believe that "Autoland Saxony" is roaring into the future?

Late at night, as Felix is reviewing his journey through "Autoland Saxony," he sees Jenny's smile in his mind again. "Now I know why you're staying here," Felix says quietly, "with all these bright prospects!" Tomorrow he'll visit her - at her place of work in VW's Zwickau Factory...

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SAXONY!

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AUTOLAND SAXONY



26.2%

share of Saxony's industrial turnover



35.8%

780

SUPPLIERS

share of Saxon industry's foreign sales

95,000 employees in Saxony's automobile industry



of whom more than **80%** work in the supply industry





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