

**Automotive
Special**

Topics

Digitalization and
Remote Learning

Electric and Hybrid
Vehicles

Driver Assistance
Systems and
Autonomous Driving

„Even if the changes in road traffic in the coming years seem rather minor to us, the long-term effects of digitalization will probably exceed our current conceptions.“

Dr. Thomas Schwarz

Head of Government Affairs Berlin at Audi AG
and Lecturer in ADAS at HTW Berlin



Rolf Lucas-Nülle

Strong concepts for new challenges in automotive engineering

„A lot has happened since we told you about this special edition of our customer magazine in February. The digitalization of education and training was one of the topics we talked about most during this period. There have been some changes, a great deal of investment, and quite a few people who have finally woken up from their analog slumber. But at the end, what remains of all the excited activity that was generated around distance learning and the Home Lab during this period?

We at Lucas-Nülle are certain that this largely depends on the quality of the concepts behind individual initiatives: good decisions can only be made by someone who knows where they want to go. That is why this edition of our magazine opens with an interview with our Managing Director, Andreas Hart, in which he explains what we understand by „concept-based digitalization“ and clarifies how Lucas-Nülle can support you on this journey thanks to our wealth of experience in digital education. We also present two of our customers' successful concepts. You can read about how Robert Bosch GmbH in Schwieberdingen and the HWK Trier chamber of trades and crafts have responded masterfully to the crisis.

The mobility restrictions have hit the automotive industry harder than many other sectors. Nevertheless, the two main topics in this special edition - hybrid and electric vehicles and autonomous driving - continue to be the megatrends defining the future of the industry. In both areas, we are happy to show you how you can use digital training solutions to keep pace with the latest developments. The following pages provide a detailed insight into our hands-on, practice-oriented approaches to hybrid and electric vehicles as well as driver assistance systems. You can also find out how the Volkswagen Bildungsinstitut training centre in Zwickau is using our solutions to shape the biggest training initiative in the company's history.

I am particularly pleased to present our new solution for commercial vehicles. I am delighted that teachers, trainers and lecturers in the field of commercial vehicle mechatronics will now join us in shaping the digitally interconnected and electric future of vehicles. I would also like to draw your attention to our interviews with Dr Thomas Schwarz of Audi AG and Graham Allen from the UK-based IMI. They provide fascinating insights into the future of autonomous driving as well as international electric vehicle training and qualifications. I wish you every success with your training and hope you enjoy reading this special edition. Most importantly - stay healthy!“

Rolf Lucas-Nülle

Special Edition Automotive Special 2020

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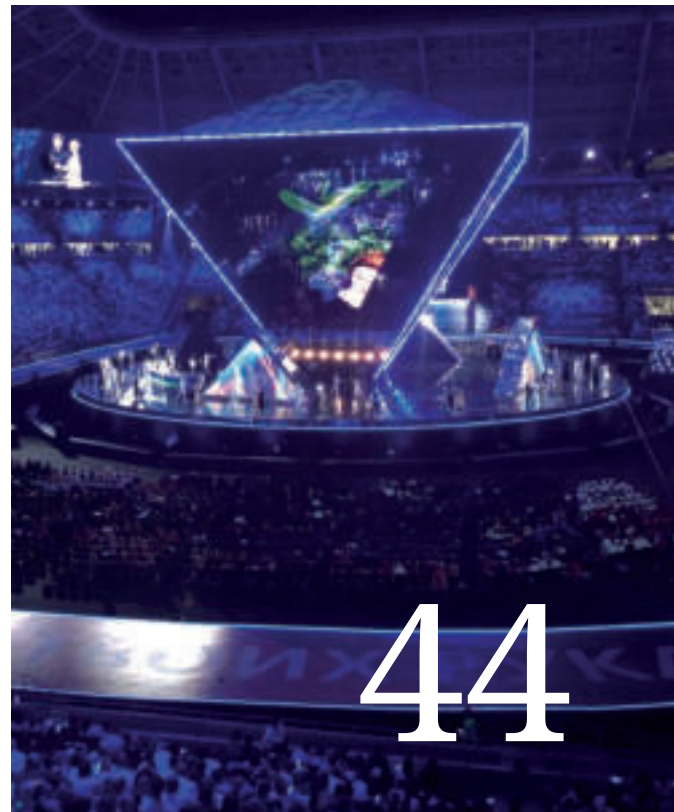
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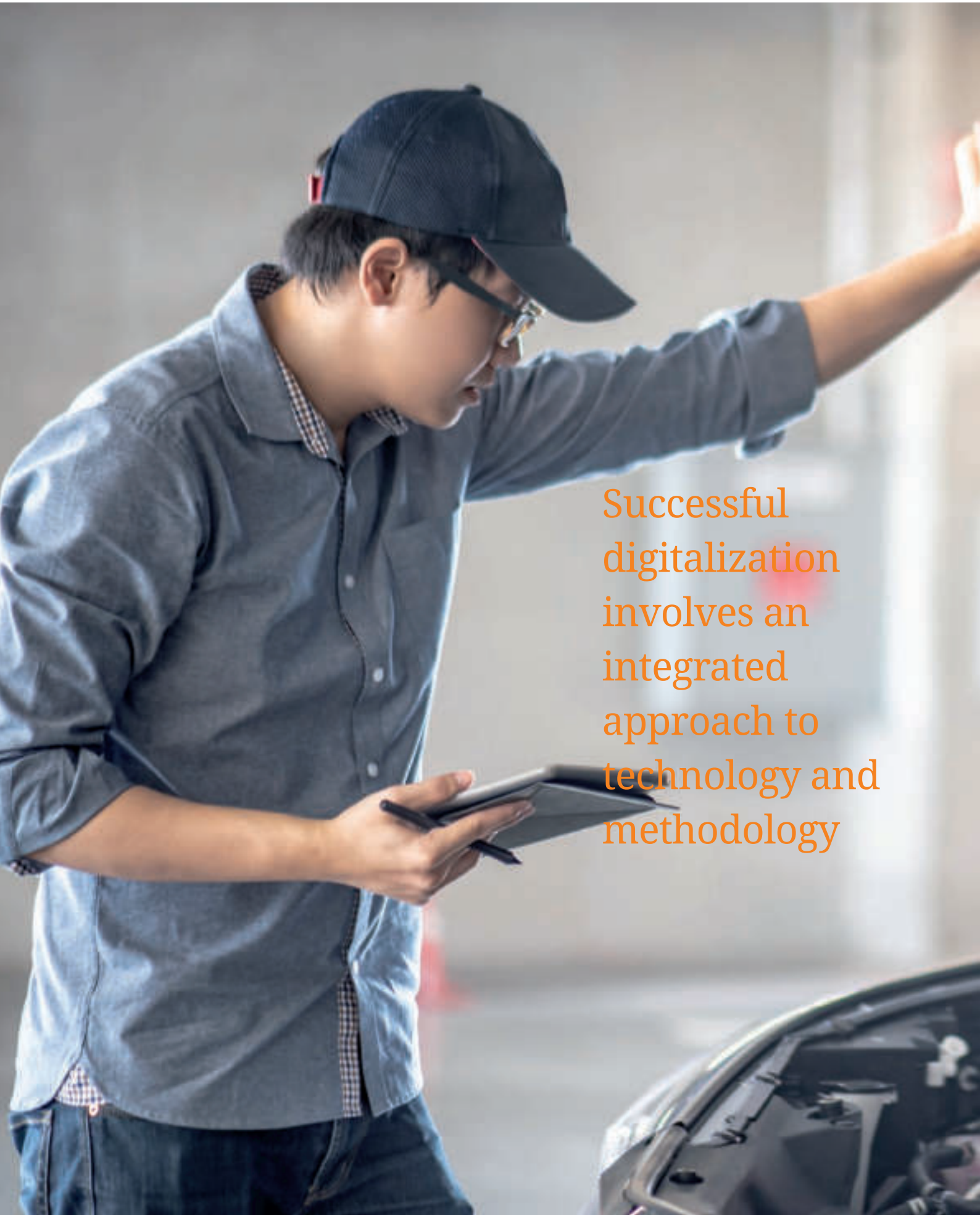
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WorldSkills, EuroSkills, SkillsUSA
Always glad to be there



Successful
digitalization
involves an
integrated
approach to
technology and
methodology



Interview with Andreas Hart, Managing Director of Lucas-Nülle GmbH

Hello Mr Hart, you have said that Lucas-Nülle is the go-to company for digitalization concepts in vocational education and training. What does Lucas-Nülle base this claim on?

„Many years of experience. Not only do we offer digital learning solutions based on state-of-the-art technology; we also support our customers by strengthening the teachers', trainers' and instructors' digital skills. And that applies to all technical occupations as well as all academic levels.

Our big advantage is that we have always seen ourselves as a specialist in educational and training concepts. It was 20 years ago that we launched UniTrain, the world's first digital experimentation platform for technical occupations on the education market, thereby blazing the trail in software-based methods of conveying basic knowledge.

The system digitally integrated classic theoretical exercises and practically relevant experiments for the first time. Back then, most customers frankly didn't yet see any added value in software-supported courses for trainers and teachers or trainees and students. You could almost guarantee that you would be asked for the good old printed lab equipment manual of the 90s.

But it was often while working with the new LN systems that our customers really became interested in the digital possibilities.“

Can you say what the reason for this increasing acceptance was?

„In the first few years, many customers approached us with inquiries about further training. While working with the digital courses, they had come across functions and possibilities that sparked their interest. Our task then was to give the teachers, trainers and lecturers training in our digital solutions. The aim of this training was, and still is, to maximize the effectiveness of the digitalized training systems by using the appropriate methods. These inquiries and requests quickly led to the development of a training programme that now forms an essential part of the successful implementation of our projects, in any country.

Only in this way can we succeed in applying digital concepts effectively in the classroom or laboratory. Acceptance thus ultimately came via further training in digital topics.“

And how have Lucas-Nülle's solutions evolved?

„The numerous discussions we had about our digital solutions during these training sessions served as an ideal opportunity for our further development. This learning process gave rise to two software solutions in the shape of the interactive LabSoft course programme - along with the LabSoft Classroom Manager - and the VOCANTO e-learning platform. Today, these tools give our customers the full range of digital training and learning possibilities for the classroom and laboratory. For years, Lucas-Nülle has used manuals only in exceptional cases where there is a good reason. We can now refer with pride to country-specific and very successful digitalization initiatives based on our educational and training ideas for technical occupations.“

So if practice shows that digitalization, in principle, isn't rocket science, what are the reasons for some of the failings?

„This learning process, which we went through with many of our customers, was neglected for a long time overall. Especially Germany failed to pay enough attention to digital training of teachers, trainers and instructors in the public and private sectors. Digitally supported teaching simply requires these key people in the knowledge dissemination process to have additional skills, regardless of age. It has become a hot topic now. But even today, teacher training in this area is still making slow progress. On the other hand, our projects around the world show a



tremendous willingness on the part of many institutions to embrace digitalization.

There's an easy explanation for this: **When talking to our customers, the focus is always on the added value of digitally interconnected teaching of technology, in other words the question of the specific know-how that is being taught.**

This leads to much higher acceptance because the need is recognized as such and, consequently, our solutions are implemented very quickly. In Germany, unfortunately, digitalization is all too often discussed as an end in itself. The question of „why“ is given inadequate attention in too many cases.“

So why do we need digitalization?

„I think the answer is obvious. Digital lessons offer far more opportunities to impart knowledge in an effective way. The aim of digitalization is to integrate and interconnect teaching in all phases of the learning process and in all its settings, thereby making it more effective. We therefore need to talk more about concrete ways in which to achieve this from a methodological point of view rather than about banalities such as W-LAN and WhatsApp.“

More specifically, what skills does this require from teachers and trainers?

„The best way to answer that is with the feedback from customers: Working together, we start by improving the skills that are necessary to implement the use of digital technologies in the learning process.

We therefore recommend starting with efficient train-the-trainer programmes straight after installation. This conceptional phase before the actual teaching begins is a key learning process for all the stakeholders. This applies to the education sector as a whole, from the education ministries to the school administration to the teachers and trainers on the ground.

Of course, our training also provides concrete skills for instructing, learning together and self-regulated learning. That brings us to the core competence of the teaching staff: lesson planning. In terms of content, that has to remain a matter for the individual teacher. But in terms of methodology, our systems provide them with a powerful set of digital tools.“



What exactly about this is more than just old methodological wine in new bottles?

„The fundamental added value is the element of individuality. Digital methods are much more precise. This allows the teacher to shift the focus of the teaching process much more to the individual student’s learning process. And, after all, giving each student the best possible learning experience ought to be the goal of any teacher or trainer. Let’s take the classic example of technical vocational training: here the use of blended learning methods is particularly important. It is only by combining and integrating theoretical and practical measures in the laboratory that we can accommodate the aforementioned individual teaching and learning processes. One trainee may be lacking practical application-related knowledge while another needs to get a better understanding of basic theory.

The appropriate learning software allows this to be better understood. As a result, lessons can be controlled much more precisely in accordance with individual learning progress. But software and digitally interconnected training systems are essential for this. And it is precisely this combination that Lucas-Nülle offers as a complete solution.“

You have made it clear why Lucas-Nülle is able to offer the necessary foundation for a digitalization concept. In conclusion, could we touch on how this relates explicitly to automotive technology?

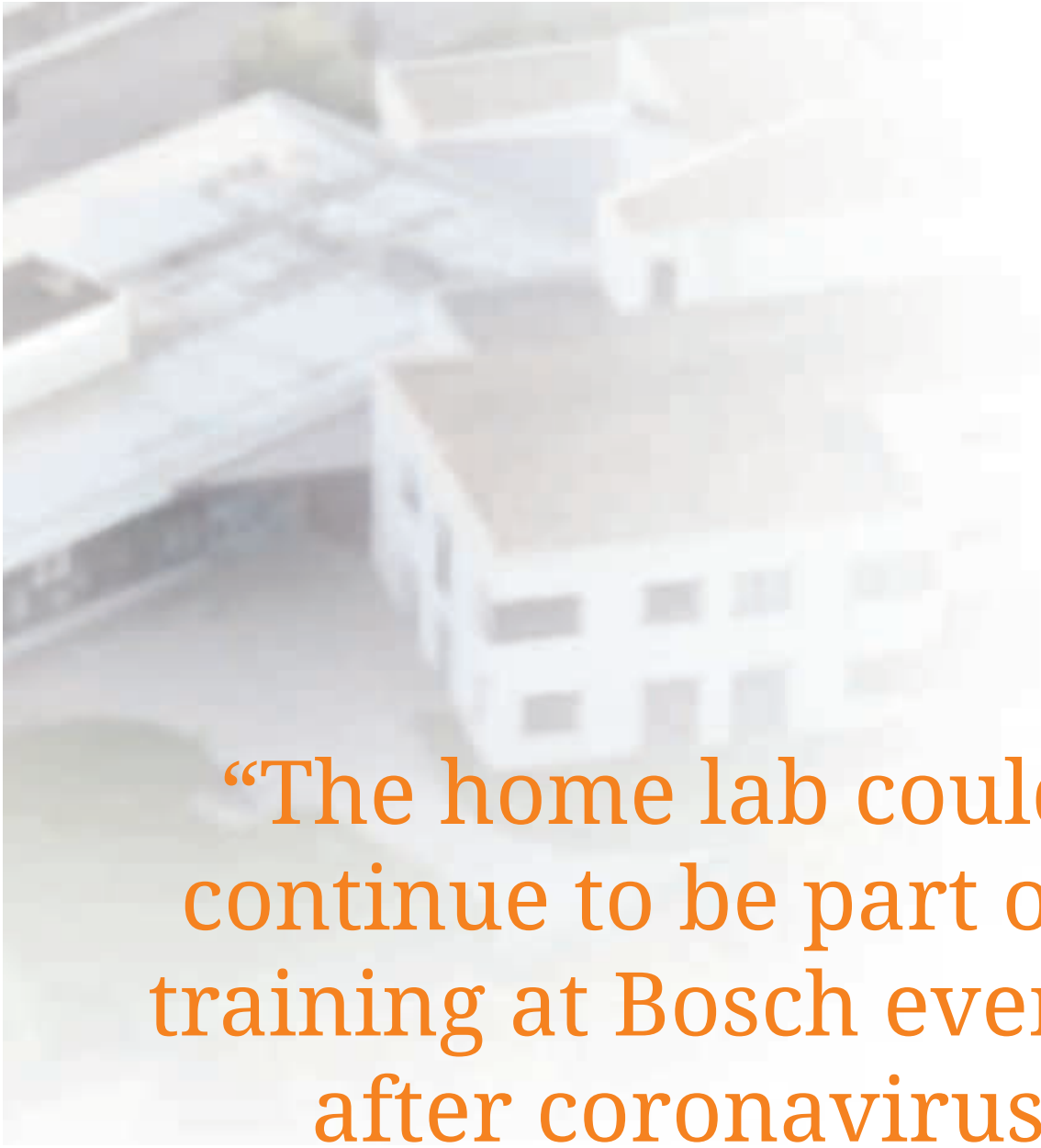
„Electric vehicles, digital interconnectedness and driver assistance mean that the automotive sector is now facing an unprecedented transformation. All over the world, automotive trainers are facing the challenge of making rapid changes in their training workshops while at the same time ensuring the necessary level of technological sophistication.

Thanks to our close cooperation with vehicle manufacturers going back many years, we at Lucas-Nülle are able to offer our customers complete solutions for training in the areas of hybrid and electric vehicles, digitally interconnected systems and, increasingly, driver assistance systems.

In other words, the Lucas-Nülle systems allow our customers to teach these subject areas using the blended learning approach described above, optimally combining theory and practice. The example of our British partner from the IMI - the Institute of the Motor Industry - shows that we are even able to equip an institute to offer internationally recognized qualification standards.

Thank you very much for the interview. Do you have any final practical advice that you would like to offer our customers who are facing the aforementioned challenge?

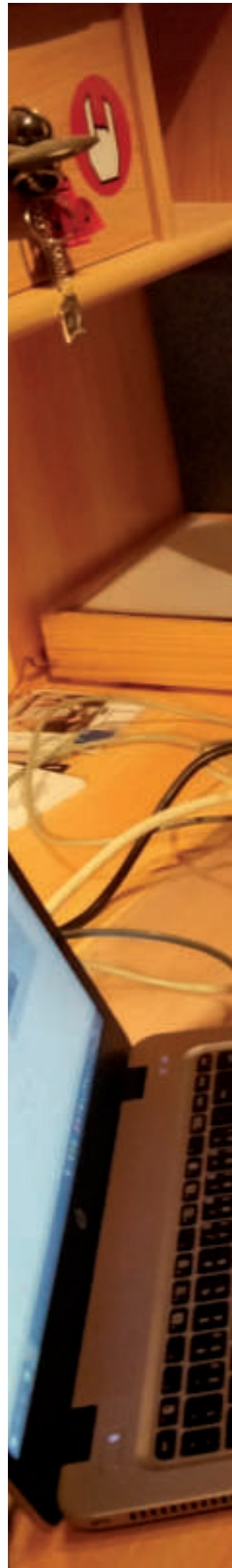
„Of course, just get in touch with us. We have the capability to put together a complete automotive training facility, from planning through to the first lesson, while at same time making sure that everything is state-of-the-art in terms of technology and methodology. In any case, our automotive customers now increasingly regard themselves as winners thanks to Lucas-Nülle’s digital training technologies. This also applies specifically to the current crisis, because remote learning does not rule out the use of the practical laboratories. They just have to be fully digitalized. At laboratory level, Lucas-Nülle has come through the distance learning stress test very well with its users worldwide. I think that speaks for itself.“ **LN**



“The home lab could continue to be part of training at Bosch even after coronavirus”

Learning from home while still covering the practical element: the trainers at Robert Bosch GmbH in Schwieberdingen achieved this balancing act in spring. When the measures to contain the Covid19 pandemic were at their strictest, they let their mechatronics trainees take the training systems home with them.

We spoke to trainer Andreas Geiger, deputy training manager Robert Köhler and students Rieke Miesterfeldt, Emil Schäuffele and Tobias Wölfler about their “home lab” experience.→







Robert Köhler
Deputy Head of Vocational Training
Bosch Schwieberdingen

Lucas-Nülle: *In the past, we have occasionally emphasized the fact that our UniTrain systems can be easily stored and transported thanks to the convenient cases they come with. Admittedly, however, we never seriously followed up the idea of using our systems ‘in living rooms’. Coronavirus has reshuffled the cards in this respect too. It was in April that we first heard about your plans to let Bosch trainees in Schwieberdingen take the systems home with them. That made us sit up and take notice. How did this decision work out back then?*

Robert Köhler: “As everyone will recall, events came thick and fast in those weeks. When it became clear that we would have to send the trainees home for an indeterminate period of time, we didn’t want to be frozen into inaction. So we decided to venture into new territory by letting the trainees take the Lucas-Nülle training systems home with them. However, for the first time, this required our trainees to have VPN access. But our efforts were supported by both the works council and the youth representatives, so internal implementation was a straightforward matter. All the trainees needed was a stable internet connection at home. All in all, that wasn’t a major problem either.”

Lucas-Nülle: *It sounds like implementation went well?*

Andreas Geiger: “Absolutely. The trainees had already become acquainted with the training systems at the factory and knew how to connect them up and use them. Of course, we only have a limited number of systems available, so organizing their distribution among the individual learning groups was a slight challenge in logistical terms. But we managed to deal with that as well.”

Lucas-Nülle: *Aside from the technical aspects of implementation, how were the lessons structured from a methodological point of view?*

Andreas Geiger: “Of course, even with the training systems, a purely distance-learning format entails a loss of possibilities. Normally, our teaching is based on a mix of theory modules, self-learning phases and project units, some of which are long-term in nature. These projects allow the trainees to apply their newly acquired skills. Unfortunately, we had to dispense with this part altogether – or rather, we had to make it up later. But the systems did provide an effective learning platform for carrying out the different measurement exercises. That part went smoothly, which was very satisfying. Communication took place via Skype. That also worked fine, but of course there’s no comparison with the ‘real thing’ in person. It was harder to answer questions.”

What do the trainees think about it? Do you agree with Mr Geiger?



Andreas Geiger
Trainer
Bosch Schwieberdingen



Emil Schäuffele



Tobias Wölfler



Rieke Miesterfeldt

Tobias Wölfler: “Yeah, it worked well. In the end, we managed to locate all the faults and resolve any technical problems with the hardware. But communication is more laborious and it takes longer than when you have the trainer next to you.”

Emil Schäuffele: “But I also found there was a positive aspect to it. For my part, I noticed that, more often than usual, it made me think twice before asking a question. To some extent, this even allowed me to remember things better. All in all, though, the concept was very easy to implement at home. The fact that there was practical content as well made learning at home more interesting and varied. I found it a positive experience.”

Lucas-Nülle: *Would you repeat the home lab experience?*

Rieke Miesterfeldt: “Under these circumstances, it was a very good solution. But I do think the real lab has a lot of important advantages. Direct face-to-face communication is irreplaceable. So the answer is yes, but only if the circumstances demand it.”

Lucas-Nülle: *And what do the trainers say?*

Andreas Geiger: “I would even go a step further. I can imagine making such phases an integral part of the training plan. Like Emil just said, we noticed that it fosters independence and strengthens other facets compared with face-to-face teaching. Another important aspect is that it requires us, as trainers, to be prepared to explore new avenues. But it is also clear that it can only be a supplement to the existing methods.”

Lucas-Nülle: *It sounds like this period of distance learning certainly made a lasting impression?*

Andreas Geiger: “It certainly did on me. We have been used to classic face-to-face training for many years. Not being able to see things changes the situation completely.

Like I said, the trainees are required to be more proactive, plus you make much greater use of the possibilities offered by technology, which we talk about so often. Looking back, I view it as an enrichment and definitely not as a necessary evil.”

Lucas-Nülle: *One of the reasons why use of the systems in the home lab worked so well is that your lessons rely substantially on Lucas-Nülle’s training software. What does this involve exactly?*

Andreas Geiger: “LabSoft is a core component of our lessons. Let’s take the semiconductor course as an example. We have adapted the existing content to ensure that the trainees first see the schedule for the whole week in which they are working on this topic. If they have to work with content or software outside the program, the LabSoft course also provides them with the necessary links and references. We have also added our own circuit diagrams and adapted the design for Bosch. Another important detail is that we write a short unit for each course, placing the topic in the overall context of training in the automotive industry. At the moment, we are supplementing our own knowledge tests for exams, which we also use for grading. The program offers us many possibilities, and we like to make use of them.”

Lucas-Nülle: *Finally, a quick glance into the future: the proportion of electrical and electronic components in motor vehicles is currently increasing at a faster rate than ever. How are you responding to this development?*

Andreas Geiger: “We decided early on to use training systems that allow these components to be experienced outside the vehicles. We have a wealth of experience in this area which will stand us in good stead. Our approach to future developments will be the same. At the same time, we will remain open and flexible when it comes to new methods.” **IN**

A digital transformation with a strong focus on practical training

A lack of options is not really the problem for inter-company automotive training courses provided by the HWK Trier chamber of trades and crafts. The brand-new training and technology centre (BTZ) provides master training instructors excellent conditions for successful digitalization. The equipment in the automotive training workshop is also state-of-the-art.



Sebastian Hilges is training instructor for automotive technology at HWK Trier since 2018.



New digital opportunities

Trainees can now use the engine testers from their PC workstations to access real-time measurements from the training vehicles in the next room.

Sebastian Hilges is standing in front of a large TV screen and discussing the measurement results of one trainee with the course participants – digitally networked and also fully Covid-compliant is the way the courses at the vocational training and technology centre (BTZ) are run by the HWK Trier chamber of trades and crafts. Hilges has been a master training instructor for automotive technology here since 2018. In that short time a lot has changed, and that is because starting last year the training centre relocated into a brand-new modern building.

In addition to that, the Chamber also invested in training equipment for the automotive training workshop choosing training systems from Lucas-Nülle for their success.

“Hands-on practice was the decisive criterion for the planning of our new equipment”, explains Hilges. In addition to basic UniTrain courses, the instructors also have eight digitally networked training vehicles at their disposal for the study courses. That is why all training participants can work with the systems

simultaneously. Arriving on the scene last was the digitally networked, latest generation of the modular CAN Bus training panels.

Thanks to this combination of digitalized training systems and a modern building infrastructure, the potential teaching power for Hilges and his associates has vastly improved. For example, the trainees can now use the engine tester from their PC workstation to be able to obtain real-time measurement values from the training vehicle in the next room. The preliminary work is carried out by the master training instructor together with the whole group using two widescreen TV displays. He also likes using split-screen to observe the live action taking place in the practical experiment in the next room. Everyone can monitor this individually and in detail at their own PC workstation.

A step forward also in terms of method

“Of course, the digital transformation which we have undertaken in training and education also includes our methodology.” Highlights Sebastian Hilges adding: “We

have also put a huge emphasis on this subject too with a focus on hands-on practice and skills.”

In order to go from talk to action, he and his colleagues decided to use the basic educational and training concept of the Lucas-Nülle systems for a host of topics. Accordingly, trainees are now learning, for example, the fundamentals of communication via CAN-Bus by doing practical experiments with the corresponding UniTrain course. After two days, their training proceeds on the seminar wall panels where they implement the control of the Xenon headlamps via Can-bus or via Lin-bus. At the end of the training week they then switch over to the digitally networked training vehicle, where they complete the transition from basics to actual hands-on applications of networked systems on a real car.

“The transparency of the systems, for example, between the high-volt trainer and the lighting systems training panel walls, was the argument in favour of Lucas-Nülle”, says Hilges in confirmation and adds: “Naturally, for us instructors the introduction of these systems took time to adjust to initially.” Previously he and his colleagues had to

think up fault simulations and then integrate them into the training themselves

“Now it is me that has to become familiar prior to the courses with all the diagnostic options made available by the systems”, reports the master trainer and adds with a grin: “But if too many options is my reason for complaining, then I probably really can’t complain.”

Asked about the impact of Covid-19 restrictions on the training, the master trainer shows himself to be a pragmatist and says: “Actually Covid-19 only forced us to implement our existing concepts even faster. You could even say it played into our hands.”

And that the concepts were a success can be shown by the real-life results: apart from the initial lockdown phase the courses in automotive technology at the training and technology centre of HWK Trier continued almost without interruption.
IN



Easy access to electric vehicles in training

Practical work on real electric vehicles can only be the last stage of training.



This is recognized by automotive trainers and lecturers around the world. While training on real vehicles with internal combustion engines can, in part, be done safely on the vehicle itself, the situation with electric vehicles is completely different. After all, the consequences of using high-voltage technology incorrectly can actually, and very quickly, prove dangerous to life.



The upshot is clear: instructors, teachers, trainers and lecturers have to break with the practice of working on real vehicles. They should instead use specially developed training vehicles and, in particular, teach high-voltage content with the aid of training systems. The trainees and students are only ready to work on real vehicles once they have demonstrated the necessary level of competence.

Lucas-Nülle has developed an effective and practically relevant concept for precisely this process - from the basics to full competence. This gives teachers a way around the dangers of high voltage and enables them to give their trainees and students access to electric vehicles in a very simple way. Effective training in hybrid and electric vehicles can thus be implemented in next to no time.



FROM THE BASICS TO HANDS-ON WORKING WITH THE CARTRAIN „HYBRID AND ELECTRIC VEHICLES“ SYSTEM

The perfect synergy between practical relevance, high safety levels and multimedia-based theory in combination with diagnostic exercises. The CarTrain Hybrid and Electric Vehicles system lets trainees and students work directly on a real HV system that does not require any previous training thanks to its special protective system. This enables trainers, teachers and lecturers to create a safe working environment, allowing students to focus on their work. All of the system's content is based on the training regulations and Level 1 and 2 of the DGUV 200-005 rules.

Another outstanding advantage is that this system combines five different drive types. Where training centres normally require five different high-voltage vehicles, this system now covers the requirement on its own.

A serial hybrid system can be changed to a parallel hybrid system, or an all-electric vehicle to a fuel cell drive, in a flash.

The corresponding e-learning system allows teachers to provide all the important theoretical content. For each chapter, the trainees and students work through numerous practical assignments and knowledge questions. The integrated diagnostic system and the specially chosen fault scenarios help develop the required level of competence to work on real vehicles. The CarTrain Hybrid and Electric Vehicles system offers the necessary level of safety when trainees and students are carrying out various diagnostic strategies and measurements on the HV system with real HV voltage.

TRAINEES AND STUDENTS MUST ALSO BE PREPARED FOR WORKING DIRECTLY IN THE HV BATTERY SYSTEM.

The subject of safety becomes

even more tricky when it comes to providing system and high-voltage technicians with the skills for working on - or in - a high-voltage battery. However, the CarTrain „Diagnosis and Maintenance of a High Voltage Battery“ system enables trainees and students to attain these learning objectives in a safe and practice-oriented way as well. The system focuses on the digitally interconnected CAN-bus battery management system in the traction battery with the corresponding components, and specifically provides training in measuring and operational testing of live HV components. The trainees and students carry out practical and live exercises involving battery cell measurements and diagnostics. The HV battery is designed in such a way that it can be taken apart to replace individual cells and sensors. This allows learners to tackle the HV battery in a practical and hands-on manner.



Our concept in detail



NUMEROUS BASIC COURSES ON THE FUNDAMENTALS OF ELECTRIC DRIVES

Without an electric motor, even the best high-voltage system is useless. Lucas-Nülle offers the right concept here, too, allowing work to be carried out on this key component during lessons. Our eight-piece set for taking electric drive motor measurements features various modules for electric motor diagnostics. Numerous measuring and switching exercises facilitate familiarization with the system and attainment of the necessary level of competence.

Our basic electrical courses on DC/AC conversion or DC/DC up- and down-conversion provide a view, as it were, inside the electrical systems. Follow-on basic courses also allow trainees to familiarize themselves closely with the battery disconnect unit, the 48-volt system, the interlock (pilot line) or the hybrid drive by carrying out measuring exercises. Further modules deal specifically with fuel cells and

photovoltaics. Then there is also a UniTrain course in how to work safely on a high-voltage system. Trainees doing this course learn to assess the first potential hazards of high-voltage technology.

Finally, for electric drives too, the digitally interconnected training vehicles represent the last stage of Lucas-Nülle's practice-oriented approach. They allow trainers, teachers and lecturers to demonstrate, in a real vehicle setting, the topics that were covered safely in the training system. **IN**



Up to speed with digital transformation: Volkswagen's training centre in Zwickau

Volkswagen has a mission: it wants electric vehicles to be affordable for everyone. That is why the group is currently in the midst of a development process that will see it become the leading supplier of electric vehicles. Training is a key component of this transformation. The company is intensively preparing its employees for new production methods and jobs linked to increasing digitalization and electrification – as manifested, for example, in the new “modular e-drive” vehicle architecture or the increasing automation in the manufacturing process.→

A yellow Volkswagen ID.4 SUV is shown from a low-angle, rear-quarter perspective, driving on a road. In the background, a large suspension bridge spans the frame, and a city skyline is visible under a bright, cloudy sky. The scene is bathed in warm, golden light, suggesting sunrise or sunset. The car is in motion, as indicated by the blurred background and the motion blur on the wheels.

Biggest training offensive in Volkswagen's history

The Zwickau site is playing a pioneering role in the transformation of Volkswagen's global production network and is currently in the process of becoming the largest and most efficient electric car plant in Europe. The last combustion engine model rolled off the production line here in July 2020. Now the plant is producing the ID.4 – the first all-electric Volkswagen SUV.

Consequently, in order to facilitate this process, the Volkswagen Bildungsinstitut (VWBI) training centre in Zwickau has launched the biggest training and qualification offensive in the group's history. At the site in Saxony, over 8,000 employees have been, and are being, prepared for the changes that are necessary to switch from internal combustion engines to an all-electric drive system. "Our aim is to provide all our employees with the best possible training that will enable them to produce large numbers of top-quality electric cars," explains Dr Holger Naduschewski, Managing Director of the Volkswagen Bildungsinstitut training centre.

The instructors and trainers have spent a long time preparing for the mammoth task that this transition represents. The training centre has boosted its personnel capacity, particularly in high-voltage and automation technology. The company has also invested heavily in new technology, IT and robotic systems in Zwickau. "We are working with around 90 training partners to cover the different training segments and source the best experts as trainers in each segment. The challenge is an enormous one. Over a short period of time, we are providing training of the highest standard covering over 300 topic areas," says Dr Naduschewski.

Training centre working with Lucas-Nülle to develop solutions for key area

One of the key tasks of this training offensive is to prepare the employees for high-voltage technology. So far, some 1,000 employees and trainees from the automotive industry and its suppliers have received special high-voltage training.

This training takes up to 52 days and leads to one of three certificates that meet trade association requirements: certified electrically competent person (gEFK) or certified electrically competent person for specified activities (EfftT). In addition, other employees at the plant are receiving high-voltage awareness training.

The training centre is the only regional training and testing provider authorized by the IHK (Chamber of Commerce) to train, test and certify electrically competent persons. The trainers also offer specially modified high-voltage training modules and qualifications to meet specific customer requirements. Another important aspect is that the VW training centre also offers an extensive range of special courses for the police, fire, rescue and recovery services to enable them to deal with emergencies involving hybrid and electric vehicles in the proper way and thereby save lives without endangering themselves or others.





“Lucas-Nülle GmbH and the VWBI training centre have been reliable partners for over 15 years. Over this period, both companies have profited from this cooperative partnership, especially in automotive technology, and harnessed synergies to develop effective training systems,” says Remo Dietrich, Head of the Automotive Technology Occupational Area at VWBI.

Particularly in the area of high-voltage technology, which is so important at the present time, the instructors and trainers in Zwickau work intensively with the Lucas-Nülle training systems. For the various HV qualification programmes, the trainers make use of, among other things, an automotive electrics exercise board, a high-voltage and air conditioning training board and a high-voltage battery diagnosis and repair board, as well as the CarTrain “High-Voltage and Air Conditioning Training System”. This innovative training portfolio is rounded off by digital web-based

learning programmes which the participants can continue to use after successful course completion.

“We even plan to intensify our cooperation in the future, particularly in the area of high-voltage technology,” says Remo Dietrich, looking ahead. He goes on to add: ***“Discussions in this regard have already begun and we look forward to continuing to shape the provision of state-of-the-art training of specialists for the electric vehicle industry together with Lucas-Nülle.”***



„With the right qualifications, electric vehicle training is possible worldwide.“

The Institute of the Motor Industry (IMI) offers training institutes around the world internationally recognized qualifications.

As IMI's Partnership Manager, Graham Allan is in contact with automotive institutes around the world. We spoke with him about the challenges of electric vehicles for training centers and asked how they can meet this development.



Lucas-Nülle: Hello Graham, what is your impression of the importance of EVs at international training centers?

Graham Allan: „It’s true, we work with automotive instructors around the world in a variety of fields, from national manufacturers’ academies to local universities. Some have been involved with EVs from the very beginning, others are just getting started. This is very diverse. However, one thing unites all training centers: We hardly ever encounter reservations about electric vehicles. Technical progress makes training more varied and the high-voltage system is undeniably the most significant change our industry has ever experienced. As a result, we meet trainers who are passionate about training both the current and the next generation. For this reason alone, I am very optimistic that we will also succeed in qualifying for electric vehicles. The committed inquiries that we and Lucas-Nülle regularly receive from all over the world speak for themselves. Nevertheless, it is an enormous task and we are using our experience to tackle it.

Lucas-Nülle: What are the biggest challenges for academies and universities in qualifying trainers for electric vehicles?

„In terms of training resources, the various institutes have very different levels. However, there is one important common challenge: The safety of trainees and students during training on electric vehicles poses problems for most customers. The operating voltage of an electric or hybrid vehicle can simply be lethal if not handled properly. In some countries, the lack of a recognized training standard for electric vehicles is another challenge.

Lucas-Nülle: How does IMI help to answer this challenge?

„When it comes to safety, the solution we have developed together with Lucas-Nülle is unrivalled. On a „real“ car, you can never completely rule out the risk of such lethal voltages. But when you work with Lucas-Nülle CarTrain systems, this risk simply does not exist. If, on the other hand, national educational standards are lacking, then we as IMI can work with training providers, industry representatives and government education departments to establish IMI qualifications as a nationally recognized solution. Together we can offer a solution for every problem“.

Lucas-Nülle: IMI is the organization with the most experience and expertise in the field of international motor vehicle qualification. Can you tell us more about the qualifications that IMI covers?

„That can be answered quickly because the IMI covers all topics relevant to the motor vehicle. Our qualification for electric and hybrid vehicles is now in its third generation and was developed in cooperation with the world’s leading OEMs. Recently, this electric vehicle qualification also includes commercial vehicles. And, as already mentioned, qualifications are also available for all other automotive topics: Be it maintenance and repair of construction machinery and motorcycles, be it accident repairs and customer service or be it vehicle sales. We are a full-service provider for automotive training“.

Lucas-Nülle: The certification market is huge and almost beyond comprehension. Why is the IMI offer more relevant than others?

„We have built up a strong network over many years, which has a name and from which our members benefit. Our experience is unique in the industry and has enabled us to develop relevant solutions for governments, OEMs and educational institutions. More than 600 IMI-approved centers and strong partners in 35 countries now qualify 110,000 automotive technicians each year worldwide. From a global perspective, IMI therefore plays an important role in qualifying a sufficient number of competent specialists. No other institute is in a position to implement new technologies at training centers around the world as we are able to. The principle is simple: Whoever is an IMI member meets the highest standards for the international automotive industry. That is what we work for“.

Lucas-Nülle: Our developers have tailored our hardware and courses specifically to the IMI qualifications. How do you experience this collaboration?

„Our partnership enables both parties to take their respective solutions to the next level. Individually, both have been successful in global markets, but together we offer a true one-stop solution. The cooperation with Lucas-Nülle is the only one of its kind for IMI. In the field of electric vehicles, Lucas-Nülle is simply the only supplier whose equipment is able to meet our requirements for high-voltage training. That is how we came together. It is currently exciting to see how we complement each other in terms of our markets. Thanks to the LN systems, we were able to certify centers in Ecuador and Iceland for the first time. In both countries we are now working on establishing our EV qualifications as a national standard. The partnership has also helped us to consolidate the Chinese market. China is undoubtedly the largest market for electric vehicles and our HV qualification is now standard there. In addition, in the short time we have been working together, we have already been able to initiate promising discussions with academies in India, South Africa, Australia and the Middle East.”

Lucas-Nülle: What do IMI members who have already gained experience with Lucas-Nülle equipment say about this new form of education? Does it help them to deliver the qualifications?

„Without doubt, the cooperation has helped our approved centers to deliver IMI EV qualifications safely and effectively. High voltage presents the institutes with a variety of practical hurdles. But the Lucas-Nülle training systems have always provided an answer. Examples? A prestigious British sports car manufacturer has told us that it is not even possible for manufacturers’ academies to train on real vehicles. The super sports cars are far too expensive for that. In the past, if a modern vehicle was able to be used for training, someone had to invest a lot of time in dismantling body parts before the relevant technologies were available. And then there was still the risk of damaging the vehicle. Another global manufacturer told us that the high-voltage isolation plug cannot simply be removed and replaced with the frequency required for training. There, too, the realization has grown that training on real HV vehicles is unrealistic. Apart from the manufacturers, I can think of dozens of responses from different colleges. The trainers there are really enthusiastic about the possibility of finally being able to conduct real high-voltage training safely. Colleges usually work with larger groups. In contrast to a real vehicle, the LN equipment allows all course participants to be fully exposed to the high voltage. And the practical experience leads to better training success. Last but not least, many trainers are delighted that Lucas-Nülle is making the subject comprehensible in the training rooms away from the workshop“.

Lucas-Nülle: Is there any cooperation beyond electric vehicles and high-voltage technology?

„I see great potential there, yes. We have started our joint journey with electric vehicles very purposefully and have thus, for the first time, created a complete, global solution for the most important technological progress in our industry in education. But a much greater revolution is already looming on the horizon: Autonomous vehicles and networked road traffic. In the future, vehicles will no longer function on their own, but only in their networked environment. It is obvious that this spatial networking will also require a completely different infrastructure for training workshops. Maintenance and repair must be taught using an equally innovative educational approach. Here we are holding very exciting discussions with each other, which will expand our partnership. Right now we are just scratching the surface of our possibilities“.

So a cooperation for the brave new world of tomorrow?

„Not only, we offer more than just dreams of the future and answers to change. The technological revolution may be advancing rapidly, but traditional vehicles with combustion engines are alive and kicking and will continue to be so for a long time to come on international roads. For this reason, we are working on coordinating the Lucas-Nülle training systems and the IMI qualification in these areas as well. Whatever your thoughts on the future of the automotive industry, you can be sure that our partnership will provide you with a training solution that will help you along the way“.

Thank you for the interview, how would you summarize your message?

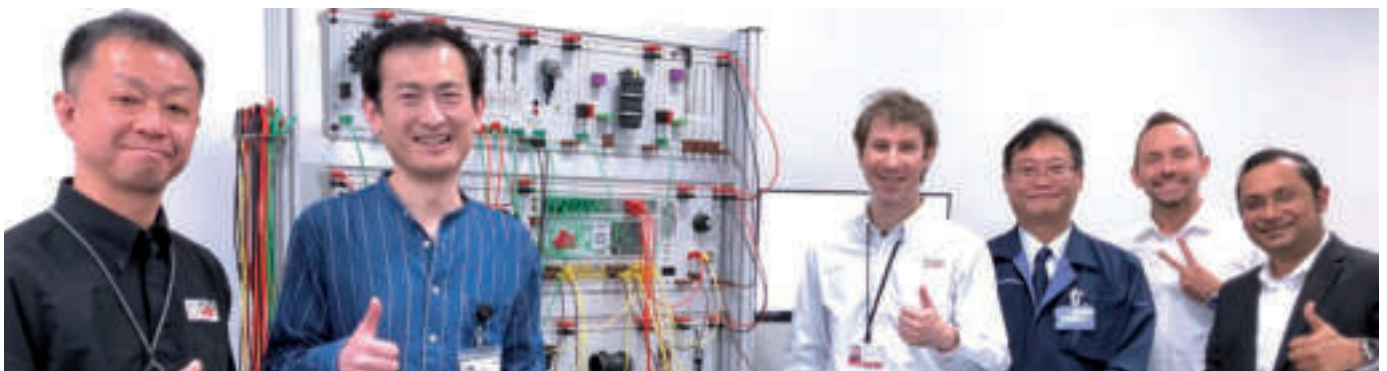
„With the right qualifications, electric vehicle and motor vehicle training is successful worldwide. I am optimistic that we can create a bright future for our automotive sector; populated by highly skilled and professional workers. If you are facing a specific challenge, simply contact IMI or your contact person at Lucas-Nülle. Together we will find a suitable solution!“.

About IMI:

The Institute of the Motor Industry (IMI) was founded in 1920. Similar to today, the automotive world was then undergoing a technological change. At that time, the IMI was intended to strengthen confidence in the young British automotive industry by ensuring that mechanics were qualified. Since then, the institute has accompanied all innovations related to the automobile and has responded to every change with training programs for employees in the industry.

Today, IMI works with automotive training centers around the world. Institutes certified by the IMI meet the highest training standards in the automotive industry. Obtaining an IMI qualification at one of these centers opens up numerous career paths for automotive minded people. A place on the IMI professional register is a strong argument for any employer looking for skilled workers.

Mitsubishi Fuso lays the foundation for electric commercial vehicles in the eLab



Over 2200 days of classroom training for 8,500 participants took place in 2019 at FUSO Academy. The central goal of the academy is to enable autonomous learning anytime and anywhere. And so, the number of participants in the e-learning courses, at 41,000, far exceeds the number of in-person attendance days. Using its own Learning Management System (LMS) „FUSO Horizon,“ the academy has been making its core business more flexible for several years now: providing training for the dealers and employees in the Mitsubishi Fuso network.

Traditionally, FUSO Academy's retail training courses consist of face-to-face training and workshops in the five Japanese and six international training centers. They have already partially digitized the traditional F2F offering through various online-based channels and expanded it to include interactive eLearning, virtual webinars, training videos, and other communication channels. Electric transportation is now driving this change even further in the area of hands-on training. Mitsubishi Fuso prepares dealers and workshops for electric vehicles in the eLab.

The commercial vehicle manufacturer is convinced that electric vehicles are the future of the industry and has underlined this by introducing the „eCanter“ model. With its all-electric light duty truck, Mitsubishi Fuso is now the market leader in this segment in key regions such as the EU and Japan. The vibration-free, low-noise and easy-to-drive truck is winning over more and more believers. Commercial vehicle owners convinced of the advantages of electric mobility. FUSO Academy has therefore developed a training program especially for the eCanter and equipped its own



With its eCanter model, the Mitsubishi Fuso Truck and Bus Corporation (MFTBC, in short: Mitsubishi Fuso) is the leader in the production of all-electric light duty trucks. The commercial vehicle manufacturer intends to remain at the forefront of developments in electric mobility in the future. With the so-called FUSO Academy, the Daimler Trucks subsidiary has commissioned their retail-training department to establish an effective learning culture within the company. FUSO Academy is playing a decisive role in shaping the transition to electric vehicles.



us,” explains e-mobility trainer Eric Weisser, explaining how the collaboration between Fuso and Lucas-Nülle came about. „We then met with Lucas-Nülle at our FUSO headquarters in Japan and together we developed a plan for equipping the eLab“.

„I gained my first experience with the LN equipment during the installation and setup of the new eLab,“ reports Weisser. In several training sessions, he and his colleagues were given an overview of the possibilities of the training systems and how to use them digitally with LabSoft.

„We greatly appreciated this

supportive customer service, and we are enthusiastic about the various methods we can now use to conduct EV training in a completely safe environment.“

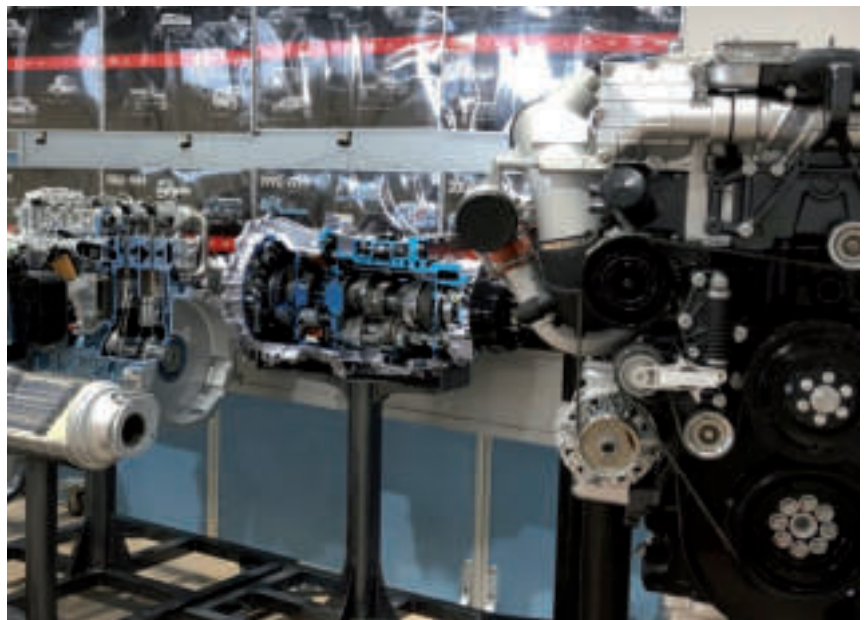
In the future, the company’s electric vehicle training will be expanded even further. In the next step, the eLab will now be integrated into the digitalized learning world of „FUSO Horizon“.

„The fact that Lucas-Nülle is providing the learning content for each training module digitally helps us a great deal in this respect,“ reports Weisser and explains: „We will use it as a comprehensive resource that we can further tailor to our specific vehicle-related needs.“

“eLab”: This facility features electric vehicle training courses that are intended to qualify employees and dealers in the field of high-voltage safety, and to train them in the maintenance and troubleshooting of electric vehicles. Moreover, FUSO Academy’s efforts also prepare the company for more electric vehicles developed by Mitsubishi Fuso.

In the eLab, FUSO Academy uses the training systems from Lucas-Nülle.

„Our international training manager was able to gain experience with the Lucas-Nülle concept for electro-mobility at Daimler Trucks and expressly recommended the equipment to





„Lucas-Nülle offers us a well-designed and complete software and hardware package for this purpose. We now want to further expand the use of the equipment.“

Eric Weisser, EV specialist

In addition, FUSO Academy uses the software's networking capabilities to manage the support of the training participants as well as the exams.

With the CarTrain for electric vehicles, trainers can also teach other core topics of the electric vehicle such as motor control, voltage and frequency conversion or, of course, high-voltage safety.

„It's a wonderful added value that we can now safely measure the HV insulation resistance and practice the shutdown procedure before we move on to the actual electric vehicle in the workshop,“ says Weisser and underlines: „We therefore integrated the LN equipment into our Smart Workshop concept and are thinking about implementing it in all our FUSO Academy training centers“.

Although the current situation has slowed FUSO Academy's efforts in this regard, the training provider does of course have an answer to this crisis. In order to provide strong support for its business partners, FUSO Academy has adapted both the classroom training courses with appropriate concepts and, above all, significantly increased the scope of online offerings. **LN**

A didactic hybrid and electric concept . . .

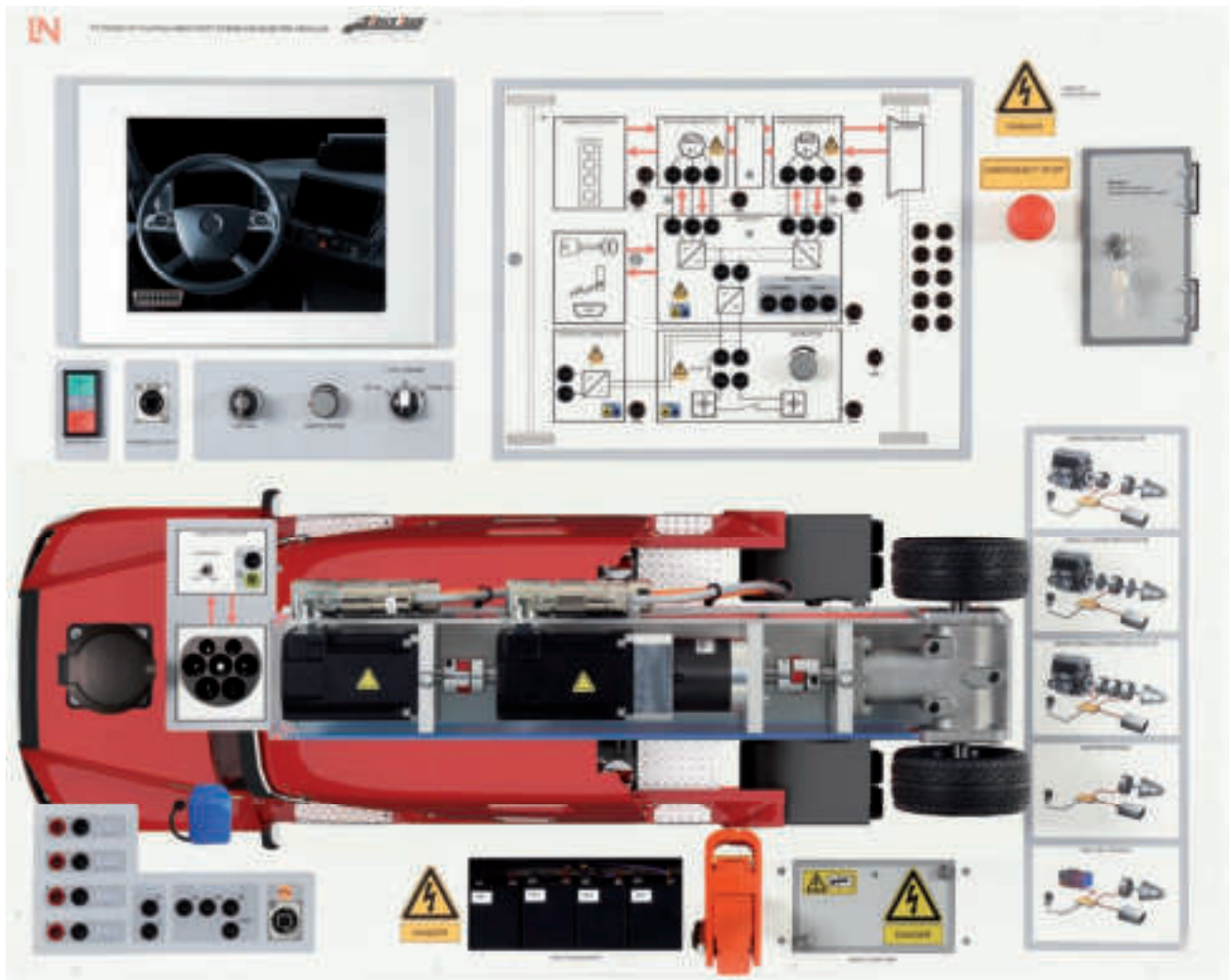


Electric and hybrid is the future for commercial vehicles as well. Electric commercial vehicles are evolving all the time. And just like in other sectors, the following applies: it is only possible to keep pace with the transition to electricity, if you also keep up to speed with developments in the training of skilled workers. German federal association LandBauTechnik, for example, has also understood this and therefore implemented a digital and electronic transformation of training content for agricultural and construction machinery technicians.

... for training mechatronics specialists for commercial vehicles



This development shows, on the one hand, that the subject of high-voltage systems is also becoming increasingly important in intrinsically safe commercial vehicles and in agricultural and construction machinery technology. On the other hand, information and communication technologies are also playing an increasingly important role. Digital process engineering techniques such as „Smart Farming“ or „Digital Farming“ encompass the use of driverless vehicles, robots and drones, and future commercial vehicle technicians need to be trained for this as well.



Lucas-Nülle's multimedia training systems deliver the answer to these new instruction plans and provide the link between industry and training. In the area of hybrid and electric vehicles, almost all the leading motor vehicle manufacturers now use Lucas-Nülle's training systems in their vocational and advanced training (CPD). The new TruckTrain systems mean that blended learning - combining hands-on, practical relevance, safety, diagnostic tasks and e-learning - is now also available to commercial vehicle technicians.

WITH SAFETY: THE BLENDED LEARNING SYSTEMS PUT HIGH VOLTAGE AT YOUR FINGER TIPS.

The TruckTrain systems allow trainees to work directly on a real HV system without the need for prior training thanks to a special protection feature. This ensures a safe working environment that allows the trainees to concentrate on their work. The TruckTrain „Hybrid and Electric Vehicles“ system takes Level 1 and 2 of DGUV 200-005 as its guide but goes further in terms of content. The integrated diagnostics system in particular, as well

as the specially chosen fault scenarios, help trainees gain an understanding of a high-voltage system. The training system enables trainees to carry out various diagnostics strategies and measurements on a real HV system with real HV voltages under the strictest safety conditions. The TruckTrain „Diagnosis and Maintenance of a High Voltage Battery“ system focuses specifically on the digitally interconnected CAN bus battery management system in the traction battery and the associated components. In electric vehicles, the HV battery has the greatest hazard potential - especially when carrying out repairs. This demands a special understanding of the system, without which it is not possible to work in the proper way. The TruckTrain system makes it possible to practise measuring and functional testing of live high-voltage components. The trainees carry out measurements and diagnostics on live battery cells. The didactically designed HV battery can even be taken apart to replace individual cells and sensors. This facilitates practically orientated and hands-on diagnostics and maintenance of the HV battery.

DIGITAL INTERCONNECTEDNESS: THE TRUCKTRAIN ISO

BUS ALSO COVERS PRECISION FARMING

Communication between the control devices in a tractor is complex. The J1939 bus is used here, in addition to the familiar systems that are also used for the motor vehicle, such as CAN or LIN bus. Trainee agricultural and construction machinery mechatronics technicians use the TruckTrain ISO bus to learn how the different protocols are combined using this special bus system and how the ISO bus can, in turn, communicate with implements from any manufacturer. The TruckTrain system is based on original components used in real life such as an Incab or Isobus socket or a universal terminal. This allows the trainees to perform real measurements on the different bus systems, diagnose typical fault patterns or learn how the relays for the implement's power supply work.

Another aspect is that the GPS system is covered by this TruckTrain system as well, which means that Precision Farming also forms part of the learning content. The system clearly shows how this process of site-differentiated

and targeted cultivation of agriculturally productive land works. In the e-learning module, the trainee first learns about job preparation on the farm PC and, for example, deals with the preparation of map data or the programming of field cultivation with GPS. After that, the course deals in detail with data transfer between the farm system and the tractor.

Besides the TruckTrain systems, many other Lucas-Nülle systems are available to commercial vehicle technicians, which ideally cover the learning content found in their training. The topics range from basic courses to networked systems such as the CAN bus through to practically relevant experiments in vehicle hydraulics and electrohydraulics. **IN**



The TruckTrain system allows trainees to practise measuring and functional testing of live high-voltage components.

The trainees carry out measurements and diagnostics of live battery cells.



Driver assistance systems and
their significance for training
and CPD



„Even if the changes in road traffic in the coming years seem rather minor to us, the long-term effects of digitalization will probably exceed our current conceptions.“

Dr Thomas Schwarz
Head of Government Affairs Berlin at Audi AG and Lecturer in ADAS at HTW Berlin

In certain situations, when drivers would rather not drive themselves, the greatest possible convenience would of course be a fully autonomous vehicle.“

How far down the road to fully autonomous driving are we?

Thomas Schwarz: „The on-road pilot projects have been running for some time. These trials are currently still showing us the remaining challenges in terms of mastering the last one percent of difficult situations from a technical point of view. Practical testing supports the evolutionary development towards autonomy. However, it must always be accompanied by theoretical, simulation-based, testing. Aside from technology, though, it is the legal and social hurdles that are currently most pronounced. And the infrastructure also has to be adapted. But progress is being made in this area, as demonstrated by the example of Audi's „online traffic light info“ initiative. This makes it possible to increase driver convenience, enhance road safety and encourage an anticipatory and economical style of driving. This involves an algorithm predicting traffic light behaviour during the next two minutes. Since most lights react variably to the volume of traffic and adjust their intervals accordingly, different data sources are used to calculate predictions. Conversely, the city authorities can be provided with aggregated vehicle data to facilitate more efficient traffic light changes and therefore more free-flowing traffic.

Within what time frame could this development happen?

Thomas Schwarz: „The pace is certainly picking up and, according to Moore's Law, will continue to do so. One of the areas of emphasis is software development, which opens up further new functionalities based on existing hardware. If we look at the autonomy levels, the maximum level currently in use on the roads is Level 2 systems, which means that the driver is in charge all the time. We are on the verge of overcoming a big hurdle, namely the leap to Level 3. This will allow the driver to take a break from the driving task in certain situations and let the vehicle take over. And I believe that we will also see Level 4 during this decade, where vehicles can take over the driving task completely in specific cases.“

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The technology exists. Autonomous vehicles are already in use in industrial production, albeit in the low speed range, in demarcated areas and with trained personnel etc.

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And Level 5 on the roads?

Thomas Schwarz: „No-one can really tell. The average age of the fleet, in other words all vehicles registered in Germany, is increasing. The quicker the fleet is renewed, the quicker the development to autonomous driving. To try and answer your question, it might help to take a look at ‚Amara's Law‘. Roy

Amara postulated that we overestimate the effect of technical innovation in the short term while tending to underestimate it in the long term. In other words, even if the changes in road traffic in the coming years seem rather minor to us, the long-term effects will probably exceed our current conceptions. At the moment, we are witnessing this in the area of hybrid and electric vehicles as well. The initial euphoria was followed by a certain disillusionment. And today almost all decision-makers agree that electric cars will eventually make up the vast majority of private cars.“

Would you attribute a prominent role in this process to a certain DAS?

Thomas Schwarz: „Definitely not. Because this effect is not achieved by an individual system or a particular sensor, but by the combination of systems. So if anything has particular prominence, it's the software that makes up the digitally networked system as a whole rather than the individual driver assistance system. You could also pick out ESP as an ‚ambassador‘ of the systems. The real added value in terms of safety that this active safety system has achieved for road traffic is disarmingly convincing.“

One of the topics you cover in your lectures at HTW Berlin is ‚Driver assistance systems and integral safety‘. How do you teach the subject to your students?

Thomas Schwarz: „We talk about the individual electronic systems and how they work. And, of course, we talk about all the stages from sensors to automated driving. So, in short, about everything we just touched on in our discussion. Another important building block is the design of the human-machine interface. Because the interface, too, needs to be adapted in line with developments. Last but not least, my lectures also cover the aforementioned social, legal and infrastructural aspects.“

In other words, a broad overview of the whole subject area?

Thomas Schwarz: „Exactly. Unfortunately, one semester isn't enough to examine the development of each system in detail. Hopefully, I am able to convey the potential of driver assistance in road traffic to the students and they then follow this up and develop their own ideas of how to push forward development in this area.“

Do you have a central message?

Thomas Schwarz: „If anything, my hope is that lots of messages get across. Where safety is concerned, though, I never tire of stressing that the main cause of accidents is mostly the human factor. The greatest potential of the

systems therefore lies in driver assistance. And it is by using the technology as a means of support that we will ultimately achieve the other benefits mentioned at the start: increased efficiency and convenience.“

How much importance do you attach to training and CPD in relation to this process?

Thomas Schwarz: „I can only draw on my experience with Audi and VW here. For us, too, it's a challenge to train up our own specialists in our plants and in the garages. There has to be continuous development everywhere. We are therefore placing an increasing emphasis on training electronic skills, for example. In addition, Audi passes information from development on to the garages even before the market launch so that they can subsequently provide competent technical support for our vehicles. We also have many internal training programmes. For example, we use a VR application that permits testing of new driver assistance systems in real vehicles in the field. In short, yes, I consider training to be an absolutely crucial factor in terms of the practical implementation of this process.“

Can the students gain practical experience of the systems as well?

Thomas Schwarz: „At HTW, students have access to an Audi S5 equipped with a multitude of assistance systems allowing them to carry out tests and experiments. Unfortunately, I rarely have the time to be with the students when they are working there. But when I do get the opportunity, I have always noticed that there is great interest in the driver assistants. The newest ones are often installed in the premium segment, making them less readily available for many students.

Another consideration is that working with the systems in a real vehicle also requires a lot of space. Lucas-Nülle has therefore developed systems which allow students and trainees to gain practical experience of the driving assistants on a lab table. Do you think that this kind of simple practical application could also be of interest to students?

Thomas Schwarz: „Practical application is definitely important for students. If the hardware allows them to experience how the various sensors react differently in practice, they are then much better able to judge how successful networking of the systems can be achieved. And this networking of systems is, as I said, the crucial foundation of automation. Unfortunately, the limited financial resources of universities can sometimes be a stumbling block here. That is why direct cooperation with industry can be helpful.“

Finally, a question perhaps verging on the realm of utopia. If you were asked to outline a vision of road traffic in 10 or 20 years' time, what would it look like?

Thomas Schwarz: „My conception would be of a highly multi- and intermodal transport system in which we rely on different means of transportation much more frequently. And these means of transportation would be interlinked in a network in the most perfect way possible. Automated driving constitutes an important building block in this scenario, among other things because it makes local public transportation more efficient and affordable. I am convinced that different forms of transportation really will gain in importance at different times and for different purposes. And that is a good thing. Because it will make provision better overall and allow us to switch to environmentally friendly transportation more often. In the period of time in question, we will no doubt see some fully automated, driverless journeys. I am thinking of multi-storey car park systems for example. You get out of your car outside the car park and technology does the rest.

In complex situations such as inner-city traffic where there are many different road users who don't always follow the rules, technology still reaches its limits. And, by the way, the same can occasionally be said of people. But here, too, AI and machine learning will help in being able to represent human anticipation in a technical way - in other words, technology will surpass us one day.“ **IN**

At the same time, even in 20 years, I can't see fully autonomous Level 5 road traffic. We will probably have mixed traffic consisting of autonomous routes and vehicles being driven by people for a long time to come.



Driver assistance training:

An integrated concept from the
classroom to the garage



It is no longer a secret that the vehicle of the future is network-connected and capable of driving autonomously. The effects of this trend on training and study are particularly evident in the area of driver assistance systems. A vehicle that interacts with its environment can no longer be looked at in isolation in the workshop or garage by trainers and lecturers.

But how do you reproduce a fully interconnected road transport system in a training workshop or even a classroom? Digitalized training systems are essential to ensure that digitally connected vehicles can continue to be serviced and repaired in future.→

In recent years, Lucas-Nülle has put a portfolio of different UniTrain training systems for driver assistance as well as bus systems on the education market, which allow you to integrate the different topics into your classrooms and seminar rooms in a simple and modular way. There is even an LN solution for calibration on a real vehicle.

Below we give you an overview of the basic functions of different systems and explain how driver assistance systems can be calibrated in the classroom.

ACC – ADAPTIVE CRUISE CONTROL (UNITRAIN)

ACC systems greatly assist drivers and provide a significant safety advantage. While the system gets the vehicle to the desired speed, all the while regulating the selected distance, the emergency brake assistant warns when there is a risk of collision and, if necessary, brings the car to a complete halt. At the heart of the system is a radar sensor. The UniTrain course explains the mode of operation and control strategy of Adaptive Cruise Control (ACC) including the emergency brake assistant. In addition to showing how the system is set up and connected, the course also provides learners with detailed knowledge of the individual components that make up this driver assistance system. Calibrating the ACC system is an important skill for automotive mechatronics technicians. With Lucas-Nülle you can teach them this skill in a practically relevant way using an appropriate calibration panel in a handy A4 format. The trainees and students can optimally align the module at their own workstation using the adjustment screws on the ACC module.

LIDAR (UNITRAIN)

LIDAR (Light Detection and Ranging) systems improve a vehicle's ability to optically capture its surroundings and thus better identify objects and estimate distances. The new

technology therefore improves the performance of different driver assistance systems and serves as an important element in the transition to fully autonomous vehicles. Lucas-Nülle's didactic DAS on this subject is based on a real LIDAR module which has been adapted to give a largely open design that affords trainees and students unique insights into the design and workings of the system. In combination with the e-learning course, teachers and trainers convey how the LIDAR functions. The learners work on various fault scenarios independently in the e-learning module and perform calibration right there in the classroom using a calibration panel.

PARKING ASSISTANCE SYSTEM WITH REAR-VIEW CAMERA (UNITRAIN)

Parking spaces can be hard to come by, especially in cities. At the same time, big cars are more popular than ever. This inevitably leads to small parking spaces. Parking assistance systems are therefore very popular and come as standard in the majority of new vehicles. Even if new mobility concepts were to solve the parking problem, network-connected cameras will continue to be an important element of autonomous vehicles. Lucas-Nülle's UniTrain system brings a complete PDC with camera into the classroom. It enables teachers and trainers to provide

practical insights into the operation and diagnostics of a rear-view camera with parking assistance. Learners use the system to familiarize themselves with the system as a whole as well as with the mode of operation of its individual components. In doing so, they find out about the physical limitations of the assistance system and get to know diagnostic processes for a variety of problems.

TRAFFIC SIGN RECOGNITION WITH SPEED CONTROL (UNITRAIN)

Attentive observation facilitates anticipatory driving. Today this applies as much to the vehicle as to the driver. Modern vehicles thus control their speed by recognizing traffic signs themselves by means of cameras. The UniTrain system lets you bring a camera to the student's workstation that records the area in front of the vehicle. The system includes different traffic signs as well as software for monitoring the data on the PC. The e-learning module guides the trainees through the detailed process of putting a traffic sign recognition system complete with speed control into operation. The learners investigate the process of integrating the camera into the system as a whole, get to know the limitations of the system and conduct various practical tasks. And, of course, the system also provides them with the necessary diagnostic skills.



GESTURE CONTROL AND CAPACITIVE TOUCHSCREENS (UNITRAIN)

Vehicle operation, too, has a major influence on how well we cope with the driving task. In their search for the simplest possible intuitive operating controls, car manufacturers are increasingly relying on alternative methods of entering commands. Instead of haptically actuated switches and control knobs, modern vehicles are increasingly equipped with on-board touchscreens and voice control systems. The latest trend is gesture control. These are systems that respond without having to touch anything. Thus, for example, the tailgate can be opened with a foot movement. For modern automotive mechatronics technicians, diagnostic skills are essential for such operating concepts. UniTrain allows trainees and students to learn how capacitive sensors work and what their differences are in terms of operation. Another important aspect is getting to know the integrated gesture control system through practical experiments. In

numerous diagnostic assignments, the trainees develop a diagnostic strategy independently and isolate the malfunction.

ELECTRONIC STABILITY PROGRAM – ESP (UNITRAIN)

Modern braking systems have long been an essential part of our vehicles. The use of electronic aids such as ABS, TCS and ESP has significantly improved road safety by keeping the vehicle stable within the physical limits. The individual systems build on each other and use some of the same sensor signals. The UniTrain system lets trainees and students get to know the different systems' mode of operation and control processes. The training system makes the rapid processes visible to the human eye. Trainees and students can explore all the relevant driving situations in a practical manner by varying simulation parameters such as surface conditions, steering angle or braking force. The integrated fault simulator and various knowledge tests provide them with important diagnostic skills.

CALIBRATION ON A TRAINING VEHICLE: THE LINK TO REAL VEHICLES

In practice, calibrating driver assistance systems is the most important task in terms of diagnostics and repair in this area. The digitally connected LN training vehicles - equipped with front camera systems and radar where required - allow the trainees and students to apply the knowledge they acquired in the basic course. The equipment needed for this consists of a calibration system for camera and radar, the relevant diagnostics tester and other accessories. [LN](#)



The various skills championships also rely on the safety of the CarTrain system. Be it at SkillsUSA in 2019, the last WorldSkills in Kazan or during the most recent German Federal Automotive Skills Competition:

The participants always demonstrated their skills using Lucas-Nülle systems.



German Federal Skills Competition



The feedback from the organizers was unanimous: „At last we can reproduce electric vehicles safely in competition!“

WorldSkills competitions are always an event. We are already looking forward to many more to come.



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Safe high-voltage training for the emergency services

Hidden technology revealed:

A training system designed to raise awareness of high-voltage issues in road transport among the emergency services.



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