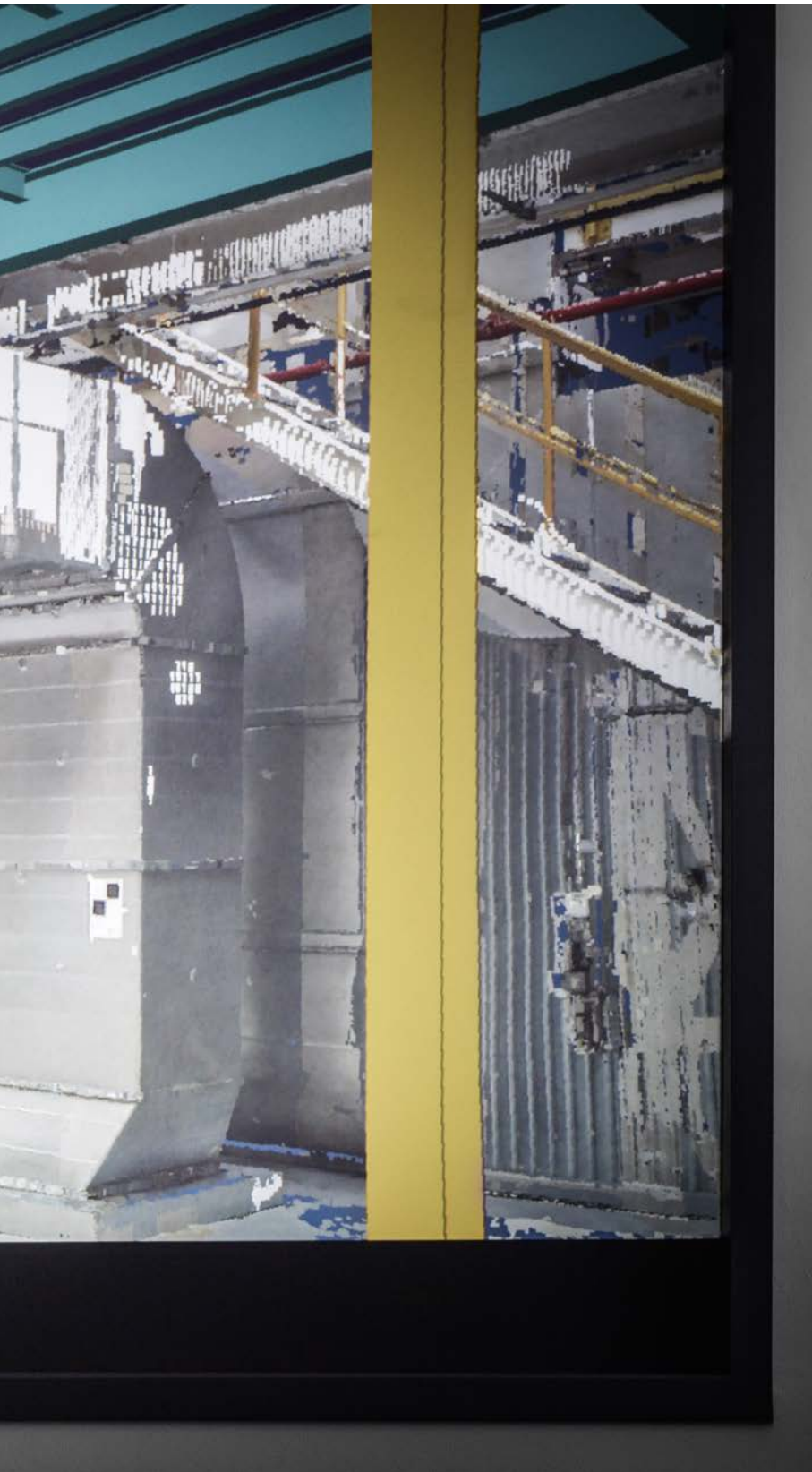




01
Just like the movies: Marc Altmann takes a tour through the virtual 3-D model of a paint shop.



SMART FACTORY

Smart factories, intelligent machines and a continuous exchange of huge amounts of data – the Industry 4.0 megatrend is taking hold in the business world. Dürr is well prepared and can build on its long-term experience.

Text: Heimo Fischer

Photos: Marcus Pietrek

A paint shop, soon to be established right in the middle of China, can already be viewed on a wall-sized screen in Bietigheim-Bissingen. With one click the viewer can put on his 3-D glasses and fly through a model of the plant, just like in the movies. Having passed control cabinets, descended into the dip tank and visited the robots in the spray booth, the viewer finishes his tour in the drying oven. As the image fades, he returns to the 'power wall' room at Dürr headquarters.

From here experts can look into every corner of the painting line. With the help of computer simulation they calculate the footprint, ensure there is enough space for all the parts, and move components from one place to another. This is made possible by merging the data of the planned painting line with the results of a highly accurate laser scan in the existing customer building. Much of what engineers once dealt with on site can now be completed in the office in front of a screen. A steel girder where there shouldn't be one, a ventilation shaft where the painting robot should be located? Marc Altmann has seen it all. "If we relied solely on the building plans we are given, we would have come unstuck many times." In the past, last-minute alterations had to be made on site, which wasted time and money, and was stressful. Nowadays the plant engineer can address these issues at the computer – with plenty of time to come up with a solution.

THE NEXT INDUSTRIAL REVOLUTION

Digitization is changing increasingly large areas of the production industry. Experts refer to the fourth industrial revolution, which follows on from previous stages ranging from the steam engine and the conveyor belt through to microelectronics. In the current era of Industry 4.0, factories are using state-of-the-art robot technology and highly optimized production processes, constantly generating and analyzing masses of data. According to consulting firm PwC, industrial companies are planning to invest an average of 3.3 percent of their annual sales revenues in Industry 4.0 solutions over the next few years. This corresponds to almost half of all equipment investments.

The automotive industry, in particular, has always imposed the most stringent demands on its suppliers. Painting is one of the most difficult processes in automotive construction: "Controlling this process correctly is a highly complex task", says Jürgen Jost, Head of R&D Paint Systems at Dürr. The organization of a painting line already has a lot to do with the world of Industry 4.0 and what it entails. "And this gives us a head start in terms of experience."

Each station of the painting process is controlled by its own software. This is monitored by a production control system, which continually evaluates all production data and ensures that the machines can work even better and faster while saving resources. Experts call it a "manufacturing execution system", or MES.

Dürr's MES software is known as **EcoEMOS**. Developed many years ago, it is now used in over 60 car factories worldwide. "Intelligent control systems will continue to grow in importance," says Ralf Schurer, Director R&D at Dürr. At the moment, **EcoEMOS** is used for controlling painting lines or other production stages in automotive plants. But its area of application is growing. In Volkswagen's new plant in Wrzèsnia, Poland, **EcoEMOS** will soon control the entire factory.

Last year Dürr acquired German company iTAC to expand into the emerging production control systems business. The Montabaur-based company is an up-and-coming manufacturer of MES software used in 150 factories around the world. iTAC software will be at the core of Dürr's solution and will facilitate further steps toward the Smart Factory, in which production and logistics systems will be increasingly self-organized. "For Industry 4.0 within the company, iTAC is our turbo", says Dürr CEO Ralf W. Dieter. Apart from collaborating on the further development of **EcoEMOS**, iTAC will also support the Dürr divisions in their Industry 4.0 activities. In addition, the company will continue its existing business with end customers in various industries, including reputable organizations such as Continental and Hella.

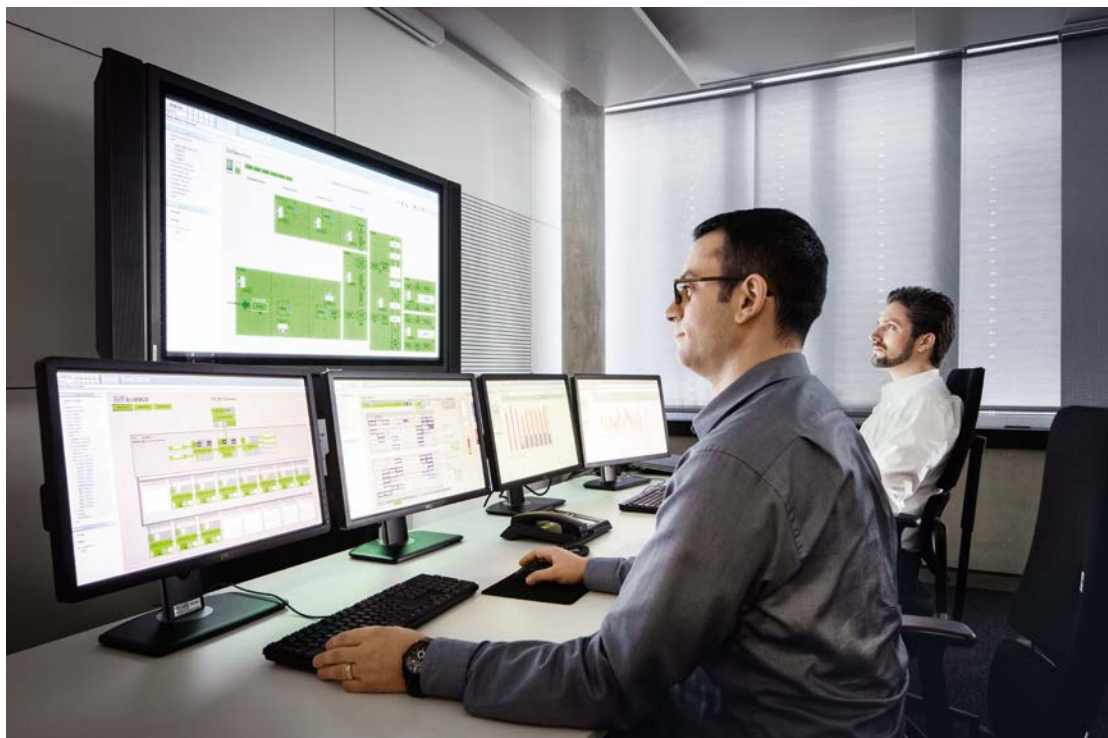
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To ensure our plan matches the space available on site when designing a paint shop, a laser scan is performed to determine the exact dimensions of the building. This soon adds up to 290 GB.

» For Industry 4.0 within the company, iTAC is our turbo. «

— RALF W. DIETER, CEO DÜRR AG

290 GB



02
 Manufacturing execution system in action: The software controls the different processes in a factory and ensures efficient production.

HAND IN HAND WITH THE ROBOT

Important building blocks of Industry 4.0 include not only process control but also intelligent products and new workflows, for example the concept of human-robot collaboration developed by Dürr. This is used in the tricky production stages currently only handled by people.

Glueing in fuel tanks in automotive production is one example of this. In the Dürr concept, the worker starts by cleaning the tank. Then the robot approaches and applies adhesive to a standard so high that no human could ever match. After that the worker accurately fixes the tank to the car body – a task he manages much better than the robot.

The worker is no longer separated from the machine by a safety fence, which used to be the case. The robot uses rounded components, operating slowly and always below

head and chest level. “There is no danger to the worker”, says Jens Häcker, Head of Product Development Control Systems at Dürr. In an emergency the machine, which is equipped with multiple sensors, comes to a standstill within milliseconds.

Intelligent products are designed to lower maintenance costs and prevent any unforeseen machine failures. Take, for example, the automatic dosing pump located in the arm of the Dürr painting robot. The sensor-controlled pressure system ensures that the dosing quantity remains consistent throughout the entire life span of the pump. In addition, the pump continuously monitors itself, with the result displayed via a traffic light system. A green light means: everything is ok. If the light is yellow, the system needs to be repaired. If the red light appears, the pump must be replaced immediately.

The service provided to customers can thus also be improved. One example is the **EcoPad** tablet PC, which is used to scan the QR codes affixed to Dürr machines and systems. Within seconds the customer receives information on operation, on potential sources of error, or the serial number.

The Dürr subsidiary HOMAG Group has used similar methods to enhance the cooperation between its service technicians and customers. Operators can use the scanned QR code to get in touch with the service team, for example by videoconference. They point the webcam at the relevant place, which can be seen by HOMAG Group experts at the other end of the line. This substantially reduces the need for on-site visits, which are time-consuming and pollute the environment. This method is particularly beneficial for customers who do not have their own service technicians.

A DATA CONNECTION ENABLES REMOTE MAINTENANCE

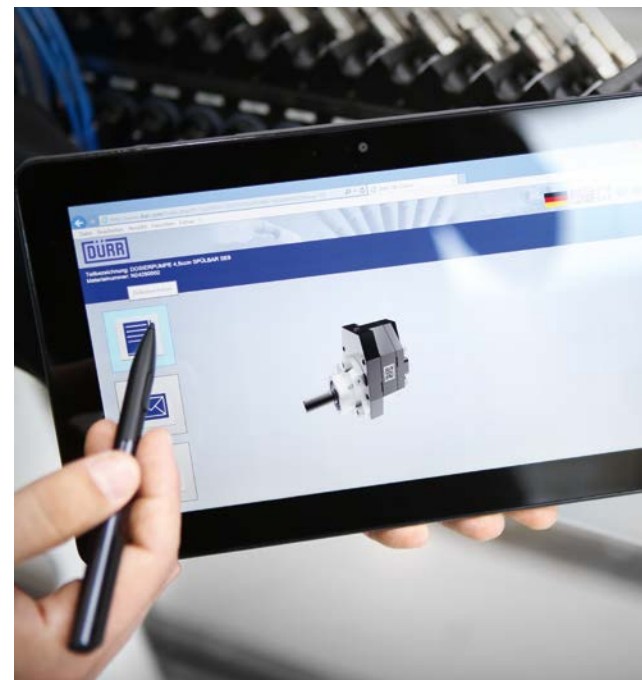
'Product life-cycle documentation' is another innovation at Dürr. Just like a medical file contains all previous ailments, diagnoses and treatments of a person, the machine documentation includes information on hours of operation, failures and maintenance – stored as huge data files. If the machine fails, a Dürr service technician can access the data on site via the Internet and find the fault using the available information.

So far, carmakers have been rather cautious when it comes to sharing production data from their factory's internal network. If sufficient information on the customer's production was available, the service provided would be even more customer friendly. This applies, for instance, to the wear and tear of parts, which depends not only on how long a machine has been running but also on room temperature, humidity and maintenance intervals. "Recording and evaluating this data systematically in many plants enables us to calculate how likely a machine is to fail at a certain time", says developer Jens Häcker. The IT systems would automatically gather information by comparing error patterns with empirical data.

If it is foreseeable that a wear part needs replacing, Dürr could have a replacement ready at a nearby site. Says Jürgen Jost: "The required part would then reach the customer as soon as he learns that he needs one."



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Photography allowed: A snapshot of a QR code is taken...

04
...and straightaway, the information on the machine is available.

20 million

In an average electronics production facility, MES software coordinates and checks data transfers between the machines and the central database 20 million times a day. The central database stores order and production data, information on material flow and much more.

The continuous automatic exchange of data will fundamentally change industrial production. Painting lines could be controlled, monitored or repaired remotely. "This would substantially reduce carmakers' efforts", says developer Ralf Schurer. Dürr experts could perform this task from a central location – perhaps in front of a large screen in Bietigheim-Bissingen.

