DIMENSIONS

THE RHEINMETALL MAGAZINE

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ARTIFICIAL INTELLIGENCE

NEURAL NETWORKS ARE REVOLUTIONISING THE WAY WE LIVE AND WORK. WHERE DOES EUROPE STAND IN THE RACE FOR TOMORROW'S WORLD?

RHEINMETALL

TRUSTWORTHY AI

Anyone who wants to be successful in the development of artificial intelligence (AI) needs powerful processors and lots of energy, data, and expertise. China and the USA are currently dominating the market. Europe wants to catch up in the global race. Important steps in this direction were taken at the Artificial Intelligence (AI) Action Summit held at the Grand Palais in Paris in February 2025: starting in 2026, five AI gigafactories are to be built across Europe. With over 100,000 AI chips per location, the planned infrastructure can be used by anyone. With this democratisation of computing power, the European Union wants to enable research and industry to develop complex AI models independently of the big tech companies. High-quality data is crucial for training these models, and European industry has more than enough of it. Brussels plans to create a single market for this purpose. The EU AI Act, the world's first AI law, sets the necessary framework. Can artificial intelligence be safe, inclusive, and trustworthy? Who else but Europe has the potential to prove it?

DEAR READERS,

The turning point of 2022 marked a profound caesura with Europe's security policy. The long-held belief that peace is a natural state and does not require deterrence proved to be an illusion. In the face of growing hybrid attacks by Russia on our infrastructure, in the Baltic Sea, within the Baltic states and also in Germany, this leaves us with only one conclusion: we Europeans are no longer living in peace.

The world is at stake. The Munich Security Conference in February revealed an epochal breaking with the past, a turning point 2.0: for decades, the Europeans relied on the United States as a protective power. Now Washington is shifting its strategic focus to the Indo-Pacific. Europe must take its security into its own hands.

The NATO summit in The Hague in June was correspondingly clear: Europe's defence spending is to rise to five percent of GDP. By 2030, European NATO countries will invest over one trillion Euros annually. But where and how? Wars cannot be solely won through drones. Without tanks and other mechanised units, it is impossible to break through front lines and capture territory. Those who have more powerful artillery than their opponents can halt advancing forces or destroy important supply facilities. Nevertheless, AI and unmanned systems have already changed warfare. In the future, success will depend on the networking of all these systems and making them interoperable. They must be able to be connected to an integrated IT infrastructure. That is the core of software-defined defence.

This issue focuses on how artificial intelligence is not only revolutionising defence, but is also shaping other areas of life. I hope you find this interesting. Enjoy reading.

Yours

Philipp v. Brandenstein
Head of Corporate Communications
Rheinmetall AG

ABOUT THE TITLE PAGE

Data nodes and connections in artificial neural networks imitate the functioning of the human brain, where billions of nerve cells communicate via trillions of synapses. The stronger the connections, the more precise the learning – whether machine-based or neurobiological. Our AI-generated cover image provides an insight into these hidden structures.

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My comrade, the AI
Whether in reconnaissance, logistics or combat: artificial intelligence is becoming a tactical factor – but humans remain the final authority.

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In conversation
"Why is artificial intelligence indispensable for defence, Mr Kappen?" The Chief Technology Officer of Rheinmetall provides answers in an interview with DIMENSIONS.

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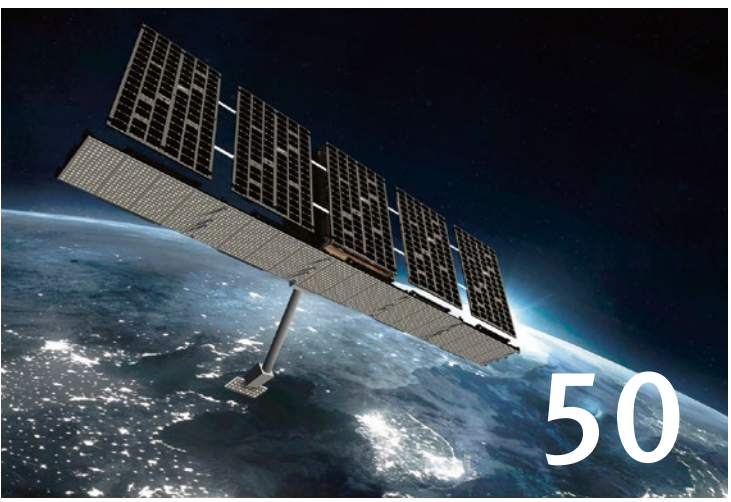
ARTIFICIAL INTELLIGENCE

Will self-learning computer programmes soon be able to think as well as their creators? On the opportunities and risks of machine learning and Europe's path to trustworthy AI. Pages 10 and 14



TRAIN LIKE PROFESSIONALS

On the initiative of Rheinmetall, 59 Ukrainian children and adolescents, accompanied by their carers from the German-Ukrainian association Blau-Gelbes Kreuz e. V., enjoyed a special day by visiting the BVB-Evonik Football Academy. Until the outbreak of the war, the girls and boys aged between 7 and 17 had all lived in Ukraine. After fleeing, they found a new home with their families in North Rhine-Westphalia.

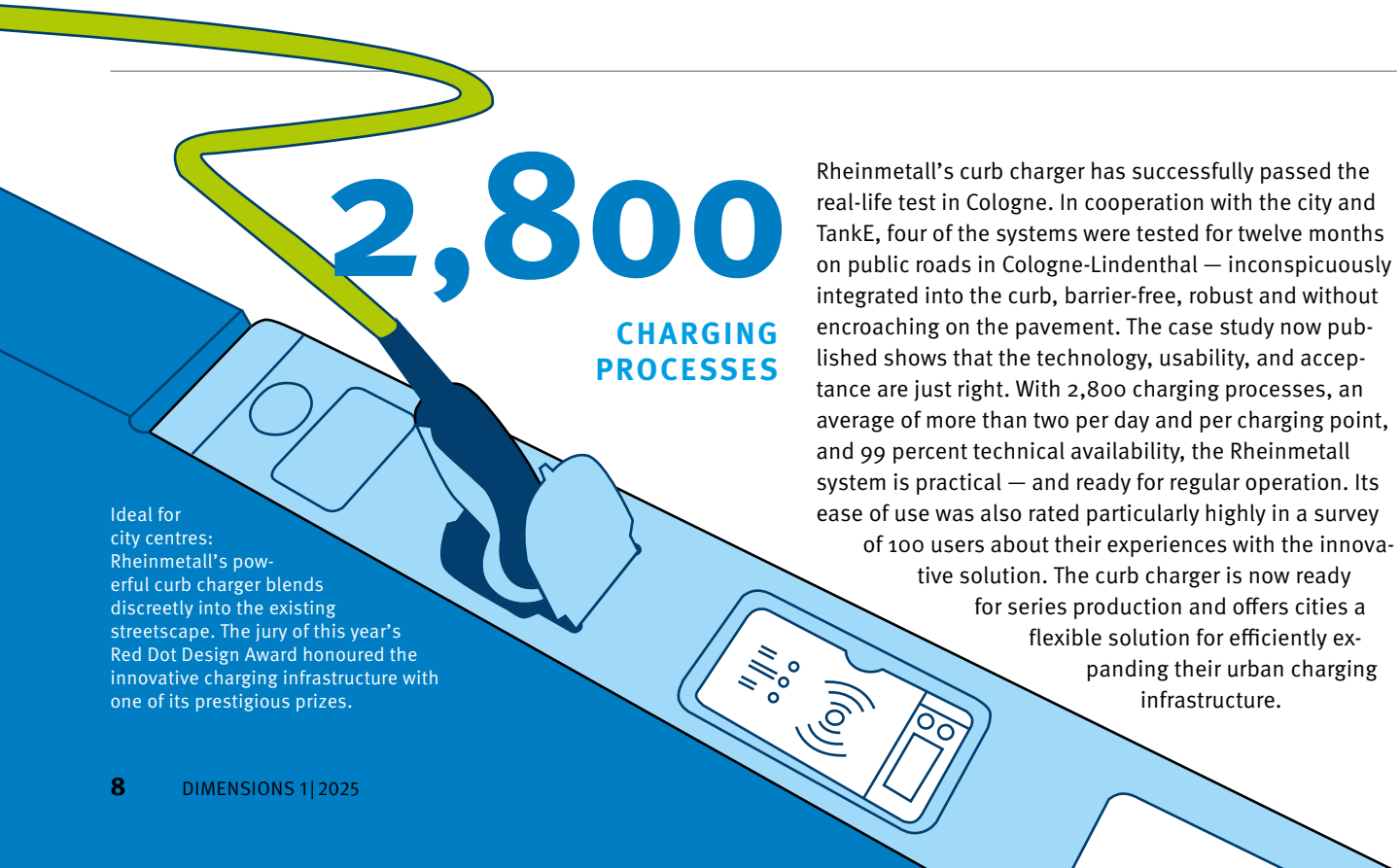
From the meeting point in Cologne, BVB team buses took the guests to Dortmund, where a surprise awaited them at the Signal Iduna Park. Roman Weidenfeller, 2014 World Cup winner and long-time BVB goalkeeper, welcomed the group with a selfie session and autograph signing. After lunch and a tour of Germany's largest stadium, the girls and boys, dressed in new BVB sportswear, began training at the academy: passing, dribbling, shooting goals. Playing football offered the guests a piece of carefree normality. A Ukrainian-speaking coach interpreted when language barriers arose.

More than 6.8 million people from Ukraine are currently living in exile abroad, 40 percent of them are children. Most of them have suffered from traumatic experiences. Even in Germany, the youngsters are confronted with images of the war in the media. This makes it all the more important to give them a short break with activities such as the visit to BVB, where they can forget their worries and fears for a moment.

The Skynex system commissioned by Italy consists of a sensor and tracking unit for airspace surveillance, a control station serving as a command-and-weapons control centre as well as four 35mm Revolver Gun Mk3 fire units.

SKYNEX PROTECTS ITALY

Italy is relying on Rheinmetall for its air defence: it is the first NATO member state to order Skynex systems in combination with 35mm revolver cannons. The total volume is around EUR 280 million. Rheinmetall's modular system is particularly suitable for close-range protection, for example against drones, missiles or cruise missiles. Skynex is already being used successfully in Ukraine, where it is proving its effectiveness under real combat conditions. For Rheinmetall, the contract with Italy is an important step towards establishing a new standard in cannon-based air defence for international armed forces. The pilot system, worth EUR 73 million, was ordered at the beginning of 2025 and will be delivered to the Italian Army by the Düsseldorf-based defence corporation by mid-2026. According to the contract, three additional systems worth EUR 204 million may follow.



Ideal for city centres: Rheinmetall's powerful curb charger blends discreetly into the existing streetscape. The jury of this year's Red Dot Design Award honoured the innovative charging infrastructure with one of its prestigious prizes.

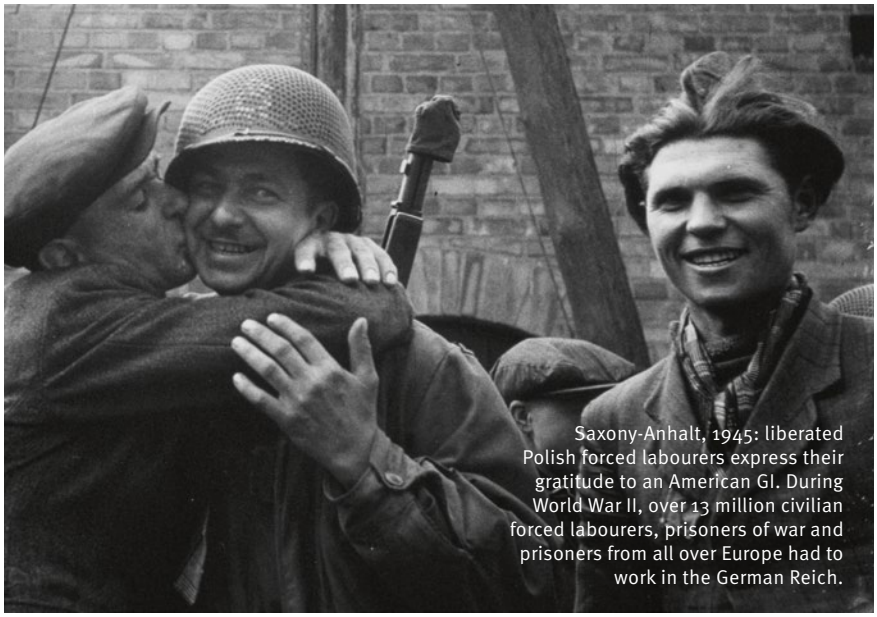
2,800

CHARGING PROCESSES

Rheinmetall's curb charger has successfully passed the real-life test in Cologne. In cooperation with the city and TankE, four of the systems were tested for twelve months on public roads in Cologne-Lindenthal — inconspicuously integrated into the curb, barrier-free, robust and without encroaching on the pavement. The case study now published shows that the technology, usability, and acceptance are just right. With 2,800 charging processes, an average of more than two per day and per charging point, and 99 percent technical availability, the Rheinmetall system is practical — and ready for regular operation. Its ease of use was also rated particularly highly in a survey of 100 users about their experiences with the innovative solution. The curb charger is now ready for series production and offers cities a flexible solution for efficiently expanding their urban charging infrastructure.

Two acquisitions, one goal

Rheinmetall is strategically expanding its business: with the acquisition of Hagedorn-NC GmbH, based in Lingen (Ems), the corporation will now also manufacture nitrocellulose in Germany — a key raw material for, among other things, the highly sought-after 155mm artillery ammunition. With the acquisition of this long-established company in Lower-Saxony, Rheinmetall is securing its supply chain for propellant charge production. At the same time, the acquisition of Stascheit GmbH in Saxony-Anhalt complements the business field of explosive ordnance disposal. The long-standing partner of Rheinmetall Project Solutions GmbH brings decades of experience in the detection, recovery, and destruction of legacy munitions — including underwater, as demonstrated by successful mine clearance projects in the North Sea. Both acquisitions contribute to the same goal: supply security, vertical integration, and sustainable growth.



Saxony-Anhalt, 1945: liberated Polish forced labourers express their gratitude to an American GI. During World War II, over 13 million civilian forced labourers, prisoners of war and prisoners from all over Europe had to work in the German Reich.

REMEMBRANCE IS THE FUTURE

Germany's surrender on 8 May 1945 ended World War II and liberated Europe from Nazi Germany. On the occasion of the 80th anniversary, Rheinmetall AG and 48 other German companies have acknowledged their historical responsibility. In a joint statement, the CEOs have sent a clear signal against hatred, exclusion, and anti-Semitism. They emphasise that it is important to keep the memory of the crimes of the Nazi-era alive. "There can and will be no closing of the books", is the clear message. Looking back is also looking ahead: constitutionality, freedom and cohesion in Europe are achievements that must be protected mutually, emphasise the CEOs: "Democracy thrives on participation — and on dissent. It needs stance and courage" — today and in the future.

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PERCENT INCREASE IN SALES

Rheinmetall's growth rate is reaching new heights: in the first quarter of 2025, Group sales climbed by an impressive 46 percent to EUR 2.3 billion. The military business in particular continues to be a strong driver, with sales growing by as much as 73 percent. "Rheinmetall is needed", emphasises CEO Armin Papperger. The sustained high demand is also reflected in the order figures: new orders rose by 181 percent to EUR 11 billion, and the order backlog reached a new all-time high of EUR 63 billion. Operating profit improved by 49 percent to EUR 199 million – a strong start to 2025. The DAX-listed corporation continues to anticipate unprecedented growth and confirms its annual forecast with at least a 30 percent plus in revenue. "We must and will deliver", said Papperger. The CEO understands that Rheinmetall is significantly closer to its goal of becoming a global defence champion.

→ You can find all the latest news, information, and background stories on the DIMENSIONS website: **www.dimensions-magazin.de/en**

Will self-learning computer programmes soon be able to think as well as their creators? Opinions are split on this question. One thing however is clear: artificial intelligence is changing our world at an unprecedented pace. AI systems analyse complex data sets, recognise hidden patterns, and draw conclusions – and they do so in a fraction of the time required by humans. They are revolutionising not only research, production, and warfare, but also the way we communicate, plan, and develop new things. However, deep learning also harbours risks, ranging from fake videos and discriminatory algorithms to questions of control and transparency. Harnessing the potential of this technology without crossing ethical boundaries remains the central challenge of our time.

THE BLUEPRINT OF LIFE

New medication in no time: AI models can now not only decode the language of human DNA, but also accurately and quickly predict the shape of proteins with their complex folds. Both lead to a deeper understanding of biological organisms, which may eventually allow diseases such as cancer to be cured. The challenges in research: the highly complex and often opaque AI models sometimes make it difficult to reproduce results and engage in scientific discourse. At the same time, they require enormous computing power that only large research institutions can usually afford.

PRODUCTIVITY BOOST

Machine learning is opening up significant efficiency gains in industry. AI systems reliably detect production faults, generate accurate demand forecasts and optimise supply chains. They analyse large volumes of production and sensor data to control manufacturing processes in real time and prevent costly downtime of machines. Adaptive robots will even be able to perform complex tasks autonomously in the future. Many companies are still overloaded by the implementation of AI systems: investment costs are high, cyber security and data protection requirements are increasing, and there is a shortage of skilled workers.

THE ALGORITHM WAR

AI-based systems already enable precise analysis of reconnaissance data and identify threats at an early stage. In the future, artificial intelligence will become even more important for defence capabilities. War is complex. Algorithms support soldiers on the battlefield in making tactical decisions, monitor flanks for suspicious movements, and improve logistics. Autonomous systems in the air, at sea, and on land minimise risks for soldiers. If self-learning AI models eventually develop combat strategies, they must be reliably protected against cyberattacks and become traceable. After all, it is still humans who make the final decision.

What is needed for the next AI revolution?

Where do we currently stand in the race concerning human-like artificial intelligence – and how did we get here? Looking back at the history of AI, certain patterns repeat themselves frequently. This also helps to assess the current hype.

Author: ***Eva Wolfangel***

HOW CAN THE AI REVOLUTION BE VISUALISED?

The language model ChatGPT has a concrete idea of what it looks like: abstract data patterns and organic neural textures merge into a humanoid robot structure – faceless, with flowing forms, glowing synaptic bridges, and warm colour accents of white and gold. And on request, it also provides the prompt, i. e. the specific instruction for Midjourney to visualise its ideas with the help of the AI image generator.

Almost exactly ten years ago, I met some of Germany's leading computer linguists for a research project. At the time, there was a heated debate in the field about whether machines could learn our language autonomously, i.e. solely based on numerous text examples, without a human being explaining grammar or connotations of words and programming this into them by means of fixed rules. At the time, there was no clear answer to this question, not even a precise trend in the form of a scientific majority opinion. But then something unexpected happened.

I need to take a step back here to explain the scale of this. The past leads directly to the present – and from here to the future. What happened back then is symptomatic of AI development: it happens again and again, just on a different level each time. Once you understand that, you can make sense of the future yourself.

I had already been in contact for some time with one of these scientists, a computer linguist at the University of Stuttgart, because I was fascinated by his work: Jonas Kuhn. His group had, for instance, researched how and to what extent people connect with each other in conversation – both linguistically and phonetically. At that time, computer linguistics in general was not primarily regarded as a discipline of machine language generation, as is often the case today. Rather, it also had the opposite effect: AI can also be used to learn a lot about people. This is still the case today, even if it sometimes gets lost in the chatbot hype.

In 2012, the Stuttgart group finally proved that sympathy is, to a certain extent, measurable, based on how people adapt their language to each other: if I find someone likeable, I unconsciously adapt my language during a conversation.

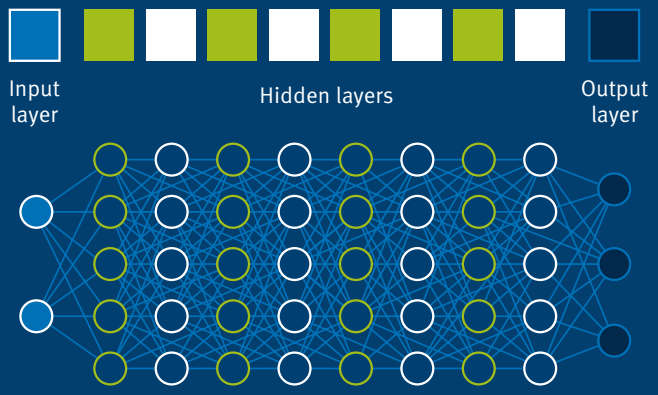
THE PATTERN OF AI: FROM BREAKTHROUGH TO BREAKTHROUGH

The advancement of technology at the time made this type of research possible: computers were becoming increasingly powerful and capable of processing ever larger amounts of data. Artificial intelligence entered public consciousness during these years – at least among those who were interested in the subject. What happened in 2015 can certainly be described as the second AI revolution – but more on that later. To date, there have been three such significant advances in the history of AI, each triggered by improved technologies and each followed by fundamental discussions. And it was precisely this development that led to controversy among computer linguists, the field of research that laid the foundation for today's AI revolution and the birth of large language models.

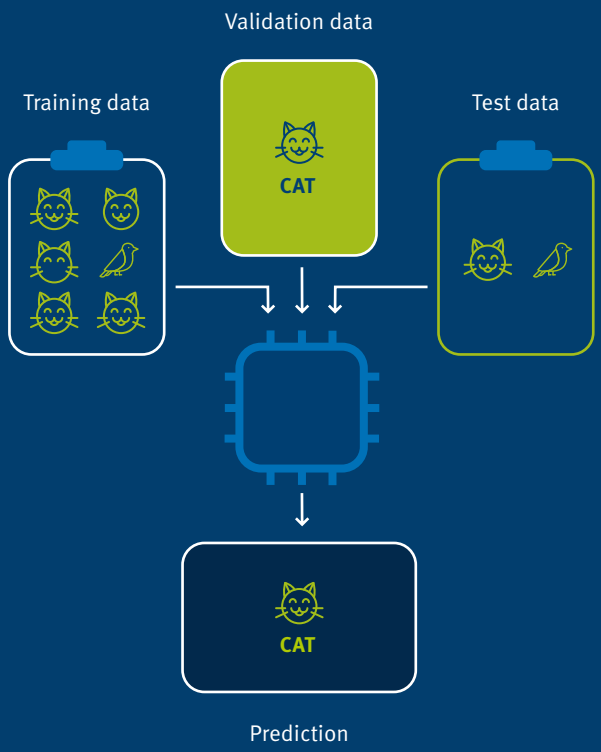
I can still remember the indignation in the researcher's voice when he eventually told me about Canadian scientists working on image recognition in January 2016. They had brazenly meddled in linguistics without knowing anything about the intricacies of linguistics. But

DEEP LEARNING

is a subfield of machine learning based on artificial neural networks (ANNs) and large amounts of data. ANNs consist of a large number of nodes that are interconnected and arranged in several “layers”. These digital nerve cells receive, process, weigh, and transmit data – from the input layer through hidden layers to the output layer, which delivers the final result. With hundreds of hidden layers, ANNs can perform highly complex tasks and make accurate predictions.



Developers train AI systems with specific training data that models the desired behaviour. Validation data is used to check the accuracy of the expected results. This also allows an assessment of how the ANN processes the training data during the learning phase. After training, the AI is evaluated using the test data.



that was precisely the point: at the time, image recognition science was the first field to make effective use of so-called deep learning. The term can be taken quite literally: with the increase in computing power, it had become possible to create “deeper” neural networks, networks with significantly more layers than before. This allowed even larger amounts of data to be processed in even greater detail. But how can image recognition systems generate language?

WHAT EXACTLY IS AI?

Before we get to this and to the question of what linguists were arguing about back then: image recognition is a good example to pause briefly and explain how AI works. To understand artificial intelligence, one concept is particularly important: pattern recognition. This remains the basis of AI to this day. The success of chatbots is also rooted in this concept.

Machine learning systems – and I use this term synonymously with AI, which we will come to in a moment – are particularly good at recognising patterns in large amounts of data. For example, take cat pictures: AI learns to recognise images by being fed numerous examples – known as training data. In the case of cats, this means thousands of photos of cats and just as many images with other subjects.

These images are annotated by humans: that is, information is added for the AI about whether or not a cat is shown in an image. Because the machine receives hints, this process is misleadingly referred to as ”supervised learning”. Nevertheless, from that point on, AI ”educates” itself, notably without supervision: it may recognise that a cat has four legs, two ears, fur, and so on. The system extracts the information it needs from the training data to distinguish cat images from other images. In a sense, it understands the ”pattern” of cats. Which specific factors the machine considers relevant remains unclear to humans at first. This is why AI systems are often regarded as black boxes. Their decisions cannot be traced. Even though progress has been made in terms of transparency, such explanations are always only approximations.

In contrast to supervised learning is unsupervised learning. Here, the AI system receives data in which it is supposed to recognise patterns independently – without any additional input from humans. The only instruction is, for example, “find ten groups in this data”. The system then searches for patterns that are suitable for clustering the data into ten meaningful groups. Or the instruction is “find anomalies in this

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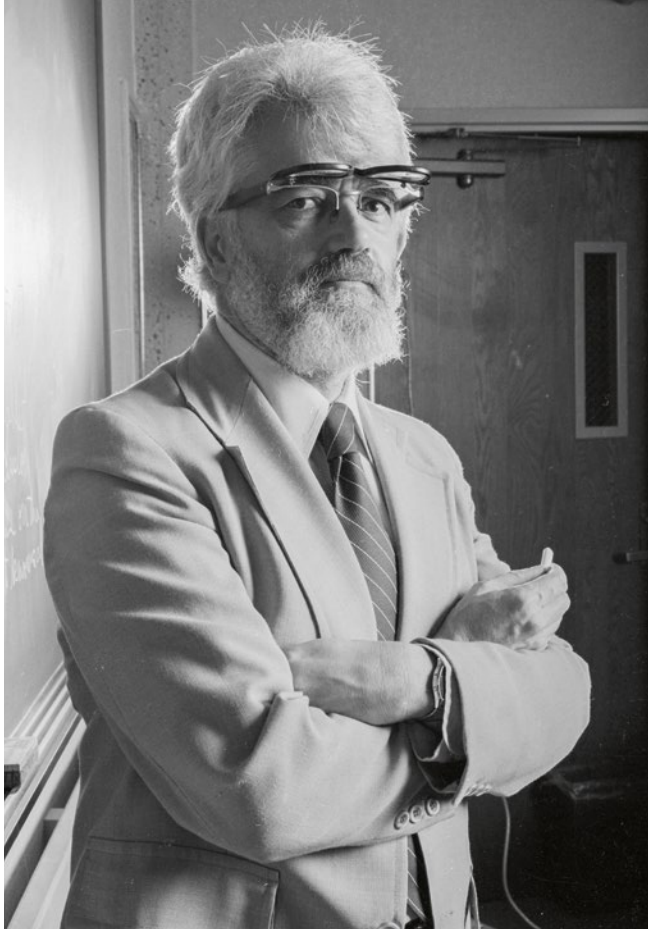

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2 Eliza is considered to be one of the first chatbots in the history of computer science. Developed in 1966, the computer programme enabled natural language communication between humans and machines via text input.

3 In the summer of 1956, John McCarthy and nine other American computer scientists held the first conference on artificial intelligence at Dartmouth College in New Hampshire.

data". Such systems can be used, for example, to identify suspicious activity in networks. This is currently used in IT security, where AI systems monitor data traffic in a company, learn the usual patterns, and sound the alarm if this traffic suddenly changes in a noticeable way: this could be the first sign of a cyberattack or espionage.

HISTORY OF AI: THE DEFINITION HAS GROWN ALONGSIDE THE TECHNOLOGY

Despite the processes in AI systems often being incomprehensible to humans, this "learning from data" is ultimately nothing more than a statistical evaluation of large amounts of data, and forms the core of today's artificial intelligence. The exact definition of AI is a matter of debate among experts, but using machine learning as the basis for this definition is widely accepted.

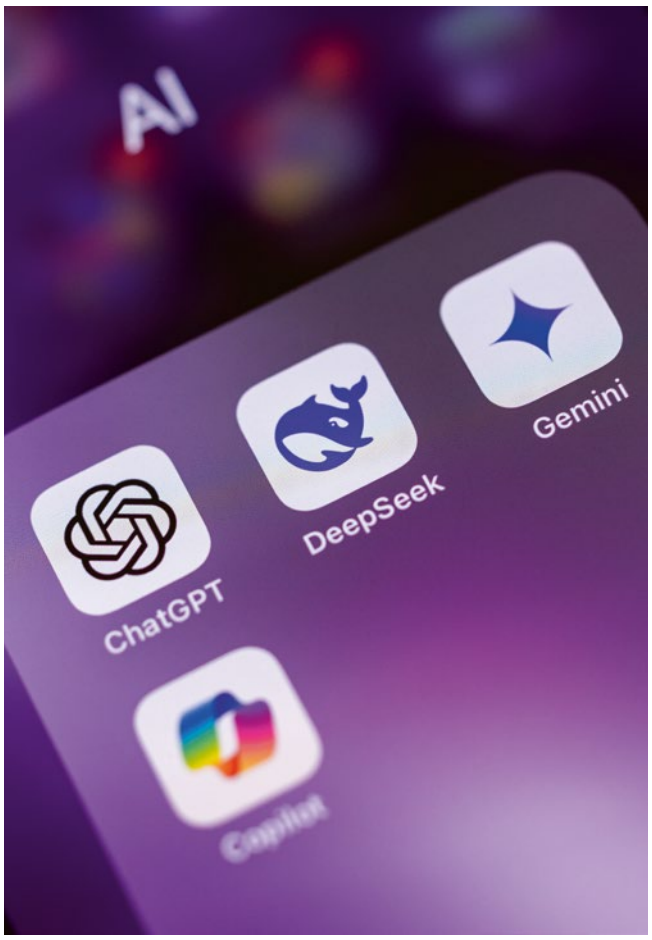
Nevertheless, this definition has evolved over time. The term "artificial intelligence" was coined much earlier, at a time when many people equated it with computer programmes, which dominated the technological landscape at the time: rule-based, deterministic instructions for machines that simply carried out the specified complex calculations. This can also lead to results that some people find "miraculous". That's why the term has always been good for imagining a greater future. But these visions have always come crashing down to earth.

The term "artificial intelligence" was formulated almost 70 years ago. In the summer of 1956, ten scientists gathered in New Hampshire, USA, for a kind of summer school called the Dartmouth Summer Research Project on Artificial Intelligence. There are good reasons to believe that the term artificial intelligence was chosen primarily for marketing reasons at the time: the ten pioneers – including John McCarthy and Marvin Minsky – needed financial resources for their project. And back then, as today, fancy new terms referring to science fiction were a successful marketing tool.

The term first appeared in a kind of funding application, even if the amount seems almost laughably small in comparison to today's investments in AI: the AI pioneers applied for travel expenses and living costs totalling USD 13,500 for their eight-week workshop at the Rockefeller Foundation. The aim was to hold a seminar on "artificial intelligence " based on the assumption "that all aspects of learning and other characteristics of intelligence can be described so precisely that a machine can be built to simulate these processes". Within two months, they wanted to

find out “how machines can be induced to use language, make abstractions, develop concepts, solve problems of the kind currently reserved for humans, and improve themselves”. They believed “that significant progress can be made in one or more of these problem areas if a carefully assembled group of scientists works together on them for a summer”. What sounds like a prophecy in retrospect was, at the time, mostly just bold words. In the short first summer of AI in 1956, there was no breakthrough: machines were finally able to ”use language”, but in a rather stiff way. Even the chatbot Eliza couldn’t hide that. As one of the first machines to pass the Turing test, the software made quite a few headlines. Looking back, it sounded very much like the “stochastic parrot” that many people still suspect language models to be today.

Those were a lot of terms – so let’s start from the beginning: Eliza is a chatbot, developed in 1966 at the Massachusetts Institute of Technology (MIT). It was designed to imitate a psychotherapist – which the programme apparently did quite successfully, because many people interacting with it on a screen were unable to definitively distinguish the chatbot from a human being. This is also the criterion for the Turing test, which checks whether a machine behaves in a dialogue in such a way that a human being mistakes it for another human being. However, anyone who talks to Eliza today wonders how this could have happened: the answers do not seem as if Eliza really “understands” what her counterpart is saying.



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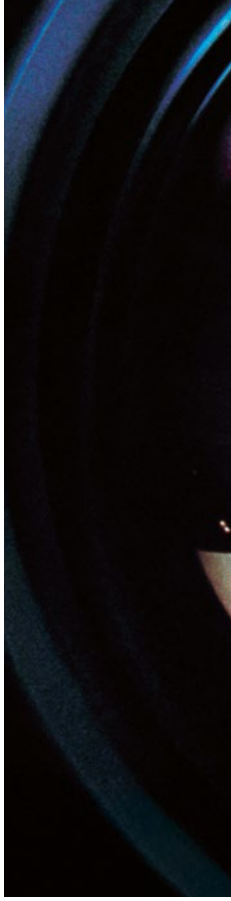

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BREAKTHROUGH IN STATISTICS: THE BIRTH OF MODERN MACHINE LEARNING – OR THE FIRST AI REVOLUTION

However, this was partly because AI in its current form did not yet exist: machine learning, the basis of what constitutes AI today, only made its breakthrough in the 1990s and 2000s. In 1995, support vector machines formed the mathematical foundation of modern AI algorithms. A year later, the first AI textbook on the new technology was published by US computer scientist Tom Mitchell, simply titled *Machine Learning*. In the early 2000s, these initial approaches found their way into the public eye when Amazon began experimenting with its so-called Recommender System: the well-known recommendation system that suggests which products customers might also be interested in.

The models of this phase, known as the “statistical turning point”, were able to identify initial patterns in data sets, which experts considered to be the first AI revolution. However, this search only worked well if humans told the machines exactly what to look for beforehand. Such models struggled to cope with images, language, or large amounts of data.

BREAKTHROUGH IN DEEP LEARNING

That changed somewhat in 2015/16, which takes us back to linguistics and the debate within the field: those years saw the breakthrough of “deep learning” – the second AI revolution, so to speak. It first manifested in image recognition: thanks to more powerful technology, machines were able to recognise cats (and all sorts of other things) much better than before. And another strange thing happened: those researchers from the field of visualisation “threw texts into their systems”, as computer linguists described it to me at the time – and obtained quite passable language generation.

All of a sudden, the visualisation experts achieved a result that had previously taken computer linguists years of work. It was now clear that the influence of humans and their grammatical rules is far less significant than previously thought. AI is apparently capable

Chatbot: speech- or text-based digital dialogue system

Stochastic parrot: metaphor for language models that can generate human-like language without understanding the actual meaning.

ALL YOU NEED IS ATTENTION

The revolutionary aspect of advanced AI models such as ChatGPT is their attention mechanisms. Instead of treating all parts of a data input as equal, the learning algorithms calculate which pieces of information are relevant for performing the task and how closely the relevant data are related to each other.

This selective focus enables them to understand and interpret complex relationships and dependencies in data much more effectively. At the same time, access to the overall context is retained, so that no meaningful details are lost.

of recognising patterns in large amounts of language and text data that enable it to generate language without knowing any rules.

AI therefore finds patterns that we humans are not aware of. Ultimately, this pattern recognition leads to the performance of AI as we know it today. But further breakthroughs were needed.

BREAKTHROUGH IN ATTENTION

Thanks to generative AI, such as chatbots and image generators, the public can now follow live how "good" AI has become. This third AI revolution was also triggered by a technical advance: the so-called attention approach, which is the basis of almost all major chatbots. In their famous paper "Attention is all you need", researchers at Google Research showed back in 2017 that a relatively simple mechanism leads to a better performance in machine language processing than the so-called recursive models, which had previously been considered as the ultimate solution.

What started out as an interesting idea has revolutionised language models. Since then, they have become truly eloquent – with all the problematic consequences, such as people believing them too easily, even when they generate nonsense.

It was not foreseeable that AI would become so articulate in this way. Even experts have watched the rise of ChatGPT and Co. with fascination. And this, like the waves of ups and downs throughout the history of AI, is also a recurring theme: its unexpected successes. Advances in AI seem difficult to predict. This is also linked to the fact that much of what happens in these models cannot be explained – which leads to challenges, especially in certain cases of applications.

FROM INEXPLICABILITY TO RACISM: PROBLEMS WITH AI UNTIL TODAY

After all, our interaction with AI is not limited to the largely trivial chats that many of us currently engage in with it. AI has been working for us all in the background for many years – whether in the form of navigation systems, voice control such as Siri or Amazon Alexa, or even questionable creditworthiness decisions that also could be based on distortions in the training data. There have been and continue to be examples of algorithmic systems that grant women lower loans than men, even when they have the same income. Or there are systems in application processes that take racist or sexist criteria into account in the background and systematically disadvantage certain applicants.

These so-called biases often go unnoticed because they are invisible to us humans. We cannot understand how AI systems make their decisions, nor do they explain it to us. The training data, on the other hand, contains thousands of

4 Thanks to natural language processing, artificial intelligence has begun to write and speak like a human being. With this ability, ChatGPT, DeepSeek and Co. are fundamentally changing the way we live and work.

5 As early as 1968, HAL 9000, the autonomous supercomputer aboard the *Discovery One* spacecraft in Stanley Kubrick's visionary science fiction film *2001: A Space Odyssey*, symbolised the fear of uncontrollable artificial intelligence. When it perceives a conflict between its mission and the astronauts' plans, HAL begins to eliminate the human crew members.

years of global power relations – in other words racism, sexism, the exclusion of humanity. It is difficult to "clean up" these biases to such an extent that they do not keep resurfacing. This is because they are also hidden in many ways in patterns in this data that we humans are not aware of or cannot intuitively detect.

For AI to become truly suitable for everyday use, regulations and innovations are needed to eliminate these weaknesses, even if this is anything but easy. EU legislation, known as the AI Act (see page 2), is a first step in this direction. Critics argue that it is too strict and warn that it could ultimately stifle innovation in Europe. However, the law also highlights what is still lacking in terms of robust and fair AI, including explainability, transparency, and proof that biases have been eliminated or at least do not influence decisions.

The big question is: how do we achieve secure, transparent, self-explanatory AI systems? The current approach, whereby humans only realise that something is wrong when these systems make incorrect or even dangerous decisions, cannot be the right way to go.

SALVATION OR DANGER: POWERFUL AI

Some are betting on a different option: truly intelligent AI. After all, if AI is really as intelligent as humans, it could – so the hope – also make truly intelligent decisions. However, there is also a risk that it will develop its own evil attitude and thus become truly dangerous. This is the basis for all the doomsday scenarios we keep hearing about. Personally, I believe that it is much more likely that such general AI will be helpful. At least when operating on its own initiative. What criminals or dictators will do with it is another question. However, it seems implausible to me that AI will develop its own evil attitude.

The current third AI revolution is certainly causing quite a stir. But it remains to be seen whether it can actually take AI to a new level which is closer to human intelligence. We are talking about artificial general intelligence (AGI).

WHAT IS NEEDED FOR THE FOURTH AI REVOLUTION?

If we now look back to the beginning of this text, it becomes clear that the bet is back on. If you imagine development as a spiral, a circular movement that expands into space and in which the same themes keep repeating themselves, albeit at a new, more advanced level, then we have arrived at the top floor with the question "Are statistics alone enough?" Thus, it is no longer just a question of whether statistics are sufficient for making recommendations or learning languages, but whether they are sufficient "for everything": Can artificial intelligence use

AI SUPREMACY
In 2024, the USA once again dominated the global market for private investment in artificial intelligence. The European Union (including the United Kingdom) followed far behind, with China in third place. Each of them wants to mobilise additional capital and sovereign wealth funds amounting to billions over the next few years: the USA with USD 500 billion, China around USD 137 billion and the EU USD 200 billion.

Sources: Statista Research Department and others.

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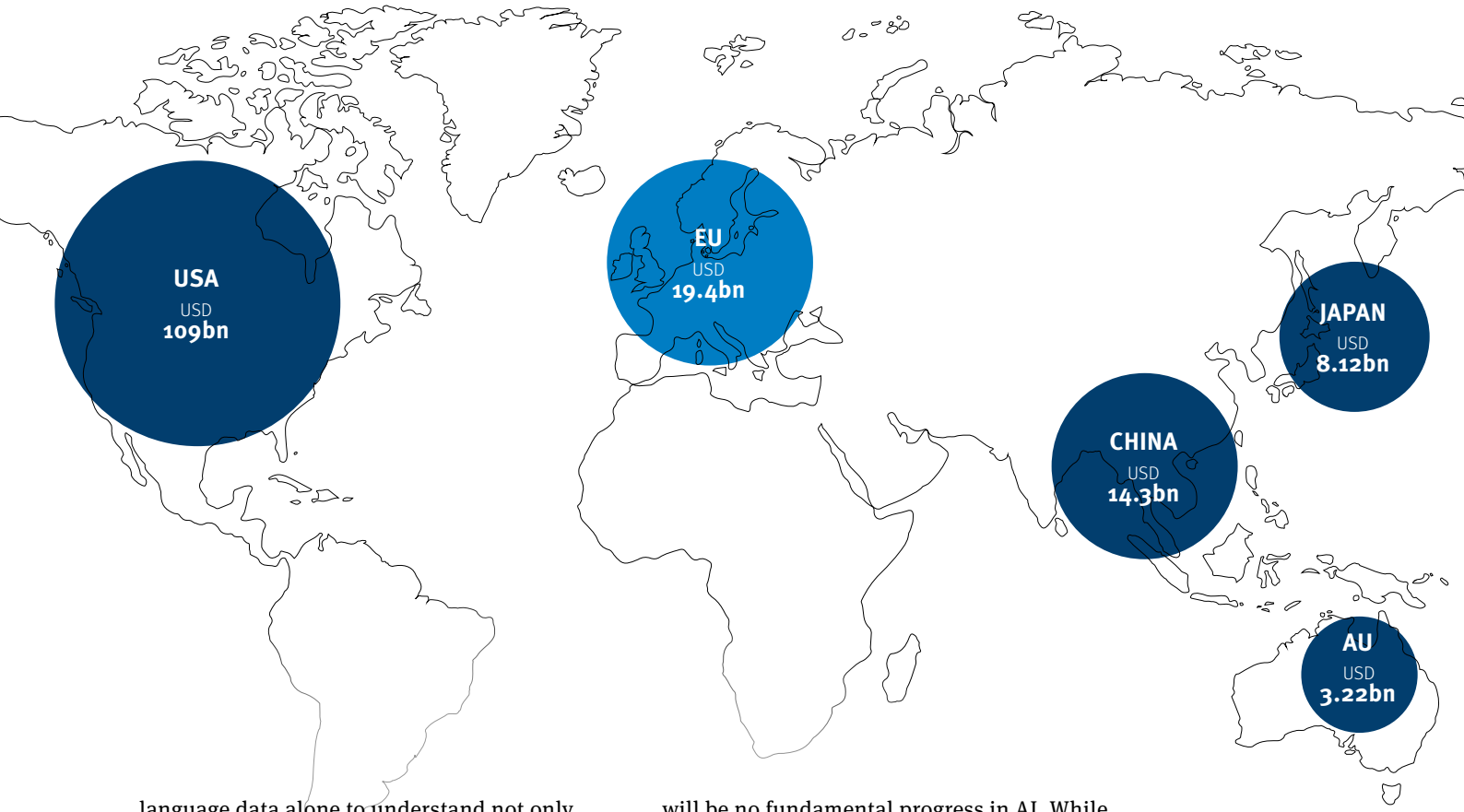
6 and **7** At the AI Action Summit in Paris in February 2025, European initiatives, companies, and politicians demonstrate that they are ready to catch up in the race for AI. According to EU plans, five AI gigafactories are to be built across Europe from 2026 onwards. Brussels is thus following the proven CERN model of scientific cooperation and creating large, scalable data centres for AI.



language data alone to understand not only language, but the whole world?

Once again, there are two camps: while some experts are already raving that language models are the first step towards AGI and that it is apparently possible to piece together the entire world from language data, others are warning that chatbots only simulate understanding. Without genuine understanding, they say, there will be no fundamental progress in AI. While some argue that AI will continue to improve as larger models and more training data become available, others say that we have reached a plateau where the classic scaling ("higher, faster, farther") will no longer yield significant gains.

At the same time, developments in China (such as the chatbot DeepSeek) show that it may be possible to achieve a lot with less effort and a different architecture. This in turn shows that billion-dollar investments like those made by the US government are not everything, but that a "substantial" breakthrough may still be needed: the fourth AI revolution.

Some researchers are now saying that humans may need to intervene more after all. This could take the form of "AI textbooks" – training data specially curated by humans – or "symbolic AI": systems that are once again based more on logical rules.

Anyone who believes that history repeats itself will reject this approach. I also lean towards the plateau faction, but I cannot warm to the idea that more human input is needed. After all, it was not necessary for the breakthroughs achieved so far. For me, however, one thing is clear: language alone is not sufficient as a basis for AGI. What holds the world together at its core is conveyed and understood on other levels. As impressive as chatbots are, part of their success is simply due to the fact that we humans are easily deceived and confuse eloquence with intelligence. ●

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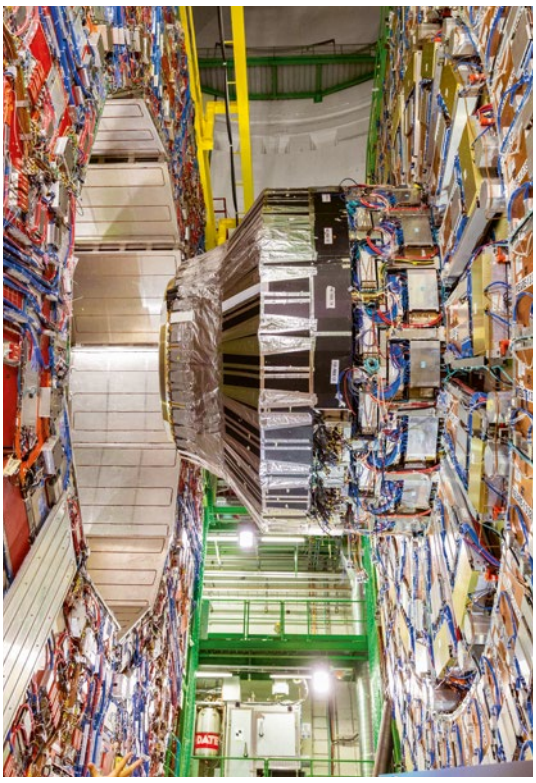


EVA WOLFANGEL is an award-winning journalist, speaker, and presenter. In 2019/20, she was a Knight Science Journalism Fellow at MIT in Boston, USA. She was awarded the Reporter Prize in 2020 and named European Science Journalist of the Year in 2018. She writes about topics such as artificial intelligence, virtual reality, and cybersecurity.

“We are becoming an AI house”

How can artificial intelligence (AI) take advantage of its strengths on the battlefield of tomorrow? Where are the risks? Klaus Kappen, Chief Technology Officer at Rheinmetall, coordinates research and development. He provides the answers in an interview with DIMENSIONS.

How do you assess the current development of artificial intelligence and its impact on industry?

We are in the midst of a new industrial revolution that will affect many areas of life – and it is already doing so today. It is driven primarily by the availability of increasingly powerful hardware that enables enormous computing power. AI will have an impact on processes throughout industry and will change the development of technologies significantly. Rheinmetall wants to play an important and formative role here by using AI to further enhance our products. However, the premise will always be to maintain control. Another challenge is to verify seemingly plausible results produced by AI. Artificial intelligence is based on machine learning, which means that any AI can only be as good as its database, i.e. the learning data it is fed.

In which areas do you see the greatest potential?

AI is already an important tool for us at Rheinmetall. It is increasingly supporting us in internal business processes, in IT, in development, and in testing. AI opens up entirely new possibilities for simulation. Just one example: in the USA, nuclear tests are already being simulated on supercomputers through AI assistance.

In the future, AI will help people wherever decisions need to be made in a dynamic environment based on comprehensive data. This will become increasingly important, particularly in a military context, where highly complex situations and huge amounts of reconnaissance data must be dealt with – and every second counts when tactical decisions are needed.

What role does AI play at Rheinmetall, both in the civil and military contexts?

AI has long been part of our corporate strategy; we are becoming an AI house. Together with our innovation team at Rheinmetall IT Service, we have already identified around a hundred so-called use cases for AI in our investigations that involve supporting everyday work,

KLAUS KAPPEN, born in 1969, has been the Chief Technology Officer (CTO) of Rheinmetall AG since 2018. In this role, he is responsible for creating and maintaining Rheinmetall’s technological expertise as well as coordinating all research and development projects. With his many years of expertise in military research and technology, Kappen supports other departments in developing comprehensive system concepts for large-scale projects for the armed forces.

and we are now validating them. These include chatbots, knowledge management, process automation, quality control, and assistance solutions for creating files for PowerPoint or other applications. It doesn’t matter to us whether these potential applications are military or civil in nature, because technically there is no difference. AI is finding its way into many of our products and will support and relieve soldiers in many of their tasks in the future.

How does AI influence decision-making processes in military operations? What are the advantages and the risks?

In future, AI will primarily play a role in tactical systems in all military areas: in the gathering and evaluation of information, in decision-making, and in the attainment of combat superiority. For example, AI can be trained to recognise and identify enemy vehicles and to propose courses of action. AI thus helps humans to improve the quality of information in dynamic situations and to make decisions.

Who is driving this development? Are customers demanding AI in their systems, or is the industry pushing it forward?

I think it’s both. We show our customers what is technically possible and where technology can relieve people. On the other hand, the military has to cope with increasingly complex tasks with a decreasing number of personnel, because manpower is a scarce resource. That’s why our customer attaches great importance to automating repetitive tasks and using technology to relieve people of unnecessary tasks.

But aren’t technical systems also becoming increasingly complex, to the point where humans will no longer be able to operate them without AI support?

One could see it that way – some cars are already overwhelming their drivers today. In the military sector, the more tasks the operator has to perform, the more assistance is needed. AI will therefore become an indispensable

component of state-of-the-art combat systems.

Let's stay at combat systems. Will we have to fear killer robots in the future?

We won't build them. We're not allowed to build them – and our customers don't want them either. After all, there are clear rules of engagement and other legal requirements that always place responsibility with humans. AI does not make independent decisions in our systems but rather makes suggestions based on the information it has evaluated. Humans are responsible for everything they do: when firing artillery, deploying a guided missile – or even a semi-automated weapon. This is referred to as the "human in the loop" principle: humans have ultimate control, make the decisions, and bear the responsibility.

But would a killer robot that makes its own decisions be technically possible?

Certainly. And unfortunately, we cannot assume that all countries or actors will adhere to the same ethical standards and international regulations that are binding for us. In the military sphere, we must expect that one day we will be facing killer robots.

Do you already have products that use AI?

We are already delivering products that are "ready for AI", such as the Boxer wheeled armoured vehicle in the Heavy Infantry Weapon Carrier version for the Bundeswehr. If the customer wishes, we can retrofit the AI later. This specifically involves an AI-based turret architecture that we have developed – the Automated Turret Target Acquisition Component – also known as AT-TAC. It serves to automatize reconnaissance and observation tasks in the turret, hence assisting in target search, classification, and threat assessment. Our new Panther battle tank and Lynx infantry fighting vehicle are also prepared for the use of AT-TAC. When we deliver SAR reconnaissance data from space to our customers in the future …

…from your partnership with Finnish satellite operator ICEYE…

… yes, AI also plays an important role in evaluating and utilising this data. And in the drone sector, we are developing a neural network for our Unmanned Aerial Vehicles (UAVs) that can identify potential military targets from a drone's perspective, even from a great distance. We are also working on an AI model that enables the recognition of an object from the perspective of another drone or at a later time. This is already being integrated into the first UAVs. In the audio event classification, we are focusing on passive audio reconnaissance to support situation awareness by using AI to warn us of approaching vehicles, drones, etc. – as an artificial intelligent ear. I could list many more examples …

…certainly, also from the civil sector?

Of course. We already use AI for bird protection in wind turbines, for example (see article on page 28ff: ProTec-Bird). Or in driver monitoring systems, which will be required by law in all new civilian vehicles in the future. AI can recognise faces, but also gestures, yawning, blinking, and much more. At our subsidiary Rheinmetall Yardstick Robotics, we are working on the AI-based commissioning and certification of robot systems, for example for

Allies for the infantry: Rheinmetall's autonomous unmanned ground vehicles use artificial intelligence methods.

learning new tasks such as loading and unloading for autonomous transport on a factory site.

How does Rheinmetall protect its AI systems from cyberattacks and manipulation?

On the one hand, AI systems are vulnerable to so-called adversarial attacks. If an adversary is familiar with the AI model, they may be able to mislead the AI by deliberately falsifying data in a way that is difficult or impossible for the user to detect. The reliability or resilience of AI is therefore a factor we consider to be highly important.

On the other hand, objects recognisable by AI systems – via satellite or other imaging sensors – can also be camouflaged by means of optical distortion so that they are no longer reliably identifiable by AI. On their own terrain, an enemy can easily employ camouflage and deception. However, data from the past can provide important reference points that could be used to verify and identify such distortions.

Consequently, the same applies here: control is better?

Yes. If I use several sensors independently of each other and combine the data obtained – this is referred to as multi-sensor data fusion – I can reduce risks. The more data I have for validation and comparison or for retraining models, the more reliably the AI works. And as with all military systems, the same applies here: it must not fall into enemy hands. In this case, protection and self-destruction mechanisms come into effect.

How does Rheinmetall manage to attract qualified specialists in the global competition for AI talent?

We are in a comfortable position here, as we receive many applications from people who would like to join us. We also cooperate with several universities and research institutions, and are in contact with young talent. "Techies" are keen to get involved with us.

Let's take a look at the future – what will happen next?

The growth in capability and combat effectiveness of our products will be driven by software and AI in the future. Our vehicles and system architectures will allow upgrading during the product's life cycle with minimal effort. Many systems will be automated to the utmost level in the future. Humans will only intervene where artificial intelligence cannot provide a solution and/or where responsibility is required. All this is going to happen rather quickly – the future is already within reach!

Mr Kappen, thank you very much for the interview. ●

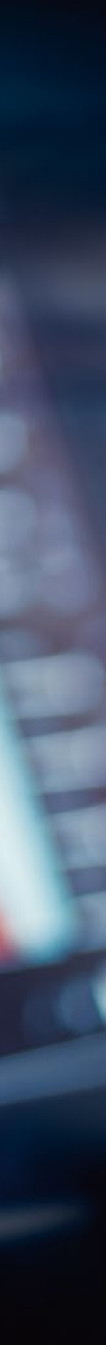
The interview was conducted by Oliver Hoffmann.

→ You can read the full interview at **www.dimensions-magazin.de/en**

When pictures learned to lie

Disinformation has influenced public opinion since time immemorial. What is new is how quickly and convincingly it goes viral today. With the help of artificial intelligence (AI) and a little practice, almost anyone can now generate authentic-looking images or manipulate audio and video recordings. How does this affect our democracy and security?

ZDF presenter Christian Sievers is allegedly promoting dubious investments, German chancellor Friedrich Merz has issued a statement disparaging democracy, and US pop icon Taylor Swift has been compromised with fake pornographic images. Deepfakes such as these examples are circulating en masse online. These are manipulated image, video, or audio files that are generated with the help of artificial neural networks and methods of deep learning. The tools required for this are freely available. The more data AI receives about the appearance, facial expressions, and gestures of the people concerned, the more authentic and realistic the computer-generated fakes appear.



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LONG TRADITION

Omitting context, altering facts, spreading lies: fake news is not a new phenomenon. Its history dates back more than 2,000 years. Since ancient times, disinformation campaigns have been used to discredit political opponents, gain financial advantages, unsettle the public, or stir up mistrust, fear, and anger. However, with the possibilities offered by social media and AI technologies today, disinformation is reaching a new dimension.

IDENTITY FRAUD IS RISING RAPIDLY

According to the Identity Fraud Report published by the Entrust Cybersecurity Institute in early 2025, a deepfake attack took place every five minutes last year. The amount of fake digital documents and identities has increased by 244 percent compared to 2023. At the same time, scams are becoming increasingly sophisticated. A particularly sensational case occurred at luxury car manufacturer Ferrari. Using a perfectly imitated, AI-generated voice of CEO Benedetto Vigna, cybercriminals attempted to initiate a large money transfer. The contacted manager became suspicious. Other companies, such as a subsidiary of payment provider PayPal and the US network component manufacturer Ubiquity Networks, were less fortunate.

PROPAGANDA WEAPON OF THE FUTURE

However, deepfakes are not only a growing threat to businesses. With the increasing prevalence of fake audio and video recordings, there is also a growing risk of political influence being exerted in elections, public discourse, and state conflicts. In March 2022, an alleged surrender video of Ukrainian President Volodymyr Zelensky appeared. While such first-generation deepfakes were relatively easy to expose, today's high-quality fakes are much more difficult to detect. Which eyewitness reports from the war zones are real and which are fake?

1 The hurdles for generating so-called deepfakes are low: freely available tools can be used to create fake video and audio files in a short amount of time – often without any technical knowledge.

2 When a fake video of President Volodymyr Zelenskyy surrendering was circulating on the internet in 2022, Facebook's parent company Meta took it off the net just one day later. The statement from Meta's head of security at the time can be seen on the smartphone display.

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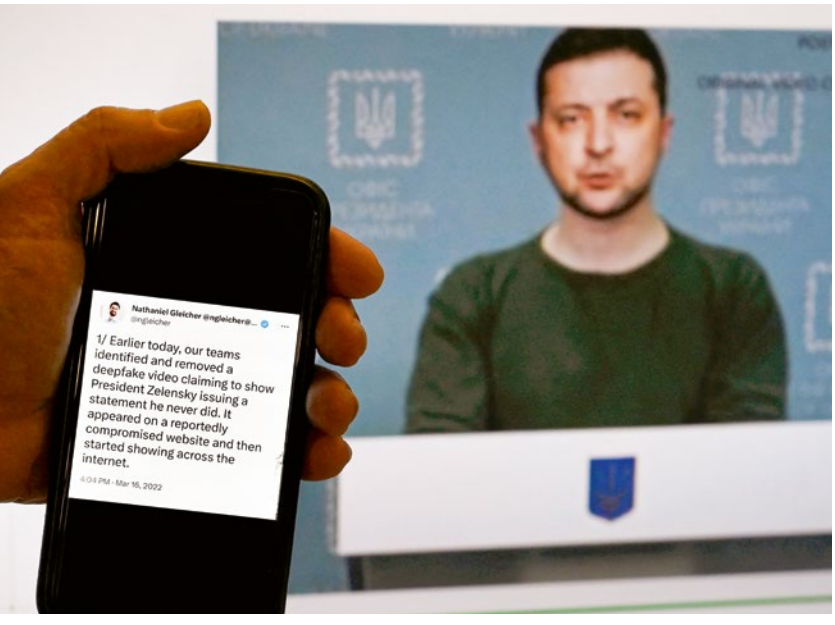
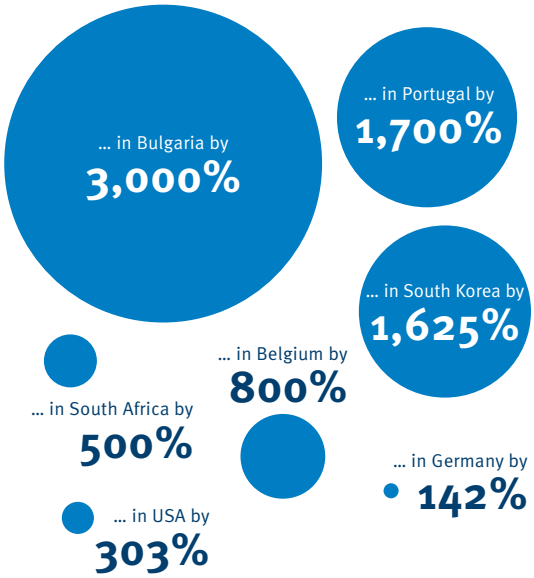


DEEPFAKES IN NUMBERS

Increase in deepfakes in countries with elections in 2024 ...



Source: sumsub Data reports

LOSS OF TRUST

Deepfakes cast doubt on the veracity of news, fuel conflicts, and demoralise people. They undermine trust in democratic institutions and contribute to polarisation and social division. The more anger an item triggers, the greater the chance that people will react to it – and thus create outreach on social media. Another effect is the so-called lie dividend: the loss of trust caused by deepfakes makes it all the easier for autocrats and populist parties to claim that real videos are fake.

TARGETING DEEPFAKES PRECISELY

To minimise the risks posed by deepfakes, it is essential to have solid digital-literacy skills. Suspicious audiovisual media should be critically examined and verified using other sources. At the same time, AI-based detection systems and robust security protocols can help. ● *Pk*

Neural networks powering wildlife protection

What was originally developed for air defence against drones and enemy missiles is now also helping to protect endangered birds of prey from wind turbines. With its AI-based anti-collision system AVES, the Husum-based start-up ProTecBird is a leader in Europe – thanks not least to software components from Rheinmetall.

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The white-tailed eagle, Germany's national bird and Europe's largest bird of prey, prefers coastal areas and lakes as its hunting ground. If it breeds near a wind farm, operators often face considerable financial losses. This is because not a single wind turbine will turn during this period – and that's from March to September. Due to the strict legal requirements, blanket shutdowns like this are widespread.

The Husum-based start-up ProTecBird has demonstrated that species protection and the urgent expansion of wind energy need not exclude each other. Founded in 2021, the start-up worked in close cooperation with Rheinmetall to bring an officially certified anti-collision system onto market within just three years. The system can temporarily slow or stop individual turbines when protected species such as white-tailed eagles, red kites, peregrine falcons, or marsh harriers come dangerously close to rotating blades.

ON TARGET: BIRDS INSTEAD OF DRONES

At the heart of the camera-based solution is a software component previously used exclusively in the military sector. Developed by Rheinmetall, the software operates as follows: when hostile drones or missiles are approaching, the software can automatically detect them from great distance on the horizon using complex real-time image processing. It can then track them dynamically using multiple cameras, classify them and calculate their trajectory in order to intervene in time in the event of a threat. Thanks to its sophisticated image processing algorithms,

1 ProTecBird's innovative AI-based anti-collision system promotes the expansion of wind power plants without compromising species protection.

Rheinmetall's surveillance and tracking software can be used in a wide range of domains: from air defence to naval systems, armoured vehicles, and now wildlife protection.

ORCHESTRATION OF MULTIPLE SOFTWARE MODULES

Unlike drones or vehicles, birds can rapidly change shape significantly whilst flying and are highly agile in their movement. To meet these unique challenges, Rheinmetall's various development teams had to adapt the software. This not only involved the algorithms and tracking functionalities, but also the interaction with the AI-based species recognition software and the ProTecBird control system which required joint programming and integration efforts.

The result of several years of development work is impressive. "Thanks to Rheinmetall's software

components, our AVES anti-collision system can detect birds at a distance of up to 1,000 metres, with an accuracy of nearly 99 percent," emphasises Thorsten Heinzen, CEO of ProTecBird. The pan-tilt cameras mounted on the wind turbines are all interconnected. When the nearest camera zooms in on the animal, the species-specific AI is activated. The software can identify the species in a distance of around 800 metres. If it is a protected species, the integrated tracking module detects the bird's altitude, flight direction, and speed. "Based on geo-referenced data, our system calculates exactly when there is a risk of collision", explains Heinzen. "At that point, AVES initiates a slowdown of the affected turbine, bringing the rotor into what's known as 'idle mode'." According to legal regulations, there is no longer a risk to the bird at 2.5 revolutions per minute.

OVER SIX MILLION TRAINING IMAGES

"Reliably identifying and tracking the protected species among the hundreds of birds in a wind farm requires a high-performance system", emphasises the CEO of the start-up. Key to success is the quality assurance in the neural network. "Training the AI-model has been – and continues to be – a major undertaking", says Heinzen. ProTecBird deploys several fieldwork teams that record birds of all kinds at all seasons and under all weather conditions. At the Husum site, the individual images are then labelled. A team of 44 employees tag the screenshots not only with the name of the species depicted, but also

HIGH-DEMAND TECHNOLOGY
Rheinmetall's long-standing expertise in the development, integration, and delivery of air defence technology is in high demand – not only from ProTecBird. Together with Diehl Defence and Hensoldt Sensors, the Düsseldorf-based defence corporation is developing the new close- and very-close-range air defence system for the Bundeswehr.

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whether it is considered protected. To ensure high data quality, every labelled image is also checked by a second ornithologist. To date, more than six million sets of data have been collected, with many more to follow.

TURN-OFF RATE AT UNDER TEN PERCENT

The substantial economic advantage of AVES for wind farm operators is reflected in its low turn-off rates. According to the CEO, these now range between just two and nine percent. “The innovative monitoring and tracking software from our technology partner Rheinmetall gives us a major competitive advantage”, Heinzen points out. Although his company has only been on the market for three years, the start-up already serves customers in several European countries. Wind farm operators worldwide are interested in the anti-collision system “Made in Germany”. Just recently, Heinzen was able to secure a major order in Lithuania: the largest wind farm in the Baltic state, with a capacity of 300 megawatts and strict species protection regulations.

CYBERSECURITY IS ESSENTIAL

To avoid the necessity of obtaining expensive export licences, ProTecBird uses the Rheinmetall technology in a civil version. All components which could be utilized to connect military systems have been removed. Nevertheless, it does not work without defensive measures. Wind farms are considered critical infrastructure. Since the AVES system can be used to shut down the turbines, the system itself must meet increased cybersecurity standards in order to be protected against hacking attempts. Here, too, the technology partner is supporting the start-up with its IT expertise and a new cybersecurity software called COAT.OS, which is already in military use.

PREVENTING BIRD STRIKES ON ENGINES

Demand for anti-collision systems such as the one by ProTecBird extends beyond wind energy. The AI-based solution also has great potential at airports. The technology is basically the same, explains Heinzen: “However, that with the AVES Airport variant, we’re not slowing down turbines, but we’re erecting a dynamic acoustic barrier. Using tracking data, we can guide bird flocks away from runways within the designated air corridors.” The ward-off system, designed to prevent bird strikes on aircraft, uses synthetic acoustic signals and is already in operation at the Airbus test airfield in Hamburg-Finkenwerder. A simplified version is also currently being tested at FC Bayern Munich’s Allianz Arena, where bird faeces pose an ongoing and costly problem—just as they do on offshore platforms and in stadiums worldwide.

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PROFITABLE COOPERATION

Whether wind turbine, airport, or stadium – the fact that the individual system components work together smoothly in each of the applications is due to the close cooperation between Rheinmetall and ProTecBird. Their next joint project will be the development of a night module for bats. These nocturnal mammals are strictly protected, but currently there is no solution which enables conditional turbine turn-offs at night. That is about to change. ● *Pk*

2 In just three years, ProTecBird CEO Thorsten Heinzen has launched a fully automated AI-based anti-collision system in close collaboration with Rheinmetall.

3 and **4** The software reliably detects and classifies birds at great distances. If a protected species is identified, the bird is dynamically tracked by interconnected cameras, mounted on the turbines. Triangulation methods enable precise three-dimensional positioning.

Strengthening the security and defence industry

The new strategy for the security and defence industry (SDI) is intended to sustainably strengthen the political, strategic, and economic significance of this high-tech sector. It will be crucial that the strategic goals are followed by concrete, smart, and powerful action that has a recognisable impact, both in Germany and across Europe.

Author: ***Dr Theodor Benien***

The core message of the new strategy for the security and defence industry (SDI), adopted by the German cabinet on 4 December 2024, is to produce more defence equipment faster. To achieve this, Germany plans to expand domestic production capacities, simplify cross-border defence cooperation and procurement, and to promote key technologies.

The document outlines a clear vision for reinforcing the security and defence economy. It also sends a strong signal to this strategically relevant sector and underlines its indispensable contribution to Germany's defence capability. The strategy paper, jointly developed by the Fed-

eral Ministries of Defence and Economic Affairs after a lengthy coordination process, replaces the previous version from 2020. This updated edition reflects the dramatically changed security landscape in Europe, shaped by the war in Ukraine more than three years ago.

With this strategy, the German Federal Government is pursuing the goal of further developing the security and defence industry in Germany and in Europe. The highest priority is given to meeting military-industrial requirements for national and alliance defence. The focus is thereby on building a dynamic, scalable, innovative, and adaptive industry – one that must be internationally competitive and capable of meeting the needs of the Bundeswehr as well as the demands of security authorities and agencies.

SEVEN ACTION AREAS FOR A CAPABLE SDI

The national SDI strategy establishes the political, economic, regulatory, and societal framework needed to accomplish these goals. In total, the strategy paper identifies seven action areas:

- Safeguard key security and defence technologies at national level. The aim is to preserve and strengthen national technological sovereignty in critical defence-related fields.
- Continue to sustain and promote strategically relevant key industries. The focus is on a comprehensive approach to promote closer integration between civil and military research and development.
- Position the state as both a customer and an enabler. This includes measures to diversify and increase the resilience of supply chains.
- Identify obstructive regulations and adapt legal frameworks where necessary. This applies in particular to planning, approval, and bureaucratic requirements for establishing or expanding production, storage, and support capacities.
- Review the financial framework of the SDI. The strategy explores how institutions such as the KfW (German Bank for Redevelopment) and the German public funding system can additionally be activated to finance the SDI.
- Secure Germany as a base for skilled labour. The already enacted cross-sector national skills strategy must now be implemented through clearly defined action areas.
- Strengthen European and international cooperation. This includes promoting joint European defence and procurement projects as well as simplifying EU procurement rules for security and defence goods and services.

BDSV AND BDLI: NEW STRATEGY – AN IMPORTANT INTERIM STEP

In a joint statement, the German Security and Defence Industry Association (BDSV) and the German Aerospace Industries Association (BDLI) described the new strategy as an "important interim step" and a "constructive approach" for this industry sector. Dr Hans Christoph Atzpodien, managing director of the BDSV, said: "Looking at the immense challenges involved in closing the capability gaps in the Bundeswehr and continuing to provide support to Ukraine, what's needed above all is the rapid operationalisation of the action areas outlined in the strategy." It would be desirable for the industry to build on the agreed results – and those to be further developed – in cooperation with federal government.

DEFINITION MUST BE FOLLOWED BY IMPLEMENTATION

A careful analysis of the SDI strategy reveals that it is not a hastily assembled "loose leaf collection", but a well-considered document with clear strategic goals. However, this document will not meet all the expectations and demands of the defence industry. This comes as little surprise, given the extremely challenging political coalition dynamics under which the strategy was developed. While the paper was still going through internal coordination in Berlin, the coalition government – the so-called traffic light alliance – began to disintegrate in a dramatic act of political self-dismantling. This internal crisis delayed the publication of a strategy the industry had awaited for so long.

What matters now is that the strategy will actually be implemented. Much, if not everything, will depend on the extent to which the new federal government, elected on 23 February, is willing to push forward with the defined measures and hence develop them in more detail. The outgoing Bundestag laid the financial groundwork for this at literally the last minute by loosening the debt brake for defence and security. ●

Standing side-by-side

On 15 June 2025, the Federal Republic of Germany honoured the service of its active and retired soldiers for the first time with a National Veterans' Day. Rheinmetall is also actively involved, sending out an important signal of appreciation.

Author: ***Jan-Phillipp Weisswange***

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Although *veteranus* means "long-serving" or "experienced", though these terms hardly define the recognition deserved by members of the German Bundeswehr. "A veteran culture, as we know it from many other countries, has been a neglected topic in this country for many years. It has only been able to grow as a grassroots movement in recent years", says Lieutenant Colonel Marcel Bohnert. The combat-experienced mechanised infantry officer and vice chairman of the German Armed Forces Association is one of the most prominent representatives of the German veterans' movement.

The fact that former soldiers, who risked their lives and health for their country in missions abroad, have received so little public recognition to date is partly due to the relatively short military history of the Federal Republic of Germany. Allied armed forces can look back on centuries of tradition: the 318-year-old British Army, the 250-year-old US Army, and the 233-year-old Armée française honour battles such as Lexington and Concord (1775), Waterloo (1815), the Somme (1916), and Arnhem (1944). In comparison, the Bundeswehr, which is not yet 70 years old, is relatively young. It was only as an "army of unity" that it led combat-ready large units into the field – about 26 years ago, starting on 10 June 1999, to stabilise the Kosovo conflict. The Bundeswehr experienced its most intense combat action to date on Good Friday, 2 April 2010, in Isa Khel, Afghanistan. An infantry company

1 Staff Officer Lieutenant Colonel Marcel Bohnert – pictured here as a participant in the "March of Remembrance" – is one of the most prominent representatives of the German veteran's movement.

engaged in a firefight lasting several hours with the Taliban, an asymmetrically operating enemy. Three comrades were killed and seven wounded.

A ROOT OF THE VETERANS' MOVEMENT

Nevertheless, the Good Friday battle is one of the roots of the modern German veterans' movement. This primarily arose as a reaction to the official treatment – or rather non-treatment – regarding the commemoration of soldiers who had been killed in action or left physically and mentally scarred.

"While politics found it very difficult to cope with an official commemoration, and both the Bundeswehr and its foreign missions received little interest from society, more and more veterans' initiatives emerged", recalls Bohnert. "Those returning from deployment and their families founded associations and took further measures to draw attention to their unsatisfactory situation." This occurred through marches, motorcycle convoys, commemorative events, publications and activities on social media, for example. One of these initiatives was the "K3" movement. On the tenth anniversary of the Good Friday battle, the influencer "NATO-Vet" called for a special commemorative march on social media: ten kilometres with ten kilograms of luggage – as a sign of remembrance for the three comrades ("K3") who died in action. "10K3 march" quickly developed into a movement: every year, the number of participants, the distance, and the weight increase – one kilometre

more per year, one extra kilo in the backpack. Several tens of thousands of people took part in this year's 15K3 march, including many Rheinmetall employees. At the company's site in Unterlüß alone, a group of 120 persons set off on the march.

The breakthrough for the veterans' movement came in 2022 with the "turning point". With hybrid threats and the need to strengthen Germany's own defences, the Bundeswehr and its active and retired soldiers once again became more prominent in the public consciousness.

TAKING RESPONSIBILITY FOR VETERANS

Their extensive experience is particularly in demand in the security and defence industries. Rheinmetall has always employed veterans: from former conscripts of the Cold War to retired soldiers as well as regular soldiers and Afghanistan veterans. It is therefore no surprise that the growing veteran's movement in Germany has long been reflected in the company's human resources department. Pascal Voß, back then in another role, began addressing this issue specifically with former soldiers in 2019. Today, as Team Lead Talent Acquisition Military Recruiting, he heads a five-person team that focuses on the needs of veterans at Rheinmetall.

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"We offer former soldiers now in civilian careers the opportunity to continue working for the safety of their active comrades in civilian careers", reports Voß. "We coordinate career orientation and work experience trainings for soldiers, conduct application training, organise soldier days at or in collaboration with Rheinmetall sites, and attend soldier-specific career fairs." With success, as his colleague Denise Jäckel adds: "Through recruiting in Germany alone, we were able to hire over 550 new employees with a military background in 2024". But their commitment also goes in the other direction: "Last year and for the first time, we gave those Rheinmetall employees who have not served in the military the opportunity to get in close contact with the army", says Voß. "This allows these colleagues to familiarize themselves with the Bundeswehr as a customer, and to see which requirements are placed on our products and systems in daily military life".

TRIVIA

According to the official definition introduced by the German government in 2018, a "veteran of the Bundeswehr" is "anyone who is serving as a soldier in active duty or has honorably left this service, precisely, one who has not lost the rank". This applies to active and retired soldiers as well as reservists – an estimated ten to eleven million people. This inclusive understanding of the term does not meet with universal approval, especially among those "veterans who were physically deployed". Nevertheless, it is becoming increasingly established in society.

Anyone who meets the definition as a Bundeswehr veteran can apply for the veteran's badge through the Armed Forces Office. The medal with the federal eagle in front of an Iron Cross is not considered a medal or decoration and is therefore only to be worn on civilian clothing.

The central point of contact for all Bundeswehr veterans is the Veterans' Office in Berlin, which was inaugurated in January 2024.

Rheinmetall offers interesting career prospects for soldiers leaving the armed forces from all branches, organisational areas, and ranks. Unsolicited applications can be sent to www.rheinmetall.com/en/career/rheinmetall-top-employer/people-projects/career-extra-soldiers

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What applies to Germany is also standard practice at Rheinmetall's international sites. In its domestic markets in Australia and the United Kingdom, for example, there are cooperation programmes with the local armed forces to provide targeted support for veterans. In the United States, many long-serving and combat-experienced members of the Army, Navy, Air Force and Marines contribute their military expertise to the projects. Spain has launched initial measures, and Hungary plans to focus more intensely on soldiers and veterans.

MUTUALLY POWERFUL

Last but not least, Rheinmetall demonstrated its solidarity with active and retired soldiers through various activities around the first German National Veterans' Day. The commemorative day, which was established by the German Bundestag in 2024 and from 2025 on, will be celebrated annually, is associated with great hopes. Lieutenant Colonel Bohnert: "If we succeed in gradually filling this day with life, it can become the starting point for a real paradigm shift in society's treatment of active and retired members of the Bundeswehr". Rheinmetall made a visible contribution to this: ten sites displayed prominent banners – in Iffeldorf, Penzberg, Bremen, Kassel, Stockach, Unterlüß, Trittau, Weeze, Kiel, and Fronau. The official flag of the organiser was hoisted at the Group headquarters in Düsseldorf. At the same time, a video clip on a large LED screen drew the public's attention to Veterans' Day.

Additionally, Rheinmetall invited participants to its own veterans' event. Around 75 participants from various company locations and guests from the Bund Deutscher EinsatzVeteranen e. V. (Association of German Veterans) celebrated the commemorative day shortly afterwards at Rheinmetall's sponsorship partner BVB Borussia Dortmund in Signal Iduna Park. In addition to camaraderie and conversation, the programme included a stadium tour and sporting activities at the football academy. Initiatives like these clearly demonstrate that the veteran culture in Germany is gaining momentum – and Rheinmetall is part of this important development. ●

2 Around 120 participants took part in the 2025 15K3 march, which commemorates those who fell in the Good Friday battle.

3 Pascal Voß, who heads Military Recruiting at Rheinmetall, in conversation with a soldier.

4 Rheinmetall and Borussia Dortmund invited 75 football enthusiasts to visit Signal Iduna Park.

Infrastructure in deployment

As part of their joint venture, Rheinmetall and the Ukrainian land systems industry are carrying out on-site repairs of military and combat vehicles. Ammunition production is also set to begin shortly, followed by the production of combat vehicles. The necessary infrastructure for this is being provided by Rheinmetall Project Solutions. The challenges are considerable, as is the responsibility – but a young professional is mastering this task with bravura.

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RHEINMETALL UKRAINIAN DEFENSE INDUSTRY
Rheinmetall Ukrainian Defense Industry LLC was founded in Kiev as a joint venture between the Ukrainian state-owned company Ukrainian Defense Industry JSC (UDI, formerly Ukroboronprom) and Rheinmetall. The joint venture has been operative since October 2023. Rheinmetall Land Systems GmbH holds 51 percent of the shares, while UDI holds 49 percent.

The repair work of military vehicles has top priority in Ukraine. But no tank repairs without workshops and functioning infrastructure. Rheinmetall Project Solutions plays a key role in building exactly that. This Rheinmetall subsidiary has lean structures, is highly flexible, and fearless of taking on demanding assignments. The results so far: the first repair centre is already operating at full capacity, the second hall is nearing its completion, and further facilities are already in the planning phase.

One might expect that the task of successfully launching the production plant in war-torn Ukraine is a job for an “old hand”. After all, it requires extensive expertise, paired with a strong talent for improvisation and diplomatic skills. Yet the project manager entrusted with this challenging mission by Rheinmetall Project Solutions is just 29 years old. Simon H. (name changed by the editors) had only just completed his university studies in forestry when he applied to Rheinmetall Project Solutions (RPS) in 2022. His new employer immediately threw the “greenhorn” in at the deep end. “Yes”, proclaims the project manager with a laugh, “handing over a task like this to someone fresh out of university definitely involves a certain risk”. But, in the end, the decision in favour of Simon H. was absolutely perfect.

A HALL BUILT IN 71 DAYS

Rheinmetall Project Solutions is supplying the workshop facilities for Ukraine as part of Rheinmetall Ukrainian Defense Industry LLC (RhUDI). The joint venture agreement covers, on the one hand, the repair of military vehicles provided to Ukraine via the German government and through direct deliveries. On the other hand, the joint

1 As project manager, Simon H. visits Ukraine every four to five weeks to inspect the construction works done by his team.

venture also comprises repairs and maintenance of other combat vehicles coming from the front-line. More than a thousand days after Russia's attack, this support is urgently needed.

Construction of the maintenance hangars should therefore be as fast and as safe as possible. In addition to that, the question of the appropriate location also arose. Since there was previously no European presence in Ukraine, Rheinmetall Project Solutions initially set up a hub in the neighbouring EU country of Romania in close cooperation with the Rheinmetall Land Systems service centre and Rheinmetall Automecanica. "Within 71 days after the order was initially placed, we had successfully delivered, erected, and handed over the hall", says Simon H. He is still justifiably proud of this "speed record" to this day.

NOTHING IS IMPOSSIBLE

Simon H. and his team didn't have much time to rest on their laurels. Shortly afterwards, a decision was made to relocate the hub from Romania to Ukraine. Transporting military vehicles from Romania into Ukraine, being a non-EU state, proved to be a complex undertaking. The local authorities have their own regulations, and despite the ongoing war, the expected level of flexibility isn't always given. "But after a few months, we were asked whether we could relocate the hub to Ukraine, including the full setup and installation", the project manager recalls. Following the motto "nothing is impossible",

Simon H. and his team took a deep breath – and rose to the challenge.

But how to move the hall into Ukraine? Simon H. and his colleagues discussed various options. Many ideas were considered and ultimately rejected. In the end, the so-called green corridor at the Polish-Ukrainian border, which is used to haul NATO and EU aid deliveries into Ukraine, proved to be the only practical solution. “The modular design of our halls is a major advantage”, the project manager explains. “We can simply pack them into containers and transport them on flatbed trucks”. Thanks to this flexibility, the halls can be assembled even under difficult conditions and safely stored should the transport be interrupted. “So, we completely dismantled the hall in Romania, loaded it, and took it to Poland,” says Simon H. From there, the Ukrainian military took over the rest of the transfer. The advantage of that: the transport route was secure. The downside: once handed over, there was no longer any way to track the shipment. “It took over a week for the first hall to arrive at its destination”, the project manager recalls.

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2 Heavy rainfall in spring and autumn turns everything into mud – a major challenge for Rheinmetall Project Solutions’ factory construction project in Ukraine.

3 and **4** A concrete slab with a load-carrying capacity of over 60 tonnes provides a stable foundation for the new maintenance hub, where damaged gun turrets will be repaired for return to the frontline just a few months later.

THE NEXT LEVEL

Once all the trucks carrying the containers had arrived, the real work for Rheinmetall Project Solutions began. As soon as it was confirmed that the hub would be relocated directly into Ukraine, Simon H.’s team, in coordination with RhUDI, began preparing the construction site at the new location. “There was still rubble and remnants of an old building on the site”, he explains. “We took care of the clearing and then erected the new hall on that ground.” This repair hub has been in operation since 2024, but it wasn’t the only one. The order for hub number two arrived while the first workshop was still being built.

The site was literally in the middle of nowhere. “The area we were given was sloped and covered with mud.” Preparing the ground proved to be a particularly demanding task. “The rainy periods in autumn and spring in Ukraine are a real challenge”, explains Simon H. “Everything gets stuck in the mud. We had to make sure our hall was built on solid ground.” This required extensive groundwork. To create a stable foundation, the team first levelled and compacted the soil, then installed a concrete slab capable of supporting more than 60 tonnes.

“The infrastructure we are building has to be universally usable and suitable for all types of vehicles”, says the project manager. Whether it’s trucks, Marder infantry fighting vehicles,

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Leopard main battle tanks, or self-propelled howitzers with their massive turrets – all of these military utility and combat vehicles can be serviced and repaired in the halls by Ukrainian specialists. Rheinmetall Project Solutions also takes care of the supporting infrastructure, from electrical and fresh-water connections to office and medical containers.

THE MARDER PROTECTS LIFE

Project management also requires being present – which is not without risk in a war-torn country, even though everything is done to ensure the safety of the German cooperation partners. "I am regularly on-site every four to five weeks", says Simon H. "Due to the security situation, we try to minimize our stays in Ukraine. However, for certain stages of construction, my presence is indispensable. I can't manage a project without having seen the progress myself or spoken to the people working there. Having someone send me pictures of the site via WhatsApp is, of course, not possible for security reasons." His first trip to Ukraine left an everlasting impression on the young project manager: "It was so surreal. You fly to Poland, and everything is fine. Then you pass the border, and it's like being in a time warp. That's when I truly understood what the EU can mean for Ukraine".

By now, Simon H. has seen many of the vehicles that have come in from the frontline for repair.

"When you look at the Marders that have been heavily damaged by drones and other attacks, it makes you feel uneasy. You think about the crew – but then, the crew compartment is intact!" He notes that German equipment is extremely valued by the soldiers, precisely because casualties are so rare. That's why everything must be repaired as quickly as possible and returned into service. The motivation of the Ukrainian and German staff from RhUDI and Rheinmetall Land Systems on-site is "incredibly high", says the project manager. "If work is necessary on a Saturday or Sunday – there is no discussion whatsoever." Because they all know: every day, every hour without these urgently needed vehicles aggravates things for the troops on the frontline.

A MARATHON, NOT A SPRINT

And what about the Russian military? How is it possible, given the surveillance and reconnaissance capabilities of Putin's forces today, to build halls of this scale without being detected? Especially when taking into consideration that the founding of RhUDI and its activities have been reported in Western media? "The halls are still standing", says Simon H., and he hopes it will stay that way. "We keep our communication flows as limited as possible. And of course, Ukraine also has a strong interest in protecting these sites."

In addition to further maintenance hubs, Rheinmetall Ukrainian Defense Industry is planning the infrastructure needed for the production of ammunition and combat vehicles. "It's a marathon, not a sprint", says Simon H. Even if the war would eventually come to an end, something everyone is hoping for, the work will be far from over. Rheinmetall was one of the first companies to stand firmly by Ukraine's side following the Russian invasion and will, if called upon, continue to support the country in the future, both in reconstruction and in securing its borders.

That is why individuals like Simon H. are so important in their commitment and dedication. As a career changer and young professional, he found his dream job at Rheinmetall: "Finding an employer who places so much trust in you felt like winning the lottery", says the project manager. "And it is incredibly rewarding to see a purpose in your work." He recommends that young people looking for an interesting job simply drop in for a taster or send a speculative application. It doesn't always have to be Ukraine. "There are so many opportunities within the Rheinmetall group!" ● *Pk*

25 YEARS OF OPERATIONAL EXPERIENCE

When the German Bundeswehr participated in the peacekeeping mission in Kosovo in 1999 as part of its KFOR mandate, Rheinmetall supported the German troops for the first time with its maintenance services. Since then, the portfolio and customer base of this business area have expanded continuously. Today, the subsidiary Rheinmetall Project Solutions, founded in 2021, offers its military partners a comprehensive range of practical services, even in dangerous deployment areas around the world. These include the provision of infrastructure for military camps and field hospitals, integrated logistics services, airfield support, field camp protection technologies, and the disposal of munition dumps, such as in the Baltic Sea.

POPULAR RAPID-FIRE GUN

While the High Command of the German Army initially decided against purchasing Rheinmetall's innovative recoilless gun around 1900, the 7.5 cm field gun was in high demand internationally. Alongside Norway and the USA, Great Britain was among the first buyers. The advantage was that soldiers no longer had to reposition the gun after firing, which allowed a much higher firing rate per minute compared to static field guns.

TIME LEAP
STORIES FROM 135 YEARS OF RHEINMETALL

1909

From exporter to global player

Rheinmetall exported its first products at the end of the 19th century. Today, the technology and defence corporation generates about 70 percent of its sales abroad. An excursion through the eventful history of Rheinmetall's internationalisation.

→ More at
www.dimensions-magazin.de/en

1929

In 1929, Rheinmetall acquired its first foreign holdings in Switzerland and the Netherlands. There, the company manufactured and sold weapons for which it did not have production permits within the German Reich under the Treaty of Versailles. Over nine decades later, the technology corporation is now operating in 32 countries with subsidiaries, joint ventures, and holdings.

After World War II, civil engineering and electrical engineering initially dominated business abroad. Following the acquisitions of Pierburg (1986) and Kolbenschmidt (1997), and the strategic focus on the automotive market, Rheinmetall's international presence reached a new dimension. Exports of defence equipment remained low until the end of the Cold War due to the War Weapons Control Act. Alongside its main customer, the Bundeswehr, mainly NATO countries were placing orders at the Düsseldorf-based defence and technology corporation until 1991.

A GLOBAL GATHERING IN UNTERLÜSS

Built in 1899 specifically for foreign customers, the firing range in Unterlüß quickly became a magnet for high-ranking military personnel from all over the world. Even a Chinese delegation visited the test site to see the quality of Rheinmetall products for themselves before placing an order.

EXPORT HIT HS 820

One of the products that achieved considerable success abroad during this period was the 20 mm HS 820 cannon. Further developed into the Rh 202, this weapon has been in effective in service since 1964 as an on-board cannon on infantry fighting vehicles, ships, and helicopters. From 1967 onwards, the cannon has also been used by the US armed forces.

51%

of total exports were accounted for by defence technology for the first time in 1998. The portfolio has continued to expand: in addition to rifles, ammunition and artillery, Rheinmetall has been manufacturing land vehicles since 1992, defence electronics since 1997, and air defence products since 1999. Today, the globally active corporation is among the largest defence companies in Europe.

Thinking big

Military operational readiness requires a resilient energy infrastructure. In the event of an invocation of the EU's mutual defence clause or NATO's Article 5, European nations can ill afford to rely on fragile supply chains for fossil fuels. So why not instead produce e-fuels on a large scale independently and locally? This is about a vision beyond the ordinary.

POWER-TO-X (PTX) incorporates all processes that convert renewable electricity into gaseous or liquid energy carriers. The "X" refers either to the energy form (e.g. gas, liquid, heat) or its intended use (e.g. fuel, chemicals, ammonia).

The Ukrainian war shows that energy is a critical military capability. When key fuel depots and supply chains are attacked, tanks are left stranded due to a lack of fuel. Also, the power supply is frequently and heavily targeted: power plants, transformers, and grid networks. At this stage, more than half of Ukraine's energy capacity has been destroyed or severely damaged, with devastating effects on both the population and the economy.

NATIONAL RESILIENCE

If Germany and the allied NATO partners in Europe want to avoid strategic vulnerabilities within their own ranks in the future, new disruptive approaches to energy supply are needed – approaches that enable greater autonomy, diversification, and geographical distribution. Otherwise, achieving a high level of overall national resilience would not be possible, says Shena Britzen, head of the Hydrogen Programme at Rheinmetall. "We need to think in terms of logistics", emphasises the energy and military expert, "and we need to think on a large scale". Rheinmetall's approach is a European network made up of several hundred decentralised production facilities for synthetic fuels, each with an annual output of between 5,000 and 7,000 tonnes.

RHEINMETALL'S PROJECT VISION: GIGA PTX

"Electricity, water, and CO_2 – that's all it takes to produce so-called e-fuels", says Britzen. Each facility in the Giga PtX network is designed to operate autonomously, powered by locally generated renewable energy from sources such as solar, wind, or geothermal. The plants are equipped with in-house electrolysis systems for hydrogen production, carbon capture technologies to extract CO_2 from industrial emissions, and reactors for synthesising diesel or kerosene. In this project, Rheinmetall is working in close partnership with INERATEC, a spin-off from the Karlsruhe Institute of Technology. The Baden-based company is the global market leader in advanced, modular power-to-liquid systems.

SUSTAINABLE KEROSENE
Sustainable aviation fuel (SAF) are the first step towards a climate-neutral future in aviation. From January 2025, EU regulations require at least 2 percent of aviation fuel to consist of SAF. By 2030, the addition of at least 1.2 percent of synthetic fuel (e-fuels) will also be mandatory. Both targets will be elevated in five-year intervals until 2050 – reaching 70 percent SAF and 35 percent e-fuels. Currently, according to the environmental organisation Transport & Environment, SAF accounts for less than 0.5 percent of total aviation fuel use.

20.5 MILLION TONNES OF FUEL PER YEAR

What makes e-fuels particularly attractive for the armed forces is their availability during times of conflict. Unlike HVO100, a diesel fuel derived from hydrotreated vegetable oils, now available at civilian fuel stations, the raw materials needed for e-fuels can still be sourced in sufficient quantities even in wartime. In 2024 alone, Germany emitted around 650 million tonnes of greenhouse gases. "CO_2 is available in abundance and at low cost", says Britzen. "For every kilogram of fuel, we only need three to four kilograms of CO_2." According to Rheinmetall's calculations, the Giga PtX network could produce 20.5 million tonnes of e-fuels annually for Europe, which is precisely the volume needed to cover fuel demands in a collective defence scenario. "Germany's share in the project is set at 5 percent", Britzen adds. "That corresponds to an annual output of around one million tonnes – far more than the Bundeswehr requires in peacetime."

This overcapacity could be sold on the open market, allowing the Government to recoup the initially high investment costs. One of the major advantages of synthetic e-fuels is their compatibility with existing vehicle and aircraft fleets, both civil and military. These so-called drop-in fuels can be used without technical modifications, or, in the case of older systems, with only minimal additives. And demand is set to increase – especially in aviation. Since 2025, flights departing from Europe are required to blend a climate-friendly fuel alternative in their kerosene.

ENERGY AUTONOMY THROUGH E-FUELS

Rheinmetall and its technology partners could implement the Giga PtX concept across Europe within five to ten years. This is made possible by the modular design of the production units. Once the prototype facility has been finalised and dimensioned, it can be replicated quickly and efficiently. The required technologies are already well-engineered and proven in practice. While the overall project cost is expected to be in the three-digit billion range, these investments can be more than amortised over the lifetime of the facilities. "Our vision isn't the cheapest solution", says Britzen, major in the Bundeswehr Reserve. "But it is the fastest and most resilient path to fuel readiness in a defence context." The fully self-sufficient production sites require no connection to the public power grid and can be established literally anywhere – ideally nearby military units or existing pipeline systems. This decentralised deployment significantly reduces their vulnerability to attack.

MOMENT OF DETERRENCE

With a PtX project of this scale, Rheinmetall is entering a new and largely unrivalled market. The defence corporation is currently in discussions with numerous ministries of defence to convince them of the extraordinary idea. In addition to the project's high resilience and amortisation, Britzen emphasizes another compelling argument – deterrence: "The message to our adversaries would be substantial: we Europeans can produce our own fuel. Our energy supply is secure, even in times of war". ● *Pk*

→ For more information on this topic, please visit
www.dimensions-magazin.de/en/the-driving-force/

Combustion engine versus electric drive

Combustion engine or electric drive? Both concepts score points beyond pure figures, data, and facts with emotional moments and a high level of driving pleasure. The duel between the two rivals is almost inevitably heading for a tie.

Author: ***Richard Backhaus***

RICHARD BACKHAUS is a technology journalist and has been covering all aspects of future mobility for more than 30 years.

COMBUSTION ENGINE

A combustion engine isn't just started; it's more or less awakened to life. In idle mode, it vibrates with a gentle pulse, breathing in and out as it waits for new tasks. A quick jab of the accelerator and its eager babbling transforms into an aggressive snarl. There's no doubt: this is an extroverted creature at work, eager to show off its strength with a roar. When driving, the engine and gearbox enter

ELECTRIC DRIVE

Battery-powered electric driving can be summed up in one simple phrase: hit the accelerator and have fun! The unrivalled performance of the electric motor, delivering maximum torque from the very first revolution, combined with direct power transmission without a power-sapping clutch or traction interruption during gear changes, results in acceleration that inevitably puts a smile on your face.

a symbiotic state that results in a unique, even sensual surge of power. It is not mathematically linear but follows its own laws; one can sense that experts with petrol in their veins have fine-tuned the complex interplay of torque and output to achieve an optimum performance. And when the work is done, a quick press of the off button interrupts the engine's circle of life. The fuel supply and ignition are cut off, the crankshaft turns once more, and only the ticking and clacking

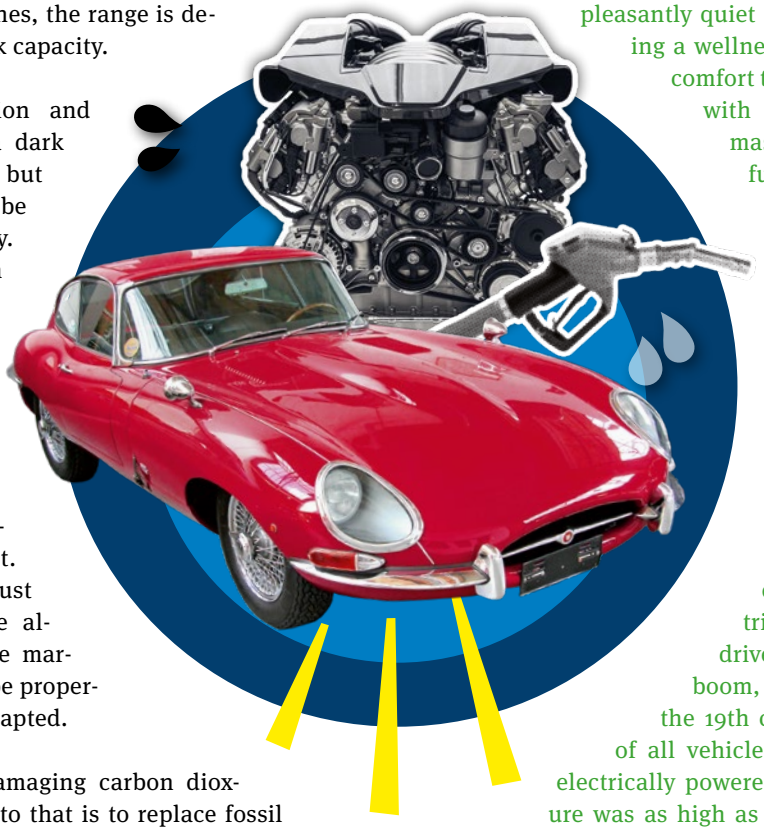
By firmly pushing down the pedal, you can feel like being behind the wheel of a dragster trying to outrun its competitors in a quarter-mile acceleration duel. The triumphant glance goes to the car next to you, still trying to keep up with its antiquated combustion engine.

While the driver enjoys moments of exhilaration, the electric drive remains calm and restrained. It is present, but never intrusive, preferring to let its

as the engine cools bear witness to the previous display of muscle power. Compared to other drive concepts, the combustion engine may be an old-school roughneck, but it is one with a soul and character. Whether it's a family van, sports car, heavy-duty truck, construction machine, or ocean-going liner on a long voyage – there's no getting away from the combustion engine. This is especially true when high performance is required over long periods of time, such as in industrial applications, and also in motorsport. There is no such thing as giving-up in its world. As a powerful endurance athlete, it is the undisputed long-distance champion, while electric drives, with their overly expensive batteries, run out of steam after just a short sprint. With combustion engines, the range is defined solely by the tank capacity.

Emissions manipulation and fraud scandals cast a dark shadow over its past, but this can no longer be held against it today. Especially since, from a technical point of view, it undoubtedly has what it takes to be "Mr Clean". The developers' goal is "zero impact emissions", i.e., pollutants in concentrations below the detectable limit. The necessary exhaust treatment systems are already available on the market; they just need to be properly dimensioned and adapted.

Concerning climate-damaging carbon dioxide, the only solution to that is to replace fossil fuels with alternative ones. Indeed, this idea is not new. Henry Ford actually wanted to run his legendary Model T on biofuel. Farmers in the USA were supposed to produce it from their crop waste and sell it directly off the roadside. As we know, things turned out differently because the oil industry took over the market very quickly with a

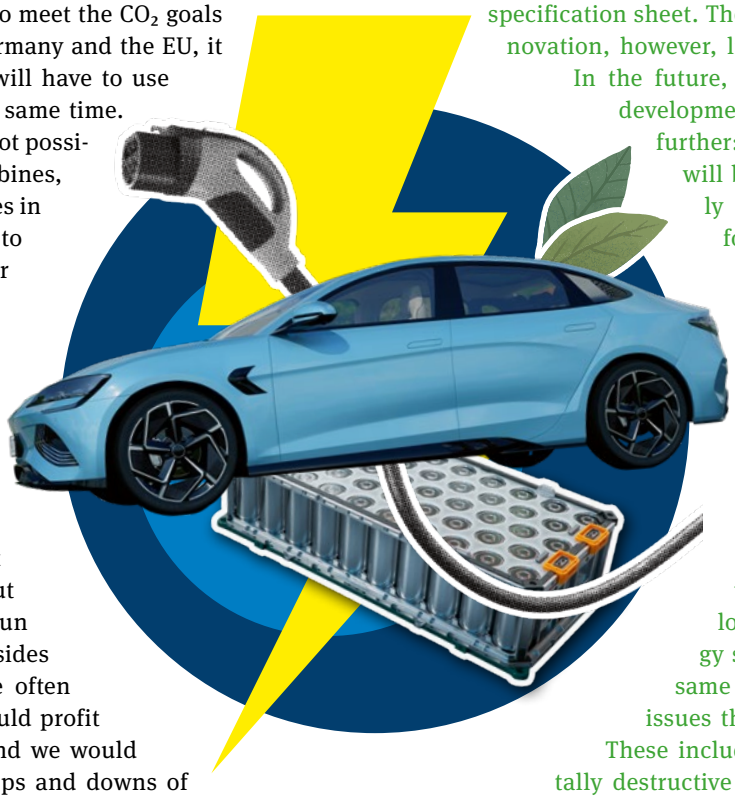


1 Classic cars such as the Jaguar E-Type have had a lasting influence on automotive design. With its flowing lines, long bonnet and elegant rear end, this iconic coupé is still considered one of the most beautiful cars of all time.

performance speak for itself. Instead of petrol, electrons flow through the electric car: plus and minus, cathodes and anodes, electrons and protons, charging and discharging – who would deny that a drive system based on the balancing of charges, which in a sense strives for perfect harmony, has something calming about it, especially in today's polarised world? However, should drivers change their mind, the electric drive can also show a different side. You drive gently, glide along the road, and enjoy the smooth delivery of power. Since the electric drive is virtually silent, it is the sound of the tyres on the road, the rush of the wind and the hum of auxiliary systems like the air conditioning, power steering, and brakes that shape the pleasantly quiet ambience. The car is becoming a wellness oasis, often offering more comfort than the living room at home, with additional features such as massage seats and infotainment functions. The step towards automated driving, which completely relieves drivers of the stress and strains of daily traffic thanks to an electronic autopilot, is just around the corner. In addition, drivers can enjoy the fact that they are driving without locally producing CO_2 emissions.

The unrivalled comfort and ease of easy handling of electric drives were already key drivers of the first electric car boom, which began at the end of the 19th century. By 1900, 40 percent of all vehicles in the United States were electrically powered, and in New York, the figure was as high as 50 percent. The peak of the electric car wave came in 1912; after that, it was a steep decline until electric cars became nothing more than a footnote in the history of technology. After electromobility re-entered the race for the crown of future drive evolution a few years ago, it has been rapidly gaining ground on the combustion engine, and in many areas it has

large network of petrol stations.
When discussing alternative fuels, critics often point to the lower efficiency of their production compared to the direct use of electricity from wind and solar power plants in electric cars. Ultimately, this objection is pointless. If we seriously intend to meet the CO_2 goals we have set ourselves in Germany and the EU, it is needless to say that we will have to use both forms of energy at the same time. This is because it is simply not possible to build enough wind turbines, solar panels, and supply lines in Germany quickly enough to fulfil the huge demand for alternative energy sources that will be required when phasing out fossil fuels. Not to mention the insufficient market penetration of electric cars. So why not take a pragmatic approach and produce green energy in areas of the world that are sparsely populated but have sufficient wind and sun – and then import it? Both sides would surely benefit: these often underdeveloped regions would profit from an economic boost, and we would be less dependent on the ups and downs of the electromobility industry and its major players in China. We also wouldn't end up slowing down our economy quite so drastically. Whether the price of fuel generated from renewable sources can compete with the direct use of locally generated solar and wind energy is something that should be decided by market forces rather than at negotiating tables. Another advantage of e-fuels – alternative fuels with chemical and physical properties similar to petrol or diesel, is their backward compatibility with vehicles already on the road. E-fuels can be mixed with fossil fuels or even used in their pure form, turning every vehicle in the existing fleet into a climate-friendly eco-mobile. The combustion engine is far from being out of fashion!



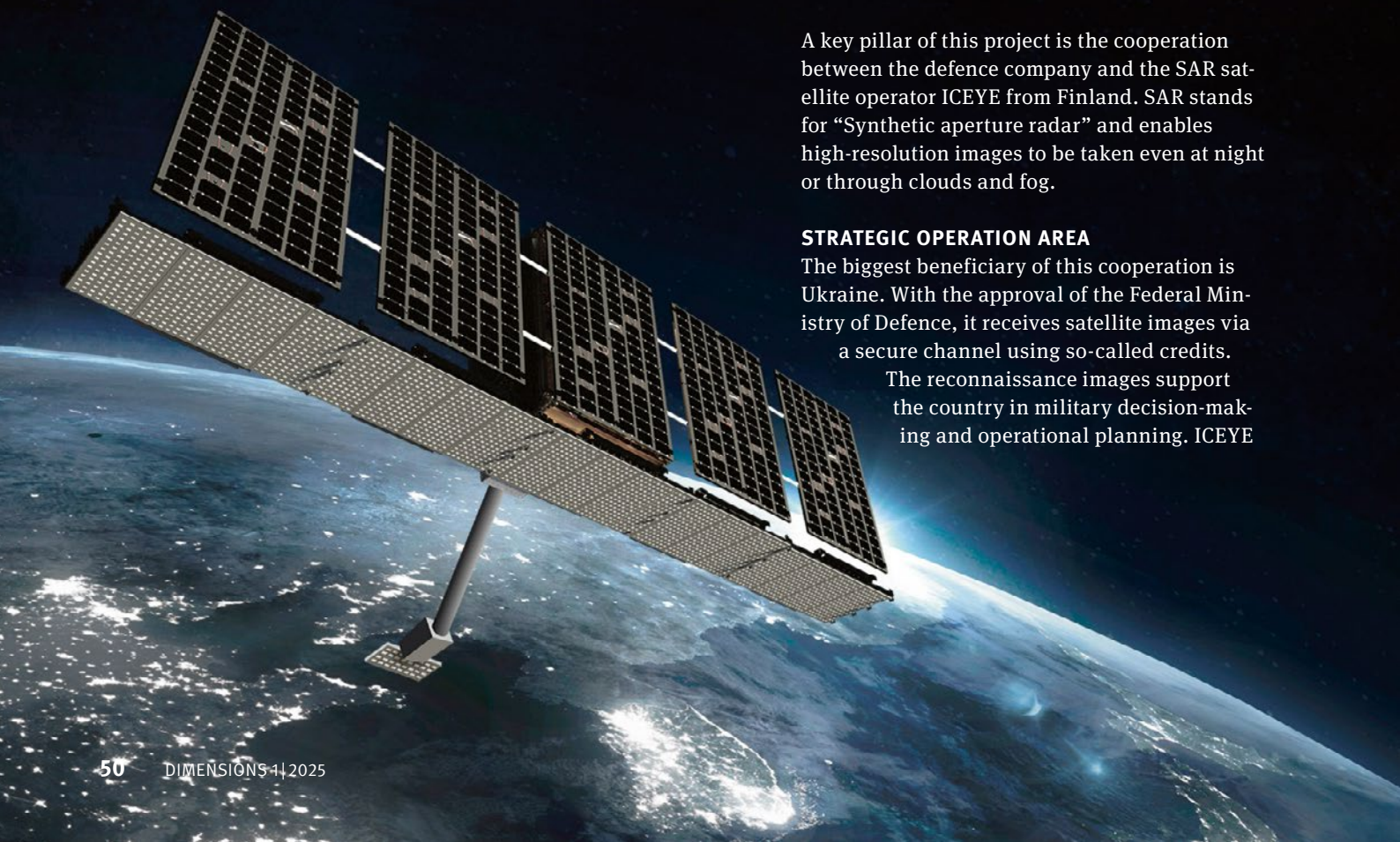
2 Even though some battery-powered models such as the VW ID.Buzz or the Renault R5 revive nostalgia with their retro-futuristic design, the majority of electric cars will look quite similar in the future. The battery structure in the chassis body offers little room for experimentation.

already overtaken it. There are many levers of technical progress. Concerning electric motors, these include high engine-speed concepts, improved thermal heat dissipation for higher continuous output, and general measures to increase efficiency in the specification sheet. The greatest potential for innovation, however, lies in battery technology. In the future, the gap between battery development is set to widen even further: on the one hand, there will be affordable but relatively low-performance systems for the mass market, such as lithium iron phosphate and sodium-ion batteries; on the other hand, there will be high-tech lithium-ion batteries designed for high performance and ultra-fast charging. Solid-state batteries are considered to be the benchmark for the next or even the follow-on generation of energy storage technology. At the same time, there are still urgent issues that need to be addressed. These include the often environmentally destructive mining of raw materials, the working conditions in local mines, and the geopolitical tensions with the exporting countries.

The vehicle of tomorrow will undoubtedly be electric. Filmmaker Robert Zemeckis was well aware of this when he had smart Doc Brown convert the DeLorean to electric drive before sending it back in time in the blockbuster film *Back to the Future*. Even today, electric cars offer locally emission-free mobility with a high level of driving pleasure and comfort. Thanks to continuous development, they will soon be able to perform even better at a lower price. The real question is therefore not if, but rather when, to get on board and start driving into an electrified future. For Doc Brown, it was in 1985.

Data out of orbit

Satellite images have long been indispensable for civil and military applications. In cooperation with the Finnish company ICEYE, Rheinmetall already has access to state-of-the-art technology. With its newly established Space department, the corporation is setting the strategic course for this important market.



The newly founded department with a focus on space does not even have a dozen employees yet. But the unit, which only began its work in January 2025, will soon be noticeable within the corporation. “Access to, and having control of, space-based reconnaissance, communications, and mission control are essential for modern armed forces”, says Chief Digital Officer Dr Timo Haas, who is responsible for the new department within the Electronic Solutions division. “We consider the integration of space expertise as being a key component of the digital transformation of defence.”

A key pillar of this project is the cooperation between the defence company and the SAR satellite operator ICEYE from Finland. SAR stands for “Synthetic aperture radar” and enables high-resolution images to be taken even at night or through clouds and fog.

STRATEGIC OPERATION AREA

The biggest beneficiary of this cooperation is Ukraine. With the approval of the Federal Ministry of Defence, it receives satellite images via a secure channel using so-called credits. The reconnaissance images support the country in military decision-making and operational planning. ICEYE

has put 48 satellites into orbit since 2018, a small number of which Ukraine can use for its defence against Russian forces.

SATELLITE PRODUCTION IN NEUSS

After Rheinmetall secured the distribution rights from the Finnish satellite manufacturer last year, the two companies are now planning to intensify their cooperation and to establish a joint venture for satellite production. The joint venture, in which Rheinmetall will hold 60 percent of the shares and ICEYE 40 percent, plans to start production of SAR missiles at the Rheinmetall plant in Neuss as early as 2026.

THE BAT PRINCIPLE

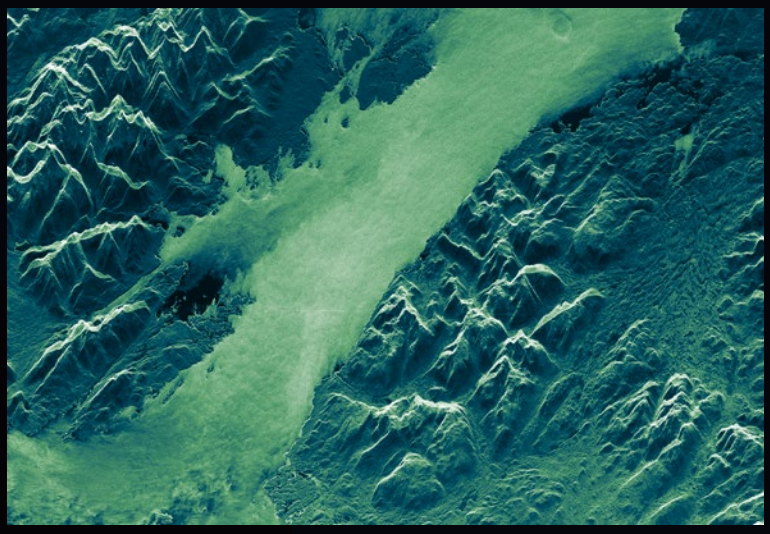
What makes SAR satellites so special? "They work in a similar way to echolocation in bats", explains Dr Nadja Peterseim, head of the Space Department. Trained in geodesy and space technology, the engineer has the ideal background for this task. The SAR radar emits a high-energy wave towards Earth. The type of objects detected can be determined based on the time it takes for the wave to be reflected and also the way in which it is reflected. As the satellite moves around the earth, many reflections are recorded in succession, which can then be mathematically put together in order to create a sharp image.

"For example, an aircraft wing reflects differently than asphalt", says Peterseim. This means that detailed information can be provided in a very short time. From a distance of 500 km above the earth's surface, a SAR satellite can detect objects as small as 30 cm. Thanks to this special data analysis, a Ukrainian tank crew can detect the presence of objects, where they are located, and whether there have been any changes since the last detection.

QUICK REACTIONS ARE REQUIRED

An important element in the space value chain: a satellite integration and testing centre. The test centre, called Rheinmetall Integration & Processing Facility (RhIPF), is scheduled to be operational in 2027. It is located on the northern part of the Norwegian island of Andøya as part of the local spaceport. For example, RhIPF works together with Isar Aerospace, the first German company to launch satellites into space from Andøya using its own carrier rockets.

This is not just a matter of "classic" satellite launch, but also of what is known as tactical responsive launch: if need be, critical satellites can be replaced within a very short time, which could play a role in a major crisis or war scenario.



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EUROPE HAS A BACKLOG

Rheinmetall's activities in the space dimension come just at the right time: "ISR (Intelligence, Surveillance, and Reconnaissance) is a crucial component of modern tactics, operations, and defence strategies. This increasingly includes observation and reconnaissance procedures in the space segment", says Peterseim. "If drones or tanks were to be seamlessly connected to this flow of information, the benefits in tactical efficiency and the increase in the effectiveness of a unit would be significant. And this is where Europe has a lot of catching up to do." The global political events of recent months show that Germany and Europe must be able to act more independently, especially in military matters. ● *Pk*

1 and **2** With its advanced satellite technology, Finnish company ICEYE provides high-resolution images of the earth's surface – even at night or in cloudy or foggy conditions. The images are extremely useful for military reconnaissance. Rheinmetall is currently examining the design and operation of its own satellite constellation. With the data thereby obtained, it would be able to make a significant contribution to German and European sovereignty in space-based reconnaissance.

A place in the sun

PORTRAIT
RHEINMETALL POWER SYSTEMS HARTHA PLANT

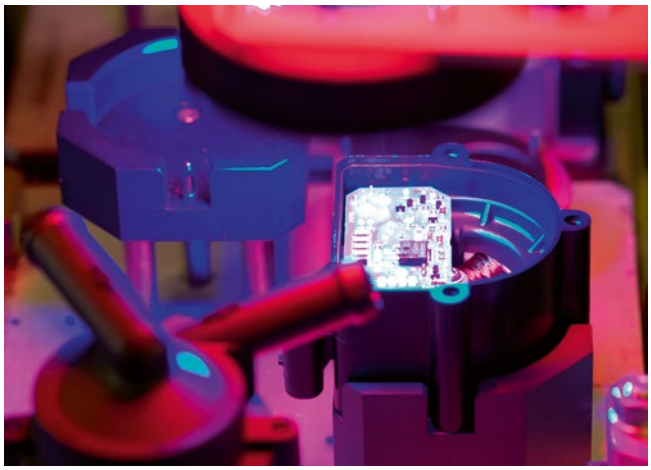
What do a Soviet space capsule, a Japanese auxiliary heater, and an American fuel cell truck have in common with a Polish record player? The answer to this seemingly difficult question is that all of them might contain electric motors from the Rheinmetall plant in Hartha.

Author: ***Folke Heyer***

1

1 and **2** Extremely high-quality standards demanded by customers in the automotive industry and other sectors require continuous quality control and, where necessary, reworking. Machine adjuster Steffen Scheinost at a specially equipped reworking station for the water recirculation pump (WUP) developed in Hartha.

3 In the new capacitor production facility, a state-of-the-art NanoLam facility produces a layer of tiny inverters. Employee Axel Czychon during the so-called harvesting of the ultra-thin laminates.



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For over 100 years, electric motors have been manufactured in the small Saxon town of Hartha, which has a population of just 7,000. Over the past century, the company has built up extensive experience in the development and manufacture of all types and sizes of electric motors, which are used in a wide variety of products and industries. In addition to its technologies for combustion engines, the plant is therefore also at the cutting edge of electromobility. But not only there!

AN EXAMPLE OF GERMAN HISTORY

At the same time, the history of this traditional location in the triangle between Chemnitz, Dresden, and Leipzig reflects German history. Founded in the economically turbulent year of 1922, the plant's product portfolio had already been affected by World War II, and its conversion into a state-owned enterprise in former East Germany did the rest. Hartha quickly became one of the most important and largest electric motor manufacturers east of the river Elbe. With up to 3,200 employees at nine production sites, ELMO – then known as VEB Elektromotorenwerk Hartha Sachsen – also supplied the former Eastern Bloc with electric motors. This period also saw the emergence of a special defence technology facet of the site, which at the time carried out orders for the East German Army under the utmost secrecy, and even manufactured electric motors for the Soviet space programme, which were used to adjust cameras in space capsules and satellites.

WIDE RANGE OF PRODUCTS

The list of innovations and components "Made in Hartha" is tremendous. To mention just a few: since the 1990s, the portfolio ranges from vacuum pumps and motors for electric fuel pumps to plastic suction pipes, electronic throttle controls, drives for truck exhaust gas recirculation systems, and secondary air pumps to the latest water circulation and coolant pumps. These are complemented by products for electromobility and new drive systems, such as a hydrogen recirculation blower for fuel cells and an extremely powerful 2,000-watt electric coolant pump.

RISING FROM THE ASHES LIKE A PHOENIX

The site, which was literally lying on the ground after the fall of the Berlin Wall, has developed continuously since its takeover by the Rheinmetall group in mid-1992. The Rheinmetall subsidiary Pierburg invested heavily in renovating buildings in need of refurbishment and replaced the machinery. "We are proud of the growth and seamless integration into our corporate group that has developed under the changing management teams" says Mario Schäfer, who has been managing the Saxony plant since 2017. For the production specialist, the integration of his site into the corporation's development activities is particularly important. "With our trained team on site and in cooperation with our central development department in Hartha, we have developed a significant number of products which today make a major contribution to the success of the site and the entire corporate group, and will continue to do so in the future. To accomplish this, we have a team of 51 people working in this area alone in Hartha. They make

up more than an eighth of the total workforce. This illustrates another focus of this site in addition to our manufacturing expertise".

From humble beginnings, Hartha saw growth not only in sales but also in its buildings as new products soon required new production halls. This even involved complex electromagnetic coupling of the hall floor, which ensures that employees are permanently earthed, so that sensitive circuit boards and electrical circuits are not damaged by flying sparks.

WATER CIRCULATION PUMP BECOMES A SUCCESSFUL PRODUCT

Together with their colleagues at the headquarters in Neuss, the Hartha team developed the "WUP", an electrically commutated water recirculation pump that does not require any wear-prone brushes. This outwardly unremarkable component, which can be used in a wide range of applications, quickly became a million-seller. By now, the fourth generation of this little all-rounder is rolling off the production line in the largely automated Saxony factory and has exceeded total production of 100 million units. In 2004, Hartha also became the central manufacturing site for an electrically driven coolant pump – a global novelty in the automotive sector at the time. It enables demand-based control of the coolant flow in the engine and is now an internationally sought-after product, not least in view of increasingly stringent exhaust emission regulations. It is also used in new drive forms.

5

4

"The areas of application for our pioneering capacitors are extremely diverse".

Another positive effect of the plant's successful story is reflected in the increased number of employees. Today, the plant has 360 employees, with current and future products potentially offering further growth opportunities.

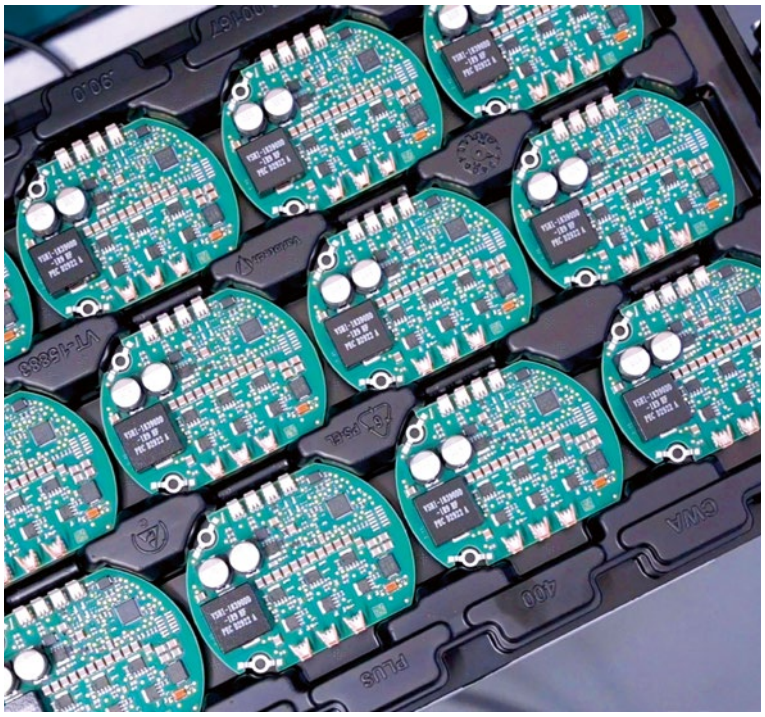
MAJOR SUPPLIER

Today, the site is not only an extremely important supplier to the automotive industry. Products from the small Saxon town are to be found in drivetrains but also, for example, in auxiliary heaters and in cooling systems for electronics and seats. In addition to this traditional portfolio, the plant is constantly driving forward a comprehensive transformation of its product range. The Hartha team is also focusing on new technologies in the fields of mobility, digitalisation, home automation, and energy.

But the proverbial Saxon inventiveness and the team's constant focus on the future go even further. Innovative miniature capacitors, the latest product from Hartha, have recently elevated the plant into a completely new era and given it a huge lead over its global competitors. For this, several million euros have been invested in a new production hall and the corresponding production lines at the site. The latter are the only ones of their kind outside the USA.

FUNDED BY THE STATE OF SAXONY

The Free State of Saxony has also recognised this internationally outstanding position and



6

4 With his extensive experience as production manager at the Hafenmole site in Neuss, Mario Schäfer has been managing the plant in Hartha since 2017.

5 In-house maintenance – here, employee Max Funk is seen performing welding work – contributes to the high availability of the facilities at the Saxony site.

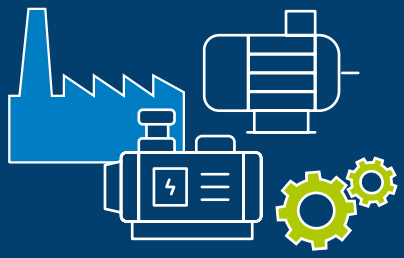
6 Modern electric coolant pumps have a complex innards with extensive control systems. Electronic components for pumps with a power output of 400 watts are ready for use in the production process.

decided to subsidise the manufacture of these new progressive products with seven million euros. These tiny technical marvels consist of thousands of microscopic nano-layers and are ultimately no bigger than a matchbox. “The areas of application for our capacitors, which are mainly used in inverters, are extremely diverse, not least because of their small size”, says Schäfer. “Our exceptionally space-saving components can be used wherever direct current needs to be converted into alternating current. In addition, our existing machinery enables us to produce larger high-voltage capacitors according to customer requirements.”

The range of applications for these products, which are new to the plant’s overall portfolio, stretch from solar and wind power systems to automotive engineering and (yet again) to aerospace. Numerous other industrial sectors can also be added. This gives lasting confidence in the future development. “In Hartha, we have extensive compensation options and an innovative product range”, says the plant manager, “which enable us to maintain and expand our favourable market position even in the current difficult times within the global automotive industry”. It is therefore no surprise that the Rheinmetall plant in Hartha, Saxony, has been located on what is now Sonnenstraße (eng. “Sun Street”) since the mid-1930s. “Nomen” is not just a proverbial “omen”. ●

RHEINMETALL POWER SYSTEMS

Founded in 1922, the plant in Hartha has been part of the current Power Systems division of Rheinmetall AG since 1992.



BUSINESS FIELDS

The plant in Hartha develops and produces electric pumps and motors in various performance ranges, and for different tasks in vehicle technology and beyond. In addition, the focus is on new technologies in the fields of mobility, digitalisation, home automation, and energy.

STAFF

360

51 developers, 8 apprenticeships, 6 dual students in the Bachelor’s degree programme “Digital Engineering”.

FROM A FORMER STATE-OWNED ENTERPRISE TO AN INTERNATIONALLY SOUGHT-AFTER AUTOMOTIVE SUPPLIER

EUR 240

Million have been invested by Rheinmetall in modernising the site since taking over the plant in Hartha, Saxony.

Good question

What drives communication? Here are the answers. Because right now, Rheinmetall is in the focus like no other company. Here is a cross-section of the dozens of media enquiries that reach the DAX-listed corporation every day from all over the world.

In light of the crisis in the automotive industry, what does the future hold for Rheinmetall's civil business?

Business in the Power Systems division has been slightly declining recently. The industry trend currently offers automotive suppliers in Germany little opportunity for growth. From a strategic perspective, automotive supply is therefore no longer part of Rheinmetall's core business. The corporation wants to offer its employees secure prospects. Rheinmetall is therefore converting two plants from the civil business and making them available for the security and defence industry. The Berlin plant (formerly Pierburg) has been assigned to Rheinmetall's military division since 1 July 2025 to manufacture metal components for projectiles. The Neuss plant in the Lower Rhine region, parts of which will become a site of the Weapon and Ammunition division on 1 October 2025, will in future manufacture protection systems (armouring). The executive board of Rheinmetall AG is currently seeking solutions for the remaining activities of the civilian Power Systems division. Purchase enquiries from potential interested parties are being examined thoroughly.

How will Donald Trump's tariff policy affect Rheinmetall?

Rheinmetall has continuously strengthened its industrial base in the United States in previous years, most recently through the acquisition of the long-established manufacturer LOC Performance. This makes Rheinmetall part of the US defence industry foundation. American Rheinmetall now manufactures defence industry products at eleven sites in the country as a "fully American" supplier. The products offered by Rheinmetall in the USA are therefore not affected by any US import custom duties. In addition, the company is well positioned in two major US programmes: the XM30 combat vehicle and the Common Tactical Truck (CTT).

What would a sudden end to the war in Ukraine mean for Rheinmetall?

Even if peace is achieved in Ukraine, Inspector General Carsten Breuer, the highest-ranking officer in the Bundeswehr, believes that Russia will continue to massively increase its number of troops. Accordingly, the Russian armed forces want to have "reconstituted themselves by 2029 in such a way that an attack on NATO territory would be possible". At their summit in June 2025, NATO member states decided that in the future they will invest five percent of their GDP in security and defence. The five percent mark should be reached by 2035 at the latest. Previously, the target was two percent. In his first government statement in the German Bundestag, Chancellor Friedrich Merz announced that the federal government intends to "provide in future all the financial resources the Bundeswehr requires to become the strongest conventional army in Europe". In this respect, Rheinmetall expects a decade of rearmament in Europe – even if the war in Ukraine should be ended through diplomacy.

To what extent is the Panther battle tank a competitor to the Franco-German MGCS programme?

The Panther KF51 main battle tank is to be seen as a complementary main battle tank concept. The European project is scheduled for completion in 2040. Rheinmetall's business consideration was therefore that a new tank was needed as a bridge solution for the long interim period. Together with the Hungarian government, the corporation is developing the Panther to series production readiness. It is intended to form the basis for the new Italian main battle tank. In general, battle tanks are experiencing a renaissance, as European countries are once again focusing more on homeland defence and defending the alliance, yet their tanks are outdated. As a next-generation battle tank, the Panther has significantly increased combat power thanks to its 130 mm gun. It is also fully digitalised, has a drone defence system, and deploys its own drones.

Price-less

1

There is more to every Olympic medal than just exceptional talent and pure discipline. The way to the top of the world is paved by special support and strong sponsorship. Thanks to its profitable partnerships with commercial enterprises such as Rheinmetall, the sports city of Düsseldorf has been writing success stories for years – from the Rhine via Paris to Los Angeles.

Author: ***Patrick Rohmann***

At the 2024 Summer Olympics in Paris, the German women's 3x3 basketball team sensationally won the gold medal. This suddenly elevated the previously little-known sport into the spotlight. The capital of North Rhine-Westphalia is one of the strongholds of 3x3 basketball in Germany – with Rheinmetall as its sponsor. For almost three years, both the women's team of the Düsseldorf ZOOS and the men's team of the Düsseldorf LFDY have benefited from the commitment of the traditional corporation. Rheinmetall has signed a sponsorship agreement with D.SPORTS, the state capital's sports marketing platform. Meanwhile, all eyes of top-level sport are firmly fixed on Los Angeles. In 2028, flag football, a sport similar to American football, will be part of the Olympic programme for the first time. Rheinmetall is supporting four national players on their way to the Olympics in California through the Düsseldorf Firecats women's team.

WORLD-CLASS LEVEL FROM DÜSSELDORF

Other flagships of the "sports city of Düsseldorf" include the table tennis Bundesliga club Borussia Düsseldorf, with icon Timo Boll as its most prominent athlete in this sport. For the 44-year-old former number one in the world rankings, the Olympic Games in Paris were already the seventh at which he was able to compete for Germany. He looks back on the major sporting event in the neighbouring country with mixed feelings: "It was tough for me that we were kicked out in the quarterfinals. The disappointment right after the match, not being completely satisfied with my own performance, and the fact that all the hard work hadn't paid off as I'd hoped, was all there". Paris also marked the end of Boll's table tennis career in the national team. "The chants overwhelmed me. Even though it was obviously great to get so much feedback from the crowd." For Alexander Schilling, CEO of Borussia Düsseldorf, the sponsorship is hugely important: "The support of companies such as Rheinmetall enables us to secure the financial resources we need in order to develop the team, sponsor talented players, and stage events". The table tennis club also says that the partnership with renowned companies strengthens its image and makes it more attractive for other sponsors.

RHEINMETALL SUPPORTS REGIONAL TOP-CLASS SPORT

The Düsseldorf-based technology corporation has been located in the state capital for more than 130 years and is involved in many ways in regional top-class sports. Since the 2024/25 ice hockey season, Rheinmetall has also been a premium partner of Düsseldorfer EG (DEG), one of Germany's most traditional ice hockey clubs. DEG is currently facing a bitter sporting and economic setback with its relegation from the German Ice Hockey League, of which the club was a founding member. In order to organise the restructuring and manage this difficult phase, the DEG shareholders have appointed two former professionals as new CEOs: Andreas Niederberger and Rick Amann. Both won several German championships with the club. Successful former defender Niederberger firmly believes in DEG's comeback: "With partners like Rheinmetall at our side, we not only have the economic foundation but also the necessary charisma to provide new impulses".
The cooperation with Rheinmetall goes beyond traditional sponsorship. Through D.SPORTS and Rheinmetall's support of top-class sport in the city, the popular sport activities and sporting culture in the city are enhanced. Timo Boll, who wants to be more involved in promoting young talents in future, sums it up: "Sometimes it's not just talent that counts, but also someone having faith in you. Partners like these are priceless for sport." ●

1 Leap into the world class: at the Olympic Games in Paris, the German women's 3x3 basketball team won gold – Germany's ever first Olympic basketball medal.

2 and **3** Regional sports promotion: Rheinmetall supported the Düsseldorf professional streetball teams for men and women and sponsors, among others, the eight-time German ice hockey champions Düsseldorfer EG.

2

3

When satchels become symbols of hope

The girl in the photo fled to Germany with her family before the war in Ukraine. She represents the children in her homeland who were delighted to receive a satchel donated by Rheinmetall for the start of the school year.

Children's eyes light up on their first day of school in the western part of Ukraine. Last year, the satchels donated and lovingly packed by Rheinmetall once again brought smiles to the faces of school beginners and for a precious moment allowed them to forget the harsh realities of everyday life in war.

Last autumn, Rheinmetall once again supported the campaign "School bags for Ukrainian first graders" initiated by the Cologne-based association Blau-Gelbes Kreuz e. V. The German-Ukrainian association, chaired by Linda Mai, is committed to helping people in the war-torn country with great dedication and passion. In addition to first-aid backpacks and starter kits for expectant mothers, the enthusiastic team is involved in many other aid projects, including the satchel campaign for first-year schoolchildren.

"The first day of school is a milestone in every child's life, filled with joy and excitement. For children who have had to grow up amid bomb alerts and bunkers since the start of the full-scale Russian invasion of Ukraine in February 2022, this day offers a brief respite from the war", said Linda Mai. Good equipment and the prospect of an education give them a feeling of normality, hope, and joy. After the first fundraising campaign, numerous pictures, painted by children in bomb shelters during air-raid sirens, reached the Rheinmetall headquarters in Düsseldorf – small works of art full of gratitude for the beautiful school supplies.

This was reason enough to donate another 240 school bags, including all learning materials and utensils, for the start of school in September of 2024. Four employees of the defence corporation actively helped to fill the colourful satchels with folders, pens and modelling clay. What moved them most during their visit to the association's warehouse in Cologne were the individual, personal stories of the association members and their children, which provided authentic and unfiltered insights into the emotional world of the people from Ukraine: women fearing for their husbands and brothers on the front line, children worrying about their fathers at war. In conversations, they expressed their gratitude for the military equipment that will directly benefit their loved ones on the front lines. Remarkably, every child knew the "Leopard" or the "Marder" – a clear indication of the popularity of German products in the area of operation. Those present also greatly appreciated the humanitarian support from Germany for the families left behind in Ukraine.

A tour of the warehouse in Cologne-Rodenkirchen and a photo book with memories from the past three years quickly conveyed how valuable the association's work is. The Blau-Gelbe Kreuz does much more than 'just' send urgently needed aid supplies to Ukraine. The non-profit organisation also lives and cultivates Ukrainian culture. Rheinmetall employees were able to enjoy a taste of this during their visit – from the Ukrainian dumpling speciality "vareniki" to the dances and songs performed by mothers and their children in traditional costumes at the end of the day.

With their heads full of impressions, moving interactions, and an excursion into Ukrainian culture, the Rheinmetall team said goodbye, deeply impressed by so much gratitude and warmth. ●

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WOMEN FOR STEM

Germany is not the only country experiencing a massive shortage of skilled professionals in the fields of science, technology, engineering, and mathematics (STEM). Industrialised nations worldwide are urgently seeking qualified specialists. Yet the potential of women in STEM careers remains largely untapped. Rheinmetall Defence Australia has demonstrated great success in addressing this issue through targeted recruitment initiatives: by offering summer internships alongside academic studies, providing dedicated support, and fostering female role models and mentoring programmes, the company is making significant strides in promoting women in STEM professions.

Keen to learn more? Discover the full story from Down Under, along with other exciting news, interviews, and insights about Rheinmetall, in the online edition of DIMENSIONS at www.dimensions-magazin.de/en. It's well worth a read!

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