TRUe

THE MAGAZINE FOR SHEET METAL EXPERTS

TRUMPF

Lightweight and stable: A dragonfly's wings are a true wonder of nature. Their unique structure has inspired engineers to create durable yet lightweight materials. From aviation to architecture, nature is a **valuable source of ideas for innovations.** Often, the best ideas come from studying our environment. Careful observation and an open mind reveal endless possibilities for technological advancement.

IMAGE: Adobe Stock / Arakatak

IMAGE: Getty Images / brandstaetter images

What goes around, comes around. The wheel is one of the most **groundbreaking inventions** in human history. Originally developed for use by potters, it revolutionized transportation and laid the foundations for modern civilization. It was thanks to this brilliant idea that trade and commerce evolved at such a rapid pace.

What might the equivalent of the wheel be in our current age? Artificial intelligence? Hydrogen propulsion? It's still too soon to tell. But the wheel shows that it only takes one groundbreaking innovation to change the world. ■

IMAGE: Adobe Stock / Sergey Novikov

Not all innovations succeed the first time around – and that's no bad thing. The history of bubble wrap is an example of how an apparent **failure can turn into a global success story.** Originally conceived as decorative wallpaper, the idea went nowhere until its inventor recognized its true potential: protecting delicate goods. Today, the shipping industry is completely dependent on bubble wrap. The lesson for business is that failure is often just the beginning, not the end. And those who are brave enough to learn from their mistakes have the best shot at triumphing with **unexpected innovations.** ■

TRUMPF's SortMaster Station and SortMaster Vision enable automated part removal.
By harnessing AI and adaptive robotic functions, they eliminate programming from the part removal process.

IMAGE: TRUMPF

Driving innovation **through AI**

Dear readers,

Humanoid robots, the U.S. government pouring half a trillion dollars into AI through its Stargate project, and a fierce technology battle between American AI model ChatGPT and its Chinese rival DeepSeek. These and other events underscore the tremendous importance of artificial intelligence both now and in the future – and they highlight how innovation is the key to companies staying competitive. In this issue of TRUe, we explore this topic in more depth.

We have long had artificial intelligence in our sights at TRUMPF. The game-changing influence of AI also extends to the machine-building industry, and we've spent the past half-decade successfully applying AI to our own production processes. Increasingly, we're incorporating it into our products, part of the next step in an ecosystem we've been developing for years. Digitalization and AI are helping us improve customer service, enhance research and development, and – most importantly of all – drive success for our customers (p. 38).

As a leading user and provider of AI in sheet metal manufacturing, we have fully embraced the digital world. We now offer our customers remote support, efficiency gains from digital solutions such as our Cutting Assistant, machine monitoring for unmanned shift operations, online troubleshooting via service apps, and much more besides. Taken together, these advances show that our customers are no longer buying a machine, but are becoming part of the TRUMPF ecosystem. With annual investments of some 50 million euros, we are constantly improving the quality of our software and expanding the features it offers. These updates are available even without purchasing a new machine, and they are designed to help our customers to continuously improve their production processes. This approach also ensures that our machines are continuously running on the latest software – so users can benefit from our digital services while enjoying the highest level of cyber security (p. 36).

When it comes to security, many machines leave a lot to be desired, especially certain models from Asian and Eastern European manufacturers. There have been numerous documented cases of counterfeit CE certifications, including some that have led to operators suffering severe eye injuries – and even complete blindness. Making machines completely safe requires significant time and investment, which obviously means higher prices. At TRUMPF, we firmly believe this investment is worthwhile. Because if an operator is injured by a faulty machine, it's not the manufacturer who is liable, but the employer – and that's something we want to protect our customers from at all costs.

TRUMPF stands for strong partnerships, exceptional service, reliable machines and constant innovation. With examples from Indonesia (p. 22), Hungary (p. 12) and the U.S. (p. 18), this issue shows how we apply these values globally. Because when it comes to ensuring our customers' long-term success in sheet-metal fabrication, TRUMPF offers far more than just high-quality machines.

I hope you enjoy reading this issue!

DR.-ING. STEPHAN MAYER
CEO Machine Tools and Member of the Management Board

TRUe

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#21/2025

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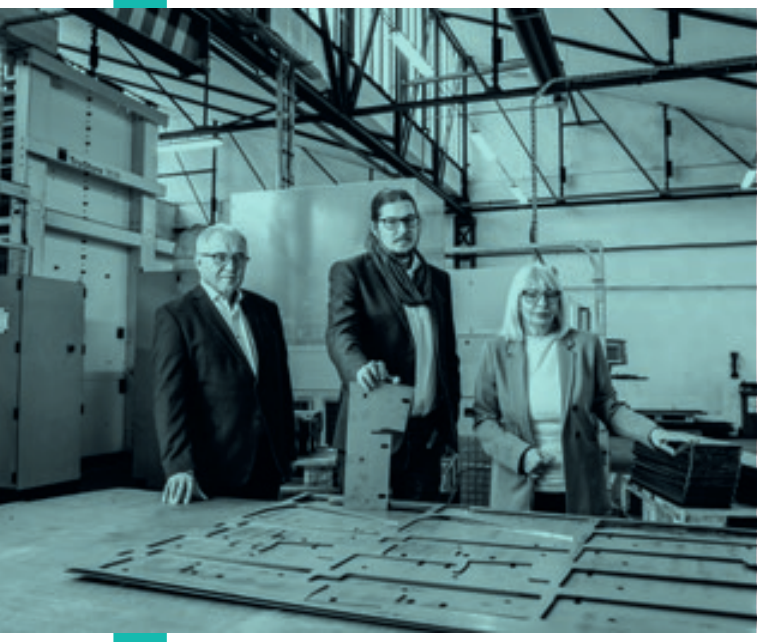

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Using cutting-edge TRUMPF technology, family firm Intertechnika helps artists from across Hungary to create unique works of art. Many of the pieces have earned acclaim at international exhibitions – and the collaboration has also led to gains in production efficiency.

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In the Steel City of Pittsburgh, O'Neal Manufacturing Services is building on a successful legacy that stretches back over 100 years. The company uses a TruBend 81000 from TRUMPF to produce XXL parts – and to shape the future of modern manufacturing.

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In the space of four decades, Tentrem has transformed itself from a rudimentary repair workshop under a corrugated iron roof into one of Indonesia's largest coachbuilders. Aided by TRUMPF technology, the company now hopes to conquer the mass market.

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TRUMPF has long deployed artificial intelligence for tasks such as accurately identifying parts in laser processing and automatically adjusting cutting parameters. But even bigger changes lie ahead for the company.

In southern Budapest, the small, **family-run company Intertechnika** specializes in welding, laser-cutting and bending bespoke creations for artists from across Hungary. Bringing together designers, machine operators and artists, they create one-of-a-kind pieces that garner international acclaim at exhibitions. In the process, they also acquire valuable expertise that enhances their production capabilities.

01

HUNGARY

Innovation in Budapest

SHEET METAL ARTISTS

IMAGES: Akos Stiller, Ornella Mari

Precision: Crafting artworks isn't a question of speed – it's about pushing the boundaries of what is technically achievable.

The art of laser-cutting: Set against a silhouette of a forest crafted from precision-cut sheet metal, illuminated shapes drift through thousands of LEDs to the rhythm of a meditative soundscape. As they move, they pulse in time to the music of double bass vibrations, gong reverberations, and the ethereal tones of Tibetan singing bowls. Hungarian artist Márton Nemes spent two years planning and producing this multisensory experience for his *Techno Zen* installation, which was hosted by the Hungarian pavilion at the 2024 Venice Biennale, the world's largest exhibition of contemporary art. His vision was transformed into reality by a small Hungarian family business called Intertechnika, which cut and bent many of the abstract shapes using TRUMPF technology.

From heavy industry hub to artistic haven

Many of the installation's paintings and sculptures were crafted in Budapest's Csepel district. From 1892 to 1993, this island on the Danube was a hub of heavy industry, home to manufacturers of motorcycles, cars and commercial vehicles. Today, one of these historic industrial buildings serves as Intertechnika's headquarters. "We're a small company focused on contract manufacturing," says Peter Alasztics. "We process around 28,000 drawings a year to produce everything from transformer components to housings for Siemens." But that's only part of the story. In the past two decades, Intertechnika's team of 64 employees has also become highly skilled at creating bespoke products. Using TRUMPF machines, the company cuts, bends and shapes sheet metal for artists from all over Hungary, and its team of designers has built a reputation for pushing the boundaries of what's possible. "We enjoy tackling complex projects," says Peter Alasztics. Peter and his brother Márton are the second generation to head up the family business. Their parents, Julianna Alaszticsné Kovács and Béla Alasztics, founded Intertechnika in 1991 during the chaotic period following the dissolution of the Soviet Union. Initially focused on building and maintaining CNC machine tools, they soon realized that the demand for such technology was declining. By 1999, they had relocated to their historic industrial building on Csepel Island. In 2000, they acquired their first laser – a second-hand 1.5 kW cutting system – and shifted their focus to sheet metal processing.

Visions: By integrating art into the family business, Peter Alasztics helps artists and engineers to find a common language.

> " We're a **small contract manufacturer.** We process around 28,000 drawings a year to produce everything from transformer components to housings for Siemens. "
>
> Peter Alasztics, CEO Intertechnika

Techno Zen: 1) *Superposed* and *Entangled* spans two walls. 2) *Breathe In, Breathe Out* consists of three ventilators. 3) Artist Márton Nemes inaugurates the Hungarian Pavilion at the 2024 Venice Biennale. 4) The sculpture *Superposed* forms the centerpiece of the pavilion. 5) *Inside Outside* combines steel, stainless steel and light in a dynamic sculpture.

IMAGES: Dávid Biró, Krisztina Bilák, Ludwig Museum – Museum of Contemporary Art, Budapest

Taking Hungarian technology to the next level

"Back then, laser technology and sheet metal processing were still relatively new in Hungary," recalls founder Béla Alasztics. "For us, it was an opportunity to get an early foothold in an emerging technology." They learned the ropes with the help of a friend who was already using lasers to produce machine tools. In the early 2000s, Intertechnika began collaborating with TRUMPF, acquiring its first TRUMPF machine, a TruMatic L 4030, in 2002. The company quickly embraced innovative technologies such as automated laser cutting systems. "As TRUMPF introduced new processes, we were often among the first companies in Hungary to try them out," says Béla Alasztics. "And TRUMPF was always on hand to help us put its innovative approaches into practice." However, working within Csepel's historic industrial buildings came with its own set of challenges. While Intertechnika has room to expand within its facility on the Danube island, structural modifications are prohibited due to its protected status. "When we installed our first laser cutting machine, it came to within 20 centimeters of the roof!" Peter explains. "But TRUMPF helped us make the best use of the existing layout." The Ditzingen-based company continues to support Intertechnika today, helping it reach new heights. "That first laser from TRUMPF opened the door to a whole new world of possibilities," says Peter.

In 2005, Peter introduced art into Intertechnika's business – an idea that initially met with skepticism from his parents, recalls Béla. While studying at Visart Art School in Budapest, Peter met István Ézsiás, an artist now in his eighties, who was intrigued by the scrap metal generated by Intertechnika's production processes. This encounter sparked a collaboration and led Peter to wonder how the company's machinery could be repurposed to craft artistic objects. "Finding a common language between artists and engineers was a unique challenge," recalls Béla. "Artists are free thinkers; they rarely consider the physical properties or limitations of materials," adds Peter. "Engineers have almost the exact opposite mindset." While his brother Márton focused on business administration, Peter pursued graphic design, culminating in a Master's thesis at Berlin University of the Arts that explored the collaboration between engineers and artists. Working alongside Intertechnika's design team, he gradually learned to interpret artists' creative visions and put them into practice.

Otherworldly creations: Intertechnika laser-cuts intricate silhouettes that artist Márton Nemes assembles into remarkable installations.

> “ The combination of sheet metal and lasers has opened up a **whole new world of creative possibilities.** ”
>
> Márton Nemes, multimedia artist

Machine work: Engineers, artists and production workers learn from one another and develop a shared language.

Learning from artists

Since 2017, Hungarian artist Márton Nemes has collaborated closely with Intertechnika, starting with a project that required the company to cut a specially coated, rainbow-colored sheet metal – an exceptionally unusual and expensive material that only Intertechnika was willing to tackle. “We had never encountered anything like it before – and haven’t since,” recalls Peter. Despite the challenge, the project was a success, and Nemes continues to feature the resulting pieces in many of his solo exhibitions. “I had no idea such technology existed until that moment,” says Nemes. “It completely transformed how I approach my sculptures.” Today, nearly all his sculptures are developed in close partnership with Intertechnika. “Before we started working together, I used entirely different materials,” Nemes explains. “The combination of sheet metal and lasers has opened up a whole new world of creative possibilities.”

Intertechnika is now a cornerstone of Hungary’s art scene. Each year, students from local art universities partner with the company to create their final projects. Peter Alasztics actively encourages his nine-member design team to push boundaries and experiment, knowing that the skills they learn from creating one-of-a-kind artworks often feed back into their production work. For instance, techniques refined through art collaborations have been adapted to produce durable, impact-resistant tablet housings for prison inmates as well as intricate lamp casings for Budapest’s iconic Széchenyi Chain Bridge.

The two brothers are now planning to increase automation within Intertechnika’s production processes, driven by the recent introduction of TRUMPF’s Oseon software. This is yet another step forward in the family tradition of embracing cutting-edge technology and innovative software solutions. The hope is that Oseon will make it more efficient and cost-effective to manufacture their standard products, freeing up valuable resources for the creation of bespoke artistic pieces. “Innovation means always seeking to create something new,” says Peter Alasztics. “Whenever one of us thinks a project is too complex to handle, we look at the art we’ve helped produce and remind ourselves just how much is possible!”

Unique pieces: Intertechnika learns from bespoke art commissions and applies this knowledge to enhance its production capabilities.

Customer details

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Phone: +3614252673

Machinery

- TruStore 3030
- TruLaser 5030 fiber
- TruBend 7036
- TruLaser 5030
- TruLaser 5040 fiber
- TruBend 5170
- TruBend 5320
- TruFlow 5000
- TruDisk 5001
- TruDisk 6001

IMAGES: Akos Stiller, Ornella Mari

01

A closer look:

Production and material flow control

Companies like Intertechnika are using TRUMPF's **Oseon** software to digitalize manufacturing processes and logistics workflows end-to-end, leading to greater efficiency and transparency. Combining production planning and control with warehouse and transport management, Oseon maps sheet-metal fabrication processes and aids users in their day-to-day work, unlocking **growth opportunities and potential cost savings.**

In brief

Perfect production flow with Oseon

Oseon serves as a central manufacturing control system. Designed to manage production and material flow, the software brings together order management, logistics coordination, data collection and analytics. Reliable and autonomous, it controls all the relevant processes in the factory. Users input their production plans into Oseon, and machines across the shop floor feed it with a continuous stream of process data for real-time analysis. Oseon monitors raw-material inventories, tracks transport cart locations, and dynamically optimizes material flow. It gives users instant access to operational insights while eliminating typical errors such as those caused by switching between programs.

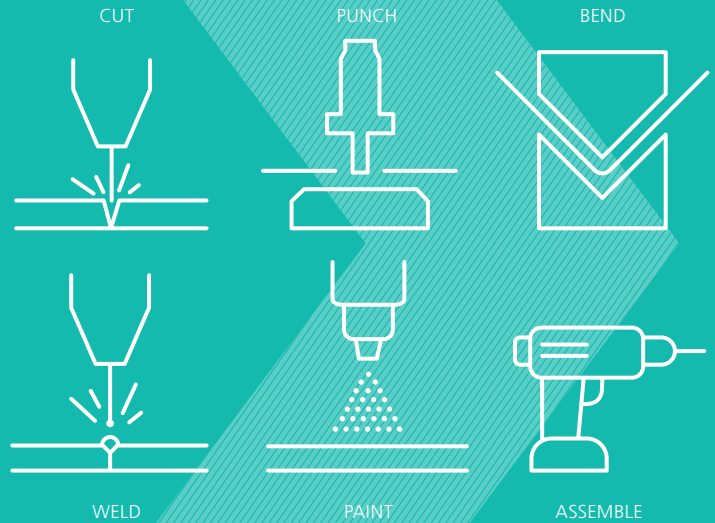
PREPARE | PLAN | MANAGE PRODUCTION JOBS

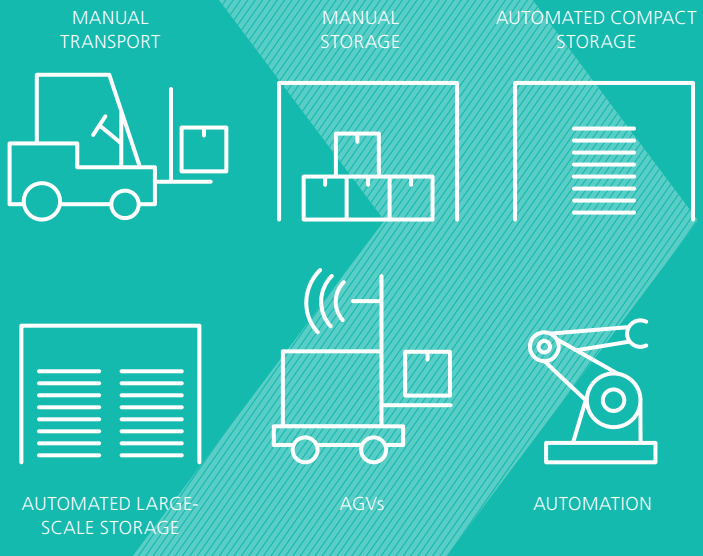
Clear overview for planners

Successful planning requires a thorough understanding of workstation capacities. This includes employee shift schedules and break times as well as machine availability. With Oseon's shift planning feature, users can track and visualize open capacity slots across production lines and then optimize production scheduling based on **priorities and delivery deadlines.** The planning dashboard provides a clear overview of all order details – from priorities and deadlines to production start times. It also offers planners a comprehensive view of workstation capacities. This prevents overbooking, ensures schedule adherence, and guarantees on-time customer deliveries through end-to-end transparency.

Smooth transport flow

Oseon **automatically generates transport orders** for raw materials, components and finished parts based on the production schedule. These orders are managed within the app, giving logistics staff a clear overview of all active and pending transport tasks. Automated guided vehicles handle automated transport assignments, while logistics staff can also select and initiate manual tasks. Once a manual task is activated, a **digital assistant** provides employees with all the details they need to complete the transport order, such as the collection point, destination and weight. Data on materials, inventory and transport orders are readily available on the shop floor. The software enables full automation of material flow, significantly reducing production and delivery times.





Support for machine operators

With skilled labor in short supply, Oseon boosts shopfloor **productivity** by delivering critical information directly to workers' mobile devices, including status reports and details of upstream and downstream processes. The software guides operators smoothly through all their upcoming tasks, from **loading** the machine with raw materials to **removing** the finished parts. Finished workpieces can be inspected by workers quickly and easily using predefined quality criteria stored in the system. Machine operators enter inspection results, finished jobs and other feedback directly in the software. This provides the basis for an almost entirely paperless manufacturing process in which all information is always up to date.

Data-driven efficiency

Oseon records and analyzes all relevant production parameters, clearly presenting the results in its **Smart View** dashboard. Smart View provides users across different roles with a comprehensive overview of relevant information. In-depth analyses offer valuable insights into machine performance, production processes and resource utilization. In addition, they highlight potential for optimization, help prevent bottlenecks and support continuous improvement of the manufacturing process.

02

USA

Innovation in Pittsburgh

LEGENDS OF STEEL

The story of **O'Neal Manufacturing Services (OMS)** began over 100 years ago. It's a journey that has taken the company from Birmingham, Alabama – where Kirkman O'Neal started a small steel processing business in 1921 – all the way to the "Steel City" of Pittsburgh, Pennsylvania. Over the past century, the company has evolved into one of the largest family-owned metal fabrication companies in North America. In 2023, OMS reported a revenue of over 345 million euros – and its position as an **innovative industry leader** looks as strong as ever.

IMAGES: Eric Mull

Up to the challenge: At its Pennsylvania facility, OMS tackles XXL-sized workpieces with the TruBend 81000.

Forged from steel and hard work

The dawn of the 20th century led to profound changes for cities like Birmingham, Alabama. Once dominated by agriculture, the region was transformed into a booming industrial hub thanks to its unique geological advantages. Recognizing the opportunity this offered for metal processing, Kirkman O'Neal – a former naval officer and an employee at a U.S. Steel Corp. shipyard – purchased Southern Steel Works in 1921. This small company served customers that needed materials in smaller quantities than the high-tonnage minimums required by large steel mills at the time.

Right from the start, O'Neal's success was rooted in hard work, resilience and an unwavering commitment to quality. Five years after he founded the company, a local newspaper quoted Kirkman O'Neal as saying: "We turn out each piece of work and each contract the very best that can be done." Today, that sentiment is echoed by his grandson, current chairman and CEO Craft O'Neal: "Our success has come through hard work, a willingness to embrace advances in technology, and the exceptional people we've been privileged to work with."

Family tradition

OMS continues to focus on the kind of efficient and innovative solutions that are the hallmark of businesses operating under its parent organization, O'Neal Industries. The company is still led by descendants of Kirkman O'Neal, and its guiding philosophy is neatly summed up by Michael Richey, director of sales and marketing: "The family has always been the driving force behind the stability, growth and success of O'Neal Industries. For four generations, the O'Neal family has led this company. At its core is the belief that the business itself is a family – one that includes all its employees."

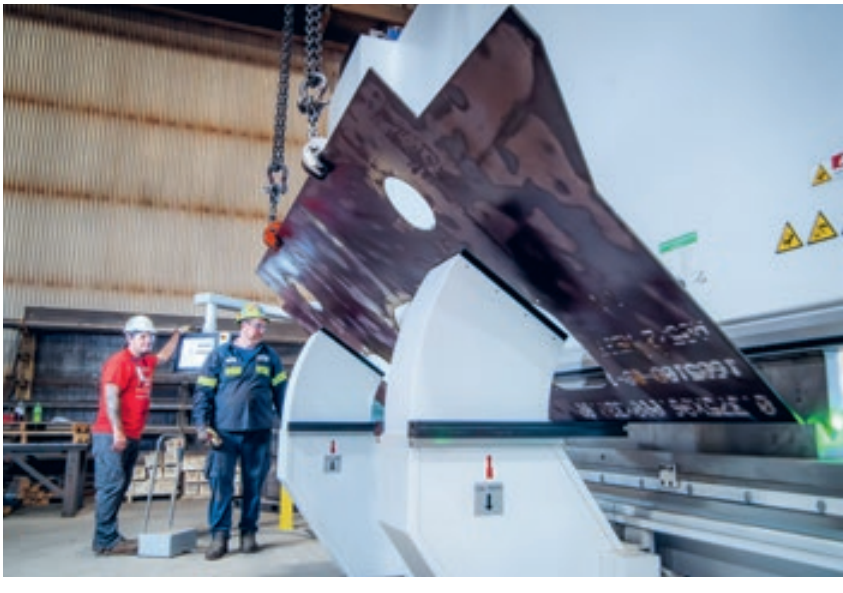
As a leading U.S. manufacturing company, OMS specializes in multistage processing and series production, particularly for original equipment manufacturers (OEMs) that require large-scale manufacturing support. "We operate as an extension of each customer's business," says Richey. "By providing end-to-end supply chain solutions, we achieve outstanding production efficiency."

Firmly rooted

For over a decade, OMS has been delivering holistic solutions to industries such as agricultural and material handling equipment, construction and renewable energy. With ten locations across North America and over 140,000 square meters of production facilities, it guarantees the highest level of quality and on-time delivery. OMS's complex fabrication processes are supported by advanced manufacturing technologies, including more than 37 TRUMPF machines – from flat-sheet laser cutting machines to tube laser cutting machines and press brakes.

Major investment

The partnership between OMS Pittsburgh and TRUMPF stretches back over 17 years to the purchase of a four-kilowatt CO_2 laser cutting machine and a LiftMaster system for automated loading



Bending aid: Automatic bending assistance simplifies the handling of workpieces weighing up to 300 kilograms.

and unloading. Today, this laser cutting machine is just one of many operated by the company. A standout recent investment is the TruBend 81000 – the largest TRUMPF press brake – which was installed in Pittsburgh in April 2023. This impressively versatile large-format machine has proven to be the perfect addition to its portfolio.

The 22,000-square-meter Pittsburgh fabrication center serves OEMs in the heavy construction, bridge, rail and power transmission industries. With a bending length of up to seven meters and a press force of 1,000 tons, the new TruBend 81000 offers benefits such as high precision and repeatability. "It's impressive not only in terms of size, but also accuracy. And that makes our production of large formed parts more consistent and precise than ever," says Gus Cassida, OMS general manager in Pittsburgh.

State-of-the-art technology

The technical capabilities of the TruBend 81000 were a key factor in OMS's decision to invest in this TRUMPF machine. Notable features include advanced programming options, extended opening and throat depth settings, and automatic laser-controlled bending assistance. "This TRUMPF press brake is a real game-changer for our business," says Cassida. "It's helping us to expand our production of large parts for existing customers while also growing our position with new customers and in new markets."

OMS continues to evolve, just as it has throughout its long history. "For over a century, we've adapted to a changing world by embracing technological innovation and always looking ahead," says CEO Craft O'Neal. "Even after all this time, we continue to treat our customers like family. But at the same time, our company is big enough to tackle whatever challenges they might face."

> "This TRUMPF press brake is a real **game-changer** for our business."
>
> Gus Cassida, OMS general manager in Pittsburgh

TruBend 81000: General manager Gus Cassida is impressed by the new press brake's outstanding features.

Customer details

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Machinery across all locations

- 1x TruLaser 1030 fiber
- 1x TruLaser 3030 fiber
- 10x TruLaser 3040 fiber
- 1x TruLaser 3060 PBH (power by the hour)
- 5x TruLaser 5030 fiber
- 3x TruLaser 5040 fiber
- 3x TruLaser 3030
- 2x TruLaser 5030
- 2x L3030
- 2x L3040
- 3x TruLaser Tube 7000
- 1x TruMatic 7000
- 3x Trumatic L3030
- 1x Trumatic L4030
- 1x TruBend 3100
- 3x TruBend 5085
- 5x TruBend 5320
- 1x TruBend 7036
- 3x TruBend 7050
- 1x TruBend 81000
- 1x TruBend 8500
- 1x TruBend Cell 7036
- 2x LiftMaster Compact
- 4x TruStore

IMAGES: Eric Mull

02

A closer look:

TruBend Series 8000

The TruBend Series 8000 is a powerful addition to TRUMPF's bending machine line-up, designed to complement the globally acclaimed TruBend Series 5000. It offers solutions for **bigger and more demanding** jobs while maintaining the high standards for which the TruBend family is renowned. When it comes to complex XXL applications, this machine is the perfect choice.

In brief

Bending XXL parts has never been easier

The **TruBend Series 8000** enables efficient, ergonomic processing of large workpieces. With a press force of up to 1,000 tons, an open height of 880 millimeters, a stroke of 700 millimeters and numerous innovative features, this new generation of TRUMPF bending machines excels at even the most complex jobs. As "big brother" to the TruBend Series 5000, it offers ergonomic features such as **bending aids and flexible tool options,** making it the perfect addition to TRUMPF's bending portfolio.

The ideal solution for large parts

The TruBend Series 8000 is a great option for companies that produce small batches of **large, heavy or complex parts.** Standard configurations deliver up to 600 tons of press force and 6,100 millimeters of bending length, expandable to 1,000 tons and 8,000 millimeters for maximum flexibility. What's more, a version with a 600-ton press force and a bending length of 4,400 millimeters can still be installed directly on the factory floor – without requiring specialized, costly foundations. The machine makes light work of both short, thick sheets and long, thin workpieces. And the ability to process several workpieces at once at multiple bending stations significantly boosts **production efficiency.**

Energy efficient and sustainable

The TruBend Series 8000 combines superb performance with outstanding **energy efficiency.** The innovative **On Demand Drive** automatically adapts the speed of the motor to the current application. This can reduce energy consumption by up to 26 percent compared to conventional hydraulic systems, making the machine a sustainable solution for modern manufacturing.

Ergonomic and user-friendly

Handling heavy parts often involves significant physical labor. The TruBend 8000 Series makes life significantly easier for machine operators with features such as **automatic height-adjustable bending aids.** In the heavy-duty configuration, these can support workpieces up to 300 kilograms. Further assistance is provided by the **ToolShuttle,** which simplifies the handling of large, heavy tools during tool changes. From 2025, the **ToolMaster** will boost efficiency further with even faster, **fully automated tool changes.**

Versatility for diverse applications

From facade construction to mechanical engineering and auto manufacturing, the **TruBend Series 8000 offers the right solution for any application.** Features such as lower tool displacement, CNC-controlled crowning and a 6-axis backgauge give operators the freedom they need to fabricate complex, high-precision parts. For even more challenging jobs, the machine can also be used in tandem operation. The standard tandem setup offers press forces up to 800 tons and bending lengths up to 8,800 millimeters; this is expandable up to 2,500 tons and 16,000 millimeters.

up to 26 %
less energy

230 t – 2,500 t
press force

3,200 mm – 16,000 mm
bending length

Bending aid for up to 300 kg
workpieces

03

INDONESIA

Innovation in Malang

FROM HANDCRAFTED TO HIGH-TECH

IMAGES: Zakaria Zainal

What began four decades ago as a rudimentary bus repair workshop beneath a corrugated iron roof has grown into one of **Indonesia's largest coachbuilding enterprises.** Based in Malang, Tentrem Sejahtera built its early success on manual craftsmanship. Now, under managing director Yohan Wahyudi, the company is targeting mass-market scalability – and leveraging TRUMPF technologies to take production to new heights.

Panoramic windows, elevated seating and plush semi-reclining chairs may sound like the description of a luxury hotel suite. But it actually refers to the upper deck of the premium double-decker *Avante H8 Grand Captain*, the flagship model in Tentrem's range of luxury coaches.

The vehicle-body manufacturer specializes in crafting custom bus bodies on chassis from renowned brands like Mercedes-Benz, Volvo and Scania, while also producing intercity buses that serve routes across Java, Bali and other islands in Indonesia. Managing director Yohan Wahyudi aims to make Tentrem into Indonesia's premier bus manufacturer. His vision hinges on getting the right balance between two seemingly contradictory goals: customization and standardization. He is determined to optimize production efficiency, but customers must still be able to access unique, tailored products. "By providing our employees with new machinery and suitable software, we help them instill creativity and innovation in their work," he says. Quite an achievement for a company that started out so small.

> " By providing our employees with new machinery and suitable software, we help them instill **creativity and innovation** in their work. "
>
> Yohan Wahyudi, managing director Tentrem Sehjatera

Customized production: Yohan Wahyudi has invested in a cutting-edge production system to standardize processes. But he is still determined to provide customer with customized solutions.

Growth through transformation

Tatang Wahyudi, Yohan's father, founded Tentrem in 1983 as a bus operator in Malang on the island of Java. In 1986, he opened a repair workshop to maintain his fleet. His mechanics fixed scratches and dents, getting buses back onto the road by handcrafting body panels and welding components under open-air corrugated shelters. Over time, Tatang's business became more and more successful, and the workshop began servicing external clients a year later. The bus operator still exists to this day, and the company was officially established in 1991 as PT Tentrem Sejahtera, or Tentrem for short. "We kept growing and gradually transitioned from repairs to designing our own bus bodies," Yohan recalls.

> " The trick is to get the right **balance** between standardized products and customized solutions. "
>
> Yohan Wahyudi, managing director Tentrem Sehjatera

Today, the original tin-roofed sheds have been replaced by modern production facilities. An elegant glass-fronted administrative building occupies a prominent position near the main road, backed by an almost eight-hectare complex of production halls. All in all, Tentrem employs more than 600 people. Yohan Wahyudi keeps a close eye on the business, and is known for his systematic and data-driven approach to management. Before joining the family firm, he studied computer science in Canada and completed an MBA in China. Today, he strives to introduce greater speed, efficiency and precision into the company's production processes. "In the past, clients brought us sketches, and we painstakingly shaped the metal sheets to match," he says. The problem was that most of the repairs had to be carried out by hand. And whenever they needed a replacement part for a badly damaged bus, the workers found themselves back at square one. "Nowadays, we try to automate as much as we can. The trick is to get the right balance between standardized products and customized solutions," says Wahyudi.

Growth: What began as a small workshop for maintaining a bus fleet has grown into a thriving company that employs over 600 people and manufactures its own bus bodies.

Accelerating ambitions

Tentrem has seen a further surge in growth under Yohan's leadership. But this growth poses its own set of challenges: customers put in larger orders, and Yohan is keen not to disappoint them. His goal is to transform Tentrem into an original equipment manufacturer (OEM), producing consistently high-quality bus bodies in reliable quantities. "We want to match the standards of established OEMs," Wahyudi says. "To do that, we need a proper production line, efficient schedules and clear daily targets. The biggest challenge for my generation is changing the mindset around manual labor."

The transformation began in 2015 when the family discovered TRUMPF at a trade fair. At first, Yohan's father, Tatang, was skeptical about spending large sums on advanced technology and automation. He felt that processing body parts wasn't complicated enough to justify such a step. But after a strong financial year, the family decided to take the leap. "We stepped out of our comfort zone and invested in new technology," Yohan says. That year, they purchased a TruLaser 3030, making Tentrem a pioneer in sheet metal processing in Indonesia.

"We immediately saw the benefits of automation for things like the baggage compartments," says Yohan. Previously, employees

IMAGES: Zakaria Zainal

Staying the course: 1) Tentrem produces bus bodies in Indonesia for major brands like Mercedes-Benz and Volvo. 2) Yohan Wahyudi continues to take individual customer requirements into account in his bus designs. 3) Advanced technology from TRUMPF allows the company to achieve high-volume production with consistent quality. 4) The challenge for Yohan Wahyudi's generation is transitioning from a manual-labor mindset to efficient line production. 5) Modern buses consist of thousands of individual parts. Oseon will help streamline production in the future.

Two generations: Founded in 1983 by Tatang Wahyudi, the company is now shaped by his son Yohan's vision of cutting-edge production.

Customer details

PT Tentrem Sejahtera
Jl. Perusahaan Raya Barat No.17, RT.05/RW.10,
Kel. Tunjungtirto, Kec. Singosari, Kabupaten Malang,
Jawa Timur 65153, Indonesia
www.tentrembus.com
Email: marketing@tentrembus.com
Phone: +62 341 492792

Machinery

- TruLaser 3030 fiber
- TruLaser 5030 fiber
- TruLaser Tube 5000 fiber
- TruMatic 1000 fiber
- TruBend Center 5030
- 3x TruBend 3100
- TruBend 1320
- TruBend 7036
- TruMark Station 5000
- TruArc Weld 1000 (RW01)

needed five or six separate parts to build a baggage compartment door. Nowadays, they take a single sheet of metal, cut it with the TruLaser 5030, and shape it with the TruBend Center 5030. "This new approach eliminates welding entirely, much to the amazement of our customers!" says Yohan.

Next year, Yohan plans to invest in TRUMPF's Oseon software. "A bus consists of thousands of parts. If we can make our production more efficient, we'll save time and money. That's where Oseon comes in," he says. "It feels like 2015 all over again, before we bought our first TRUMPF machine. We know what the technology can do, it's just a question of learning to make the most of it." The consistent quality offered by TRUMPF machines has a wide array of benefits. "It allows us to oversee the entire production process, so we can prioritize which parts are needed most urgently and which can wait," Yohan explains. "We can also optimize the design of each part by using innovative design formats and manufacturing technologies. That makes the process simpler and reduces costs – similar to what we experienced with the baggage compartment door."

For Yohan, innovation is synonymous with efficiency. It's about offering a standardized production process that remains flexible enough to accommodate individual customer requests. In the double-decker *Avante H8 Grand Captain* bus, for instance, semi-reclining seats are the premium choice – but customers can also opt for extra rows of standard seats instead.

New possibilities: Previously, producing a baggage compartment door required five or six parts to be welded and bent. With the TruLaser 5030 and TruBend Center 5030, Tentrem can now create the door from a single sheet of metal.

IMAGES: Zakaria Zainal

03

A closer look:

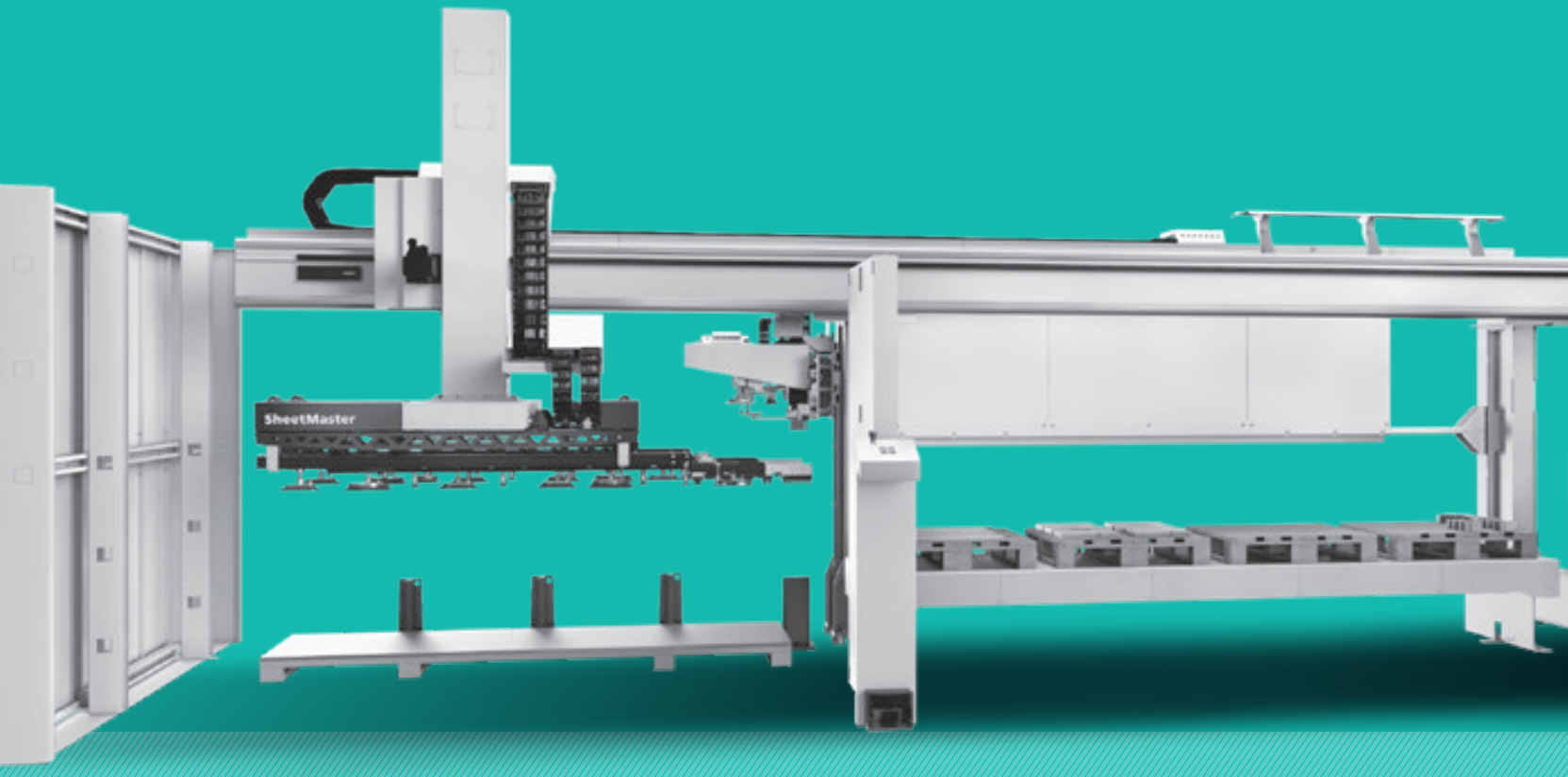
TruMatic 5000 with new SheetMaster

Indonesian company Tentrem has set itself the goal of fully automating its production processes. For Tentrem and companies on a similar path, the **combination of a TruMatic 5000 and the new SheetMaster** could be just what they need – a fully integrated punch-laser processing cell. Here, we take a look at the performance, energy efficiency and reliability of this advanced solution for connected manufacturing.

In brief

Efficiency redefined: The autonomous punch-laser manufacturing cell

The combination of a TruMatic 5000 and the next-generation SheetMaster marks a fundamental shift in punch-laser production. The manufacturing cell fully automates all the processes – from loading and unloading to palletizing and sorting. With its powerful six-kilowatt laser, this system sets new standards for both productivity and energy efficiency.



Lightning-fast loading

The next-generation SheetMaster ensures the smooth and rapid flow of materials. Sheets are pre-separated in parallel with the production process and fed directly into the TruMatic 5000. Perfectly synchronized workflows ensure seamless production operations.

High-throughput processing

The TruMatic 5000 offers outstanding performance in punching, laser cutting and forming. Its descending die guarantees exceptional part quality and adaptability, while the six-kilowatt laser ensures impressive cutting speeds. TruTops Boost programming software further enhances overall processing efficiency.

Highlights of the manufacturing cell

Maximum productivity and energy efficiency:
The combination of the six-kilowatt TruFiber laser, universal cutting unit, DeltaDrive and SheetMaster achieves maximum throughput while reducing energy consumption by up to 65 percent.[1]

Seamless warehouse integration:
The TruMatic 5000 integrates smoothly with TRUMPF warehouse systems, ensuring a steady supply of materials for extended production runs of hours or days.

Versatile material processing:
The TruFiber laser also has no problem handling highly reflective materials such as copper and brass. It cuts a wide range of non-ferrous metals and material thicknesses with impressive flexibility and efficiency.

[1] Compared to hydraulically driven punching machines with TruFlow CO_2 laser.

Flexible unloading and palletizing

Once processing is complete, the SheetMaster automatically removes the finished parts. Individually controlled suction cups allow for precise part handling, while the ability to move the SheetMaster in the vertical axis makes palletizing even more flexible. The automated process is rounded off with the GripMaster, which ensures reliable removal of the scrap skeleton.

Seamless tool handling

Additional tools can be inserted in the ToolMaster during operation without interrupting operations. Even if tools need to be removed for sharpening, production can still continue, ensuring the productivity of the manufacturing cell remains high at all times.

04

GERMANY

Innovation in Ditzingen

OVER TO YOU, AI!

IMAGES: Andreas Sporn

With **artificial intelligence (AI),** lasers now cut and weld with unparalleled precision. Machines can sort sheet-metal parts flawlessly, and customers can optimize efficiency without the need for complex programming. That's why AI has established itself as a **cornerstone of TRUMPF's business,** enhancing everything from training programs to machine tools and laser technology.

Say goodbye to complex programming: The advanced VisionLine Detect image processing tool harnesses AI to pinpoint the exact spots for laser welding – a task that once required extensive programming expertise and operator experience. The process is now remarkably simple: users upload a few images to the EasyModel AI cloud application and mark weld points on the parts using a mouse. EasyModel AI then generates an AI model, which trains itself. This AI model enables VisionLine Detect to identify welding points automatically and to position the laser with unmatched speed and accuracy, streamlining operations like never before. The EasyModel AI solution is just one example of how TRUMPF is using AI to transform manufacturing processes. By integrating AI into its tools, this family-run business continues to lead the way in innovation.

Overcoming skepticism about AI

When Florian Kiefer from TRUMPF Laser Technology talks to customers, many express concerns about introducing AI onto their shop floors. However, these doubts often dissipate once they witness AI in action during day-to-day operations. A prime example is the EasyModel AI cloud application, which uses advanced image recognition to identify parts during laser welding. This solution stabilizes production processes and offers significant advantages, particularly in high-volume manufacturing environments like the automotive industry. In the best-case scenario, it increases the volume of parts produced while maintaining the highest data protection standards. Kiefer, who heads up Product Management Performance Solutions at TRUMPF Laser Technology, is firmly convinced this is the way forward.

Team AI: At TRUMPF, Jens Ottnad, Louisa Peters and Florian Kiefer (from left) drive the use of AI in different areas of the company.

Traditional image recognition systems without AI often struggle with complex geometries, very small parts and highly reflective materials. These challenges are especially pronounced in tasks like welding battery cells, delicate electronic components, and round reflective cables that require extreme precision. In such scenarios, a laser might perform thousands of welds in a matter of seconds. A single misidentification by a conventional system could have serious consequences – even a minor inaccuracy could render an entire car battery unusable, increasing waste and driving up costs. The AI model developed by EasyModel AI for VisionLine Detect is a valuable tool for meeting this challenge head on.

No AI expertise required

As a product manager, Florian Kiefer has spent the past three years leading the development of EasyModel AI. After extensive conversations with customers and in-depth market analysis, he identified the need for a simple, cloud-based solution. The result is EasyModel AI – a tool that requires no prior AI expertise. All users need are high-quality images of their parts. The process is straightforward: users start by uploading images to the application. Using an intuitive, Microsoft Paint-style tool, they then mark the welding positions with color. From there, the AI takes over, training itself on the provided data. Initially, users manually mark weld points on just a few images. Based on this input, the model begins generating its own suggestions for weld positions. Users can then review and refine

Efficiency gains: The best way to dispel customer skepticism is by demonstrating how much more they can produce with AI.

these suggestions as needed. After training on just 10 to 50 images, EasyModel AI creates a reliable AI model – a process that typically takes only minutes and, at most, a few hours. Once the model is complete, users can download it and integrate it into the VisionLine

EasyModel AI: An intuitive and user-friendly online tool that requires no AI expertise. High-quality images of parts are all that's needed to get started.

Detect image processing software. This software ensures precise and consistent part recognition, enabling the laser welding system to consistently apply each weld in exactly the right place.

Data, data – and more data

"From the moment data are generated, we need people who can identify which data are relevant for the company and for the production process," says Jens Ottnad. This is one of the key reasons he took on the role of head of global training at TRUMPF: to equip young employees with these critical skills. "Quite simply, this is the biggest transformation we face – and that's why it's so important for as many people as possible to understand the basics of how AI works."

AI's central role at TRUMPF is reflected in Ottnad's own career path. With a doctorate in mechanical engineering, his work initially had no connection to training. Instead, it focused on AI development and research at the Karlsruhe Institute of Technology (KIT). Today, his mission is to transform TRUMPF into a data-driven

IMAGES: Andreas Sporn

Florian Kiefer: As head of Product Management Performance Solutions at TRUMPF Laser Technology, Kiefer has been instrumental in refining the EasyModel AI app for AI-powered part recognition in laser welding.

> “ From the moment **data** are generated, we need people who understand which of these data are relevant for the company and for the respective production process. ”
>
> Jens Ottnad, head of Global Training at TRUMPF

Jens Ottnad: With a doctorate in mechanical engineering and a background in AI development and research, Ottnad now serves as global training manager. His goal is to transform TRUMPF into a data-driven company.

company, recognizing that data forms the foundation of artificial intelligence. Having pursued this goal in earlier projects, Ottnad saw a natural progression in preparing the next generation by passing on his expertise to apprentices and dual-study trainees. Today, he focuses his efforts on 300 apprentices and dual-study trainees working in 15 different professions at TRUMPF’s Ditzingen site, while also overseeing the ongoing training of all the company’s employees.

Louisa Peters: The Product Manager for TruLaser machines says customers can reap major benefits from the Cutting Assistant.

Figuring out cutting edges

While tiny cables present a challenge in laser welding, optimizing cutting edges poses similar difficulties in laser cutting. "Our customers demand the highest possible part quality, including exact and precise cut edges," explains Louisa Peters, a TruLaser product manager in TRUMPF's Machine Tool division. Peters has spent three years improving the edge quality of sheet metal parts. "It can be really challenging when you're faced with materials or surfaces that aren't optimized for laser cutting, especially if you have limited experience," she says.

In such cases, operators from sheet metal processing companies often have to manually adjust cutting parameters one by one to achieve the desired result. This involves selecting the cutting process, testing it on parts, and then subjectively evaluating the edge quality. If the results aren't up to scratch, they must tweak individual parameters repeatedly – a time-consuming process that requires expertise, increases scrap rates, and consumes valuable production time. With skilled personnel in short supply, this approach is not always feasible.

To address this issue, TRUMPF experts developed the Cutting Assistant, an innovative support system centered around a simple hand-held scanner connected to the laser cutting machine. Users scan the cut edge of a part they want to optimize, and the system processes this data using an AI-powered algorithm trained on over 100,000 images. The assistant evaluates edge quality objectively and automatically suggests adjustments to cutting parameters. This allows users to achieve better results quickly and efficiently. Moreover, the AI algorithm continuously learns from each adjustment it recommends, improving its suggestions over time.

> " It offers a fast **solution to the customer's problem,** and it doesn't require any prior knowledge. "
>
> Louisa Peters, product manager for TruLaser machines, explains TRUMPF's Cutting Assistant

IMAGES: Andreas Sporn

Hunter supercomputer: AI development and simulation demand immense computing power. TRUMPF leverages the Hunter supercomputer at the University of Stuttgart's High-Performance Computing Center (HLRS) to tackle complex AI applications. With a peak performance of 26 petaflops – one petaflop being one million billion calculations per second – it is one of Europe's most powerful industrial computers.

Driving innovation through AI

According to Germany's Federal Statistical Office, one in five companies in Germany now uses AI technologies – a figure that continues to grow globally as part of digital transformation efforts. TRUMPF is at the forefront of this trend in Germany, driving innovation through numerous AI-powered solutions. This year marks another major milestone for TRUMPF as it establishes new structures to integrate AI developments across all departments worldwide. The newly formed AI Hub will play a pivotal role in coordinating these efforts and accelerating TRUMPF's company-wide AI strategy.

Cyber security at TRUMPF

TRUMPF also develops AI solutions using customer machine data – and that makes safeguarding sensitive information a top priority. At its Ditzingen site, a dedicated team of 30 cyber security experts – supported by 80 coordinators worldwide – ensures robust protection for both digital systems and customer data.

How TRUMPF enhances the security of its data, products and processes at every level.

These efforts focus on three key areas:

Information security: TRUMPF maintains ISO certifications across all Ditzingen-based business divisions to protect internal and customer-specific data. Additionally, the company is preparing to implement the EU directive on network and information security, which mandates strict reporting requirements for security incidents.

Product security: TRUMPF is progressively redesigning its product development processes to comply with the EU's Cyber Resilience Act. This regulation sets binding cyber security requirements for digital components. Secure software development practices, detailed risk assessments and regular security updates enhance product reliability.

IT security: An annually updated cyber security roadmap defines clear objectives and drives continuous improvements to TRUMPF's IT security infrastructure.

BIZ+

SHORT CUTS

Fascinating facts and exciting innovations.

TRUMPF and ZEISS awarded Werner von Siemens Ring for High NA EUV lithography breakthrough

The Werner von Siemens Ring Foundation has honored research teams from ZEISS and TRUMPF for their pioneering work in **High NA EUV lithography.** This breakthrough technology opens the door to fabricating microchips that are more powerful and energy-efficient than ever before. Dr. Peter Kürz from ZEISS Semiconductor Manufacturing Technology (SMT) and Dr. Michael Kösters from TRUMPF accepted the award on behalf of their teams. Dutch firm ASML, the sole global manufacturer of High NA EUV lithography systems, developed the overall system architecture and the High NA EUV light source. TRUMPF supplied the **high-power laser** that generates the extremely short-wavelength EUV light, while ZEISS provided the optical system that uses High NA technology to create chip structures with unprecedented precision. This advanced manufacturing process for the latest EUV-based chip generations sets new benchmarks and pushes the boundaries of what is technically achievable. This marks the second time TRUMPF has received the Werner von Siemens Ring following Berthold Leibinger's receipt of the award in 2005.

New Smart Factory at TRUMPF's Pasching facility

TRUMPF recently invited representatives from the worlds of business and politics to attend the inauguration of a new extension at its Pasching site, which features a **dedicated smart factory.** The company invested approximately 40 million euros in this expansion, which includes two new production halls covering 7,000 square meters as well as 850 square meters of office space. "This major investment underscores our long-term commitment to Austria. Pasching is one of our most important locations outside Germany," said TRUMPF CEO Nicola Leibinger-Kammüller.

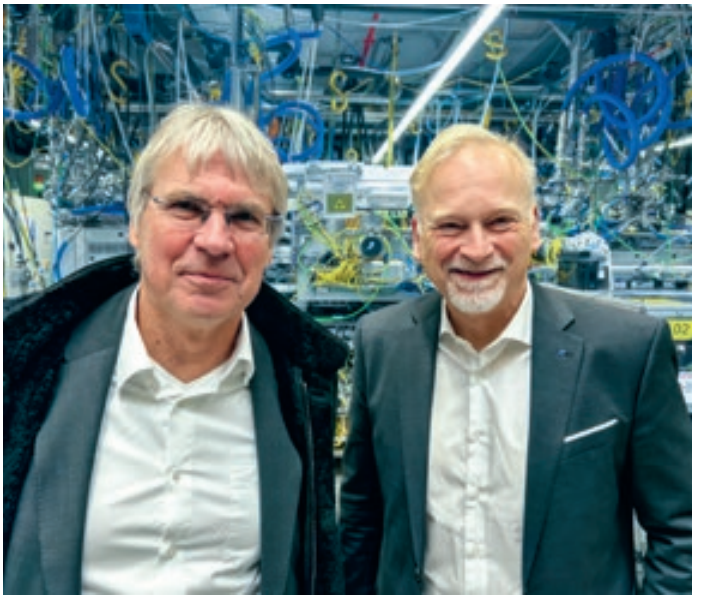
Art meets technology

Of all the machines at EuroBLECH 2024, there was one that really stood out: a **TruLaser 3040 Bevel Cut Edition** was transformed into a **work of art** by Berlin street artist Felix Aaron Hülpüsch (alias "Hülpman") in front of a crowd of trade-fair attendees. In a collaborative process, visitors to TRUMPF's booth suggested ideas to Hülpman that he fed into the final design. "Innovation thrives through personal connections," said Stephan Mayer, CEO TRUMPF Machine Tools. The customized TruLaser 3040 now has pride of place at Molon Antonio e Lorenzo S.r.l., an Italian precision laser-cutting firm.

IMAGES: TRUMPF

Smart factory training for service technicians

As part of efforts to further enhance its services as a smart factory solutions provider, TRUMPF has established a training center at its Global Training Center in Ditzingen. The new facility runs a program of **intensive training courses for TRUMPF service technicians** on the efficient operation and maintenance of innovative smart factory systems. The two-week program covers system networking, commissioning and field error analysis. TRUMPF also offers courses that show customers how to rapidly deploy new systems. In the future, this on-site training will give even more customers the support they need to implement and operate their smart factories. Similar training initiatives are planned for the company's centers in the Americas and Asia.



Fraunhofer president visits TRUMPF

In December 2024, Prof. Dr. Holger Hanselka, president of the Fraunhofer-Gesellschaft, met with Berthold Schmidt, CTO of TRUMPF, to discuss how to strengthen their **collaboration on forward-looking research initiatives.** The talks followed the signing of a new framework agreement designed to bolster the decades-long research partnership between the two organizations. "Innovation remains the key to maintaining Germany's industrial leadership," Schmidt emphasized. "This agreement marks yet another milestone in TRUMPF's successful partnership with Fraunhofer. It reminds us that strong partnerships between companies and research institutions are crucial for the innovative capabilities of a high-tech company." Currently, half of TRUMPF's publicly funded projects involve Fraunhofer partnerships. Since their first cooperation in 1986, TRUMPF and Fraunhofer have completed 80 projects together. "This framework agreement with TRUMPF further cements our solid and successful partnership in research and development," says Hanselka. The visit concluded with a tour of TRUMPF's R&D departments and EUV production facilities.

TRUMPF helps democracy thrive

Through its involvement with the cross-sector initiative "Allianz der Chancen", TRUMPF is training young professionals to become advocates for **democratic values.** The first democracy training session took place in December 2024 for apprentices and students on dual vocational training schemes. It featured attorney Sven Weber, who posed the question "Why democracy?" to his audience. Experts working on the initiative have prepared further sessions for 2025 which will focus on communicating democratic principles effectively and fostering critical thinking. "Our goal is to empower trainees and dual-study students to champion these values within their networks," says Jens Ottnad, Head of Global Training.

Six digital game-changers: TRUMPF services make manufacturing more efficient

Digitalization of the manufacturing industry is advancing at a rapid pace. TRUMPF offers innovative services to enhance transparency, optimize production processes, minimize downtime and improve productivity. Here, we explore six digital solutions that create clear added value for modern, competitive manufacturing operations.

1

Smart View for Machine Tools: All the relevant production and status data in one place

Smart View for machine tools presents all your machine and production data in a **clear and accessible visual format**. It integrates information from various sources, including machine operating data, camera-system images and data from the Oseon production control software. Compiled in a central dashboard, this data enables users to monitor production processes in real time, identify unscheduled deviations and pinpoint ways to improve efficiency. The dashboard delivers the transparency required for data-driven decision-making.

Benefits: Full visibility into manufacturing processes, faster response times, improved decisions and fewer sources of error, while also avoiding the wait times and stoppages that might otherwise occur due to missing raw materials, machine retooling or other factors. This drives productivity gains.

2

Condition Monitoring: Enhancing machine availability

Condition Monitoring **continuously records and analyzes critical machine parameters**. Automated diagnostics detect potential machine failures early, and the analysis results are sent directly to TRUMPF experts for proactive problem-solving. This monitoring and diagnostic service reduces unplanned downtime and achieves lasting improvements in machine availability.

Benefits: Higher machine availability thanks to reduced downtime, proactive troubleshooting recommendations and lower follow-up costs.

3

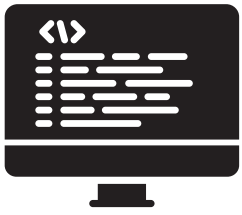
Remote Support: Solving problems from a distance

Remote Support enables fast and secure troubleshooting of technical issues. TRUMPF service technicians can access systems securely to **analyze and resolve problems remotely**, in many cases eliminating the need for an on-site visit.

Benefits: Shorter downtime, rapid fault diagnosis and lower service costs.

4

Programming Solutions: Streamlined work preparation



Tools like **TruTops Boost and ScaleNC** make the programming of laser, punching and bending machines more efficient. TruTops Boost provides comprehensive tools for 2D/3D design and programming, while ScaleNC leverages flexible cloud services to help with programming in peak workload situations.

Benefits: Faster work preparation, improved resource utilization, optimized machine programs, superior part quality and increased productivity.

6

MyTRUMPF: Centralized machine management portal

The **free MyTRUMPF customer portal** consolidates numerous processes into one intuitive, personalized platform. It supports employees in organizing their machinery and software assets while providing self-service solutions for completing tasks, such as accessing the documentation, reports and training materials for a specific machine. The integrated **TruShop** module offers multiple channels through which users can identify and order TRUMPF original parts and punching/bending tools. Users can also request custom tooling solutions through TruShop. Daily tasks become easier once MyTRUMPF is up and running.

Benefits: Streamlined processes, reduced administrative overhead and clear management of assets.

5

Service App: Digitalizing service processes

The **Service app** saves time and simplifies round-the-clock **reporting and management of service incidents** by directly routing them to the appropriate technician. Users can also use the app to identify spare parts, access machine information, and review maintenance schedules and reports. Integrated Technical Guides allow operators to quickly resolve many issues independently, and a link to the die **Visual Assistance feature** provides the option of live support from TRUMPF technicians.

Benefits: Smooth handling of incidents, greater transparency and time savings in day-to-day service operations.

Check it out!

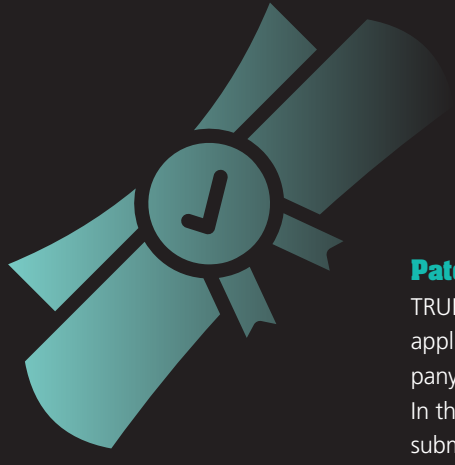
DRIVING FUTURE INNOVATION

Innovation is the key to the future – and TRUMPF plays a leading role in pioneering new technological advances. With its strong **commitment to research and development,** the company is actively shaping tomorrow's industrial landscape. From laser technology and quantum computing to artificial intelligence, TRUMPF makes targeted investments in innovative solutions.

530

530 million euros for research and development

As part of its **visionary strategy,** TRUMPF invested an impressive 530 million euros in research and development in fiscal 2023/24. This substantial sum opens the door to numerous future innovations.



Approx. 300 patent applications a year

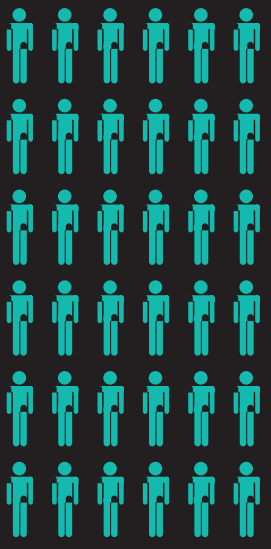
Patents drive progress

TRUMPF files some 300 new patent applications a year, making the company a significant driver of innovation. In the last fiscal year, the company submitted **352 first-time patent applications,** underscoring its impressive innovative capabilities.

Global research presence: TRUMPF maintains research facilities in key sales regions worldwide – from Asia and Europe to the U.S.

Promoting scientific excellence

TRUMPF supports **professorships and doctoral theses.** In addition, TRUMPF also has doctoral students conducting research and working directly on cutting-edge projects.



>3,000

Thousands of great minds

More than 3,000 employees across the globe work on research and development at TRUMPF. This **team of experts and visionaries** is shaping the technology of the future.

Awards: Research with an outstanding reputation

TRUMPF's dedication to research has garnered several prestigious awards, including:

- **Werner von Siemens Ring 2024** for EUV lithography
- **German Future Prize 2020** for EUV lithography
- **German Future Prize 2013** for ultrashort pulsed lasers

Publicly funded projects and collaborations

TRUMPF is currently involved in some **40 publicly funded projects.** In addition, the company collaborates with renowned partners such as Fraunhofer institutes (e.g. ILT Aachen, IPA Stuttgart, IOF Jena) and Germany's TU9 universities (an alliance of leading technical universities in Germany, including the University of Stuttgart and the Karlsruhe Institute of Technology.)

40

Technological focus:

TRUMPF prioritizes key technologies for industrial manufacturing:

- **Laser technology:** Developing innovative lasers for industrial applications
- **Quantum technology:** Pioneering future technologies for science and industry
- **Artificial intelligence:** Enhancing efficiency and precision in manufacturing
- **Electric vehicles:** Technologies for sustainable mobility
- **Sustainability:** Solutions for reducing energy consumption and emissions

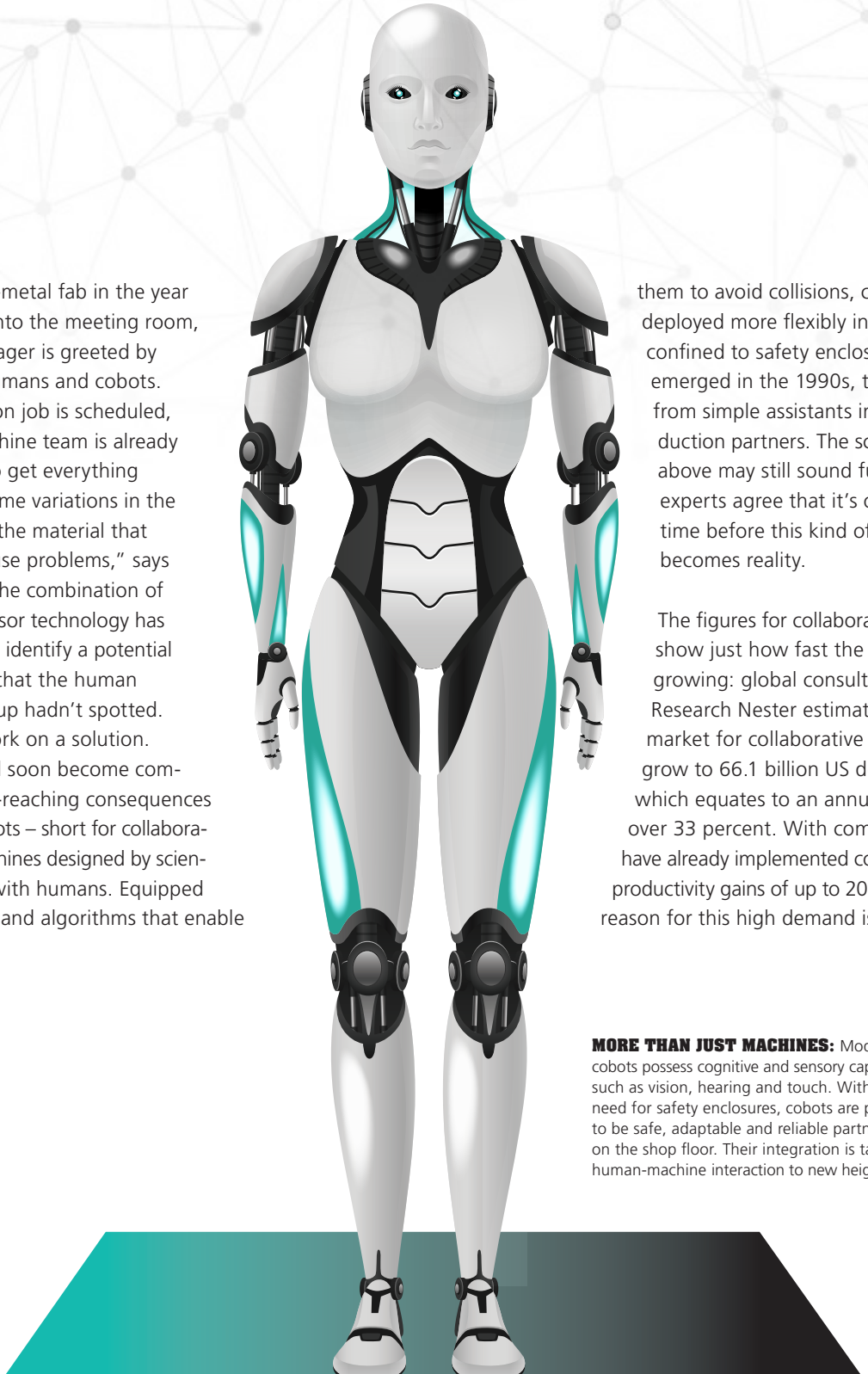
05

FUTURE

FRESH IMPETUS FROM ROBOT COLLEAGUES

IMAGE: Adobe Stock / peerapong

Smart, autonomous **cobots** are poised to radically transform the world of production. With **cognitive abilities** that are bringing humans and machines ever closer together, the next 20 to 30 years could see them not only solve key challenges, but also completely reshape manufacturing chains.



The scene is a sheet-metal fab in the year 2050. As he strolls into the meeting room, the production manager is greeted by a hybrid group of humans and cobots. A complex production job is scheduled, and the human-machine team is already working smoothly to get everything ready. "There are some variations in the surface structure of the material that could potentially cause problems," says one of the cobots. The combination of AI and advanced sensor technology has enabled the cobot to identify a potential source of problems that the human members of the group hadn't spotted. The team gets to work on a solution. Such scenarios could soon become commonplace – with far-reaching consequences for the industry. Cobots – short for collaborative robots – are machines designed by scientists to work safely with humans. Equipped with sensor systems and algorithms that enable them to avoid collisions, cobots can be deployed more flexibly instead of being confined to safety enclosures. Since they emerged in the 1990s, they have evolved from simple assistants into complex production partners. The scenario described above may still sound futuristic, but experts agree that it's only a matter of time before this kind of collaboration becomes reality.

The figures for collaborative robotics show just how fast the industry is growing: global consultancy firm Research Nester estimates that the market for collaborative robots will grow to 66.1 billion US dollars by 2036, which equates to an annual increase of over 33 percent. With companies that have already implemented cobots reporting productivity gains of up to 20 percent, the reason for this high demand is clear.

MORE THAN JUST MACHINES: Modern cobots possess cognitive and sensory capabilities such as vision, hearing and touch. Without the need for safety enclosures, cobots are proving to be safe, adaptable and reliable partners on the shop floor. Their integration is taking human-machine interaction to new heights.

Companies that have introduced cobots report **productivity gains** of up to 20 percent.

DIALOG WITH THE FUTURE: David Reger, founder of Neura Robotics, pictured seemingly in conversation with a cobot – a symbol of the evolving collaboration between humans and machines. Cobots integrate AI-enhanced perception with precision and flexibility. But however useful they can be as production partners, experts like Johannes Stoll caution against blurring the lines between humans and machines. Maintaining clear roles remains critical for both efficiency and safety.

Sixth sense on the shop floor

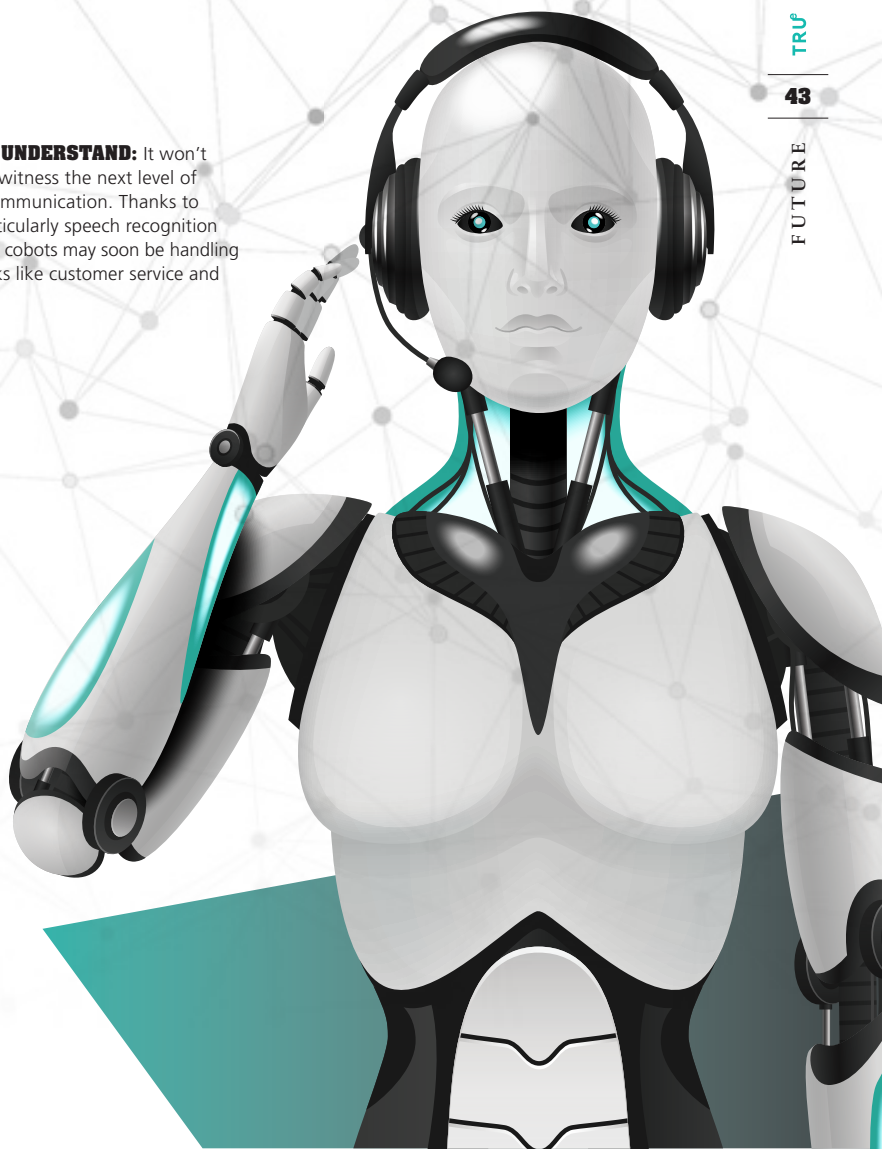
Johannes Stoll, group leader of robot processes and kinematics at the Fraunhofer Institute for Manufacturing Engineering and Automation (Fraunhofer IPA), argues that the potential of cobots lies in continuous technological advancement. "The next generation will feature more sensors, extended axes of movement and artificial intelligence," he says. These technologies will enable cobots to identify, grip and accurately position irregularly shaped objects. "Achieving that would have been unthinkable just a few years ago," he says.

David Reger, founder and CEO of Neura Robotics, a high-tech company based in Metzingen, is even more optimistic. "Rapid advances in AI and robotics are driving developments that were pure science fiction not so long ago," he says. His company's cognitive robots already boast key sensory capabilities such as sight, hearing and touch. "Our human-recognition sensor technology works even without visual contact, significantly improving the robot's ability to sense and react to human coworkers," says Reger. Cobots equipped with this technology can recognize humans using heat or motion sensors, adapt their movements and avoid collisions.

Reger envisions future cognitive cobots as even more adaptable and intelligent: "We're already developing robots that can recognize their environment, identify the tasks at hand, and then operate autonomously, instead of being limited to a single pre-programmed function." For example, a cobot could use vibration analysis, thermal imaging and acoustic patterns to predict when a component or machine part is close to failure. It could then proactively order a replacement part and schedule the most efficient repair – potentially even before a human notices the problem.

In this scenario, the cobots in a production facility would form a kind of interconnected neural network, with information flowing between them on a continuous basis. "Because robots – like

IMAGE: NEURA Robotics

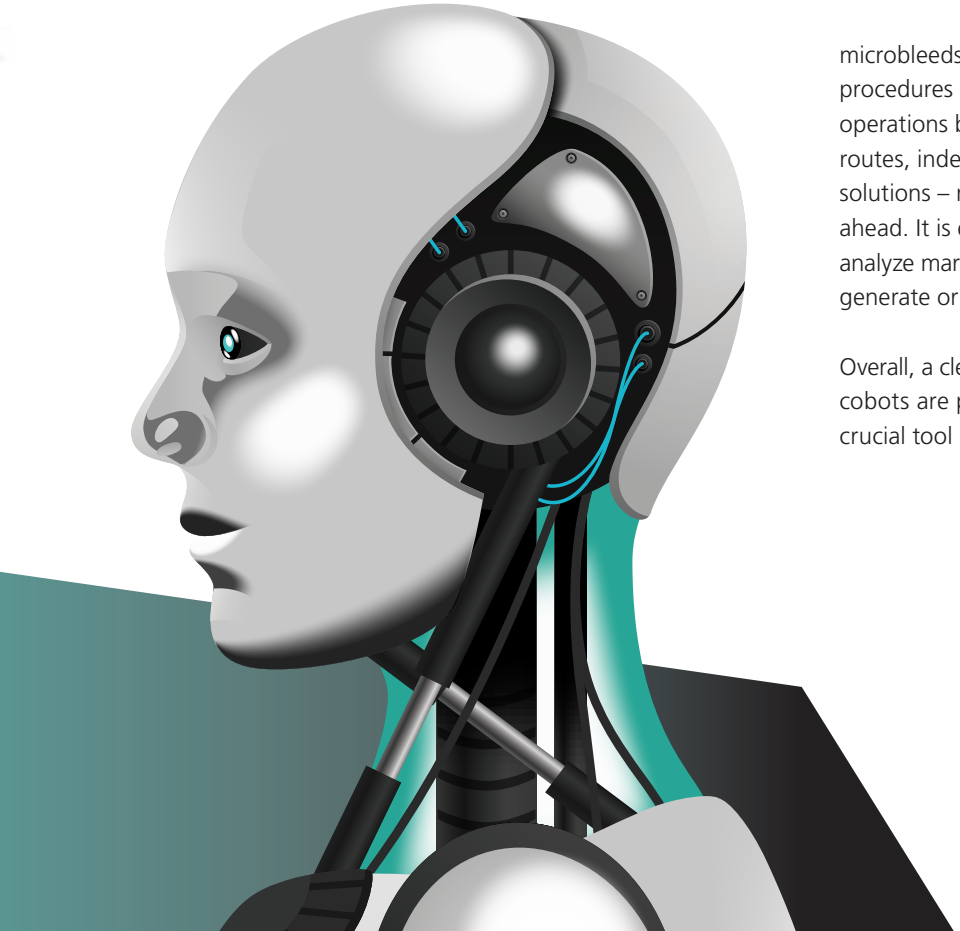


LISTEN, SPEAK, UNDERSTAND: It won't be long before we witness the next level of human-machine communication. Thanks to advances in AI, particularly speech recognition and responsiveness, cobots may soon be handling communicative tasks like customer service and technical support.

computers – are networked, they can share data efficiently, learn from each other and optimize processes," says Reger. The International Federation of Robotics (IFR) predicts that cobots will soon unlock new markets and applications, driven by advances in AI and machine learning. Cobots already account for approximately 10 percent of the more than four million industrial robots operating worldwide.

Unlimited applications

The potential applications extend far beyond factory floors. In operating rooms, cobots could scan tissue in real time, pinpoint microbleeds or cellular anomalies, and perform precise surgical procedures autonomously. In logistics, they could revolutionize operations by efficiently sorting packages, optimizing delivery routes, independently flagging unforeseen issues and proposing solutions – much like a chess grandmaster planning several moves ahead. It is even possible to envision "creative" cobots that could analyze market data, past design trends and customer feedback to generate original suggestions for new products.



Overall, a clear trend is emerging: Instead of being mere assistants, cobots are poised to become a driving force for innovation – a crucial tool in a world where progress is paramount.

TEC+

SHORT CUTS

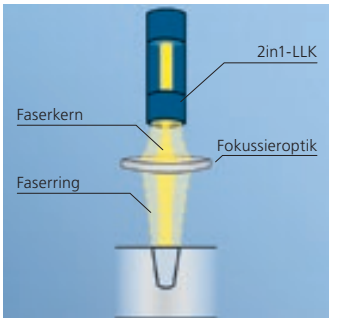
Innovations, technologies and future trends.

Real-time monitoring of production processes

Smart View for machine tools simplifies the use of data-driven TRUMPF products. As a **central dashboard,** it consolidates all the key information in MyTRUMPF and presents complex data in an accessible visual format. Production processes can be monitored in real time, enabling users to detect unscheduled deviations and identify potential for improvement. This creates **maximum transparency** and provides a reliable basis for informed decisions. The tool provides easy access to each machine's operating status, as well as to condition monitoring data, camera images, process data and information from Oseon. Smart View is a web-based application, which means it can be accessed across multiple devices, giving users the information they need, when they need it.

ToolMaster now available for TruBend Series 8000

The ToolMaster automated tool changer is now also available for the TruBend Series 8000. The ToolMaster switches between bending tools in a matter of seconds, allowing operators to focus on other tasks. Its precise positioning accuracy simplifies stage bending, makes the whole process more user-friendly while preventing the common problem of setup errors. The ToolMaster provides space for up to **65 meters of bending tools** (depending on selected tools), including standard and special tools. Adding tools is simply a matter of clamping the tool in place and scanning a data matrix code. ToolMaster significantly boosts shopfloor efficiency by eliminating time spent searching for and transporting tools, making it a good choice even for small batch sizes.



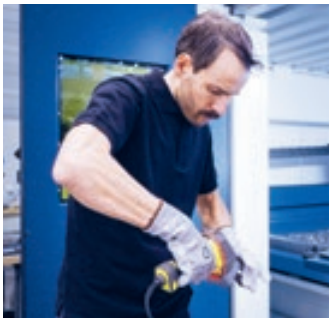
BrightLine Weld: an innovative solution for laser welding

Spatter and thermal distortion are common challenges in laser welding. As well as reducing weld seam quality, they also increase the need for rework, which drives up operating costs. With its **BrightLine Weld** technology, TRUMPF has developed an efficient solution for virtually spatter-free laser welding of mild steel, stainless steel, copper and aluminum. The innovative TRUMPF 2-in-1 Laser Light Cable (2-in-1 LLK) flexibly splits the laser light between an inner and an outer fiber core for optimum power distribution. This adaptive input of energy improves weld seam quality and reduces thermal distortion while also increasing productivity through higher feed rates. Less rework, lower scrap rates and a reduction in the frequency of protective glass replacement result in lower operating costs.

Optimized laser cutting with Active Speed Control and Smart Rerun

In laser cutting, variations in material quality or sheet thickness can lead to cutting flaws or poor part quality. Active Speed Control from TRUMPF offers an **adaptive means of controlling the feed rate.** It monitors the cutting process in real time, analyses the kerf, and determines and regulates the optimum feed rate independently, thereby minimizing the effect of material variations on process reliability. If a faulty cut is imminent, the machine stops before it occurs. Paired with the Smart Rerun feature, this technology enables **production of the part to continue automatically**, or moves on to the next part. These intelligent functions help to reduce scrap rates and allow for greater autonomy, which translates into lower costs.

IMAGES: TRUMPF



Intelligent cutting data optimization

The TRUMPF Cutting Assistant offers a **smart and efficient solution for cutting-edge optimization** that requires no prior knowledge. Currently, users are required to manually adjust cutting parameters and subjectively assess the quality of the cutting-edge surface. This requires a great deal of experience and is both time-consuming and resource-intensive. With the **Cutting Assistant,** the user simply scans the part's cut edge with a hand-held scanner connected to the machine. The **AI-powered algorithm** objectively evaluates burr and roughness and recommends adjustments to the cutting parameters, specifically to the focal position, feed rate and gas pressure. This self-learning system offers a quick way to optimize cutting quality and is also suitable for users without prior experience.

New machine cooler cuts energy consumption by 50 percent

TRUMPF has released a new cooler for its laser-cutting machines which uses up to **50 percent less energy** than conventional solutions. Unlike traditional coolers, the main components of this system – such as pumps, fans and compressors – are equipped with speed controllers. This ensures that the cooler only uses as much energy as is actually required to cool the laser. Energy savings are particularly high when cutting thin sheet metal or during scheduled breaks in production. "By introducing this energy-efficient cooling unit, TRUMPF is continuing to **advance sustainability in industrial manufacturing.** Users not only reduce CO_2 and electricity, but also energy costs. This ultimately makes their companies more competitive," says Fabian Staib, product manager at TRUMPF (right in the image).

With such high energy savings, companies can expect the cooling system to pay for itself within less than four years. And with a footprint of just one square meter, the cooler should fit seamlessly into any production environment. TRUMPF currently offers this solution for its 24-kilowatt laser-cutting machines. It plans to expand availability to lasers with other power outputs in the future.

Future-proof production with factory simulation

Companies are increasingly recognizing the need to future-proof their production processes by tackling supply bottlenecks and inefficient manual logistics processes. TRUMPF's factory simulation provides a **detailed digital representation of the production environment,** enabling **precise simulations of transport processes and cycle times.** By facilitating the modeling of individual production plans, the simulation allows users to make their decisions on the basis of concrete scenarios. It also supports the integration of partner systems. By optimizing workflows and providing clear metrics for solid investment decisions, the factory simulation makes investments more predictable and keeps production competitive.

Seven jobs in one

Austrian company Cimbria Heid was faced with the challenge of replacing a 130-year-old punching machine that makes parts for machines used to sort grain and seeds. Several machine-makers declined to take on this complex task – but fortunately TRUMPF rose to the occasion. Today, the TruPunch 5000 not only fulfills the duties of its historic predecessor, but also those of six other machines.

For over a century, production workers at Cimbria Heid have hauled around 40-kilogram metal sheets, manually loading them into an antique punching machine that rhythmically punched rows of indents into the sheet's surface. Designed in 1894 by Nikolaus Heid, this punching machine was a groundbreaking technology in its time. "Its job is to produce components for a trieur, a device used to sort grains and seeds," explains Günther Schwarz, Cimbria Heid's operations manager. But after 130 years of service, it was time to find a more modern solution.

Innovation drives efficiency

Such machines are an important part of Cimbria Heid's heritage, but the company needed to adopt new technologies in order to stay competitive. A trieur separates grains by size, using cylinders made of punched sheets that rotate around a trough. Small indentations in the metal, known as "pockets", hold grains of a specific size and lift them upward. Grains that are too large or too small fall out during this process and are collected in the trough. Creating these pocket indentations in a sheet poses two main challenges: first, making the indentation exactly the right shape, and second, maximizing the number of depressions on the available surface area. To complicate matters further, each type of grain requires a dedicated punching tool: tiny clover seeds fit in small dimples, while sunflower seeds need 28-millimeter pockets. "Punching a single pocket may sound relatively quick and easy," says operations manager Günther Schwarz. "But fitting so many pockets onto a two-meter-long sheet is technically quite demanding."

Günther Schwarz and the management team began searching for alternatives to replace their aging machines in the summer of 2021, but it wasn't until September 2023 that they finally had the TruPunch 5000 up and running. "We had such reverence for the

IMAGES: Klaus Schwaiger

PRECISION WORK: The TruPunch 5000 punches the maximum possible number of high-precision indents, or "pockets", into the sheet metal surface. Workers then form the processed sheet metal into cylinders, which are a key component of a trieur – a machine designed for sorting grain and seeds.

> “ We still need to test each tool individually to ensure **sorting accuracy.** So there’s plenty of work left to do! ”
>
> Günther Schwarz, operations manager at Cimbria Heid

RELIABLE: Operations manager Günther Schwarz supervises a seamless production process at Cimbria Heid.

old machines – we just couldn’t imagine a modern machine processing the sheets in the way we needed,” says Schwarz. Cimbria Heid initially approached ten potential suppliers, but only TRUMPF was ultimately willing to take on the challenge.

Advanced technology for greater efficiency

The TruPunch 5000 has driven major efficiency gains at the company. Tasks that once required multiple machines are now handled by a single system capable of punching pockets at a rate of up to 1,600 strokes a minute. Active material clamps prevent sheet deformation during punching, eliminating the need for additional straightening. The machine also includes features such as cutting sheets to size, deburring edges and engraving labels directly onto the metal. The 40-kilogram metal sheets are now handled by a SheetMaster instead of by production workers, and the process of switching between 50 different tools is also fully automated. Complex trieur components are produced during daytime shifts, when quality checks can be performed. At night, the machine runs unattended, manufacturing simpler flat sieves.

Over the past 130 years, Cimbria Heid has amassed some 450 punching heads for processing various grain and seed types. These remain vital for use in the new machine. “Each tool needs to be tested individually to ensure sorting accuracy,” says Schwarz. “So there’s plenty of work left to do!” As for the old machines, their future is still undecided. However, Schwarz is confident of finding them a worthy new home: “Perhaps they’ll even end up in an industrial museum.”

WELL-EARNED RETIREMENT: After 130 years of service, it’s time for the old punching machines to retire – and for the TruPunch 5000 to take over.

SMART SAVINGS: TRUMPF PART DESIGN

Better quality at a lower cost: At TRUMPF's part-design workshops, engineers learn how to maximize the potential of their parts and machines in order to make production more cost-effective. Each issue, TRUe showcases a different application to illustrate how this process works.

This issue:

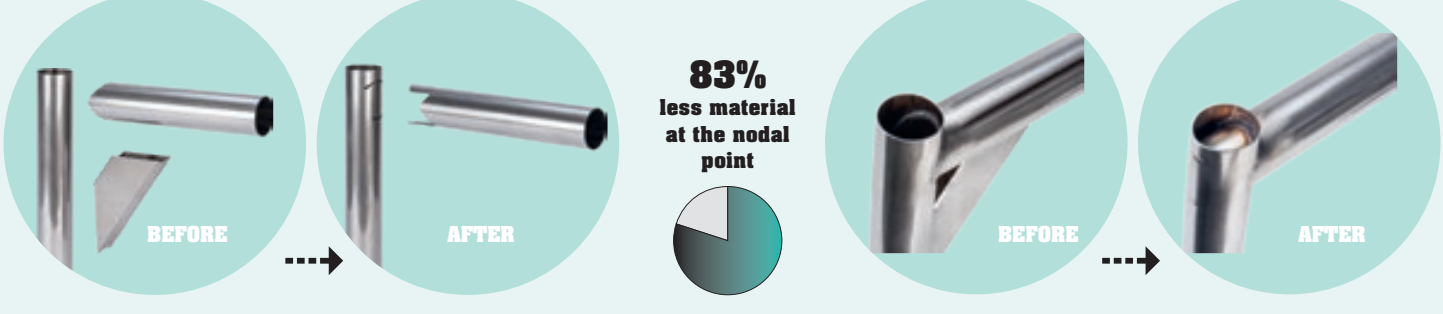
Optimizing tubular structures – how laser cutting can enhance flexibility and cut costs

Tubular frameworks are essential in many industries, from furniture manufacturing and plant engineering to vehicle chassis. Yet traditional production methods tend to limit design flexibility and drive up costs.

"Conventional techniques such as sawing, drilling and milling often aren't the most efficient ways to produce tubing," says Ralf Fenchel, a trainer at TRUMPF Part Design. In its seminars and workshops, TRUMPF shows how laser cutting can be used to unlock the full potential of tubular systems. Sawing permits only straight or angled cuts, which means curves or holes require secondary steps such as drilling or milling. Additionally, engineers often rely on gussets for structural stability. "Every joint has to be welded," says Fenchel. "That takes time – and it requires a lot of material." Laser cutting provides a streamlined alternative, enabling the creation of dovetail joints, cutouts and interlocking nodal connections in a single step. This results in significantly shorter processing times, fewer assembly stages and reduced material consumption. "The biggest challenge is understanding how to put these design options into practice," says Fenchel.

Ralf Fenchel, trainer at TRUMPF Part Design

Participants in the TRUMPF workshops and seminars learn the fundamentals of laser-based design as well as techniques to optimize applications. In one case study, TRUMPF experts achieved an 83-percent reduction in material use at each nodal point by employing interlocking dovetail joints. "It's a fantastic way to improve stability, even without gussets," Fenchel says. This approach is particularly effective in structures with multiple connections, where intelligent geometries evenly distribute loads across various points, enhancing durability. At the end of each workshop, the participants develop functional, cost-efficient designs that are ready for seamless integration into reliable production processes.



IMAGES: TRUMPF

#21

pARTgallery

Presenting parts in a new light is something we do in every issue of TRUe.
This picture shows **laser-cutting nozzles** as you've never seen them before. Cutting nozzles direct the laser beam and cutting gas onto the workpiece.
Photographer **Pia Hertel** has taken these parts out of their usual environment and presented them in a completely new light,
surrounded by the slag residues that form during laser cutting.

Uncharted paths to new horizons

Innovation doesn't always follow a straight path. Take BioNTech and its founders, Ugur Sahin and Özlem Türeci, for example. Before COVID-19 swept across the globe, few outside the biotechnology sector had ever heard of the company. While Sahin and Türeci were respected names among scientists in similar fields, their work was certainly not widely known. BioNTech itself was based in Mainz, a modest German city best known for its historical claim as the birthplace of Johannes Gutenberg and his revolutionary printing press – a breakthrough that dates back more than half a millennium.

Then came COVID-19. Practically overnight, BioNTech and its vaccine became global phenomena. The company dominated headlines, featured on news programs, and was celebrated worldwide as a symbol of hope during an unprecedented crisis. And in a true mark of success, most reporters even managed to spell the company's name correctly!

Ugur Sahin and his wife, Özlem Türeci, had originally set their sights on a very different battle. Since the 1990s, the pair had been studying messenger RNA, or mRNA – a molecule that acts as a kind of blueprint, delivering the information needed to produce specific proteins within a cell at the right time and in the right place. But their focus wasn't on infectious diseases. Instead, they saw mRNA as a useful means of harnessing the human immune system to target cancerous tumors in a highly precise and personalized manner.

As is often the case with offbeat and unconventional research paths, BioNTech's early years were anything but easy. The team faced relentless skepticism, money was always tight, and securing the necessary equipment was a constant struggle. Yet Sahin and Türeci never gave up. They remained curious and determined, steadfast in their belief that their research was worth pursuing. In 2008, they founded BioNTech, giving even more impetus to their work. "We were delighted when something worked," says Sahin, reflecting on those early days. "And when it didn't – which was most of the time – we tried to understand what had gone wrong."

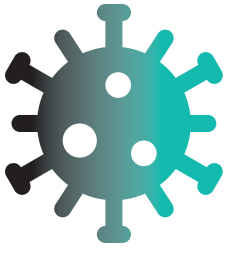
When the World Health Organization declared COVID-19 a pandemic in March 2020, BioNTech was uniquely positioned to respond. Armed with cutting-edge expertise in mRNA technology, the company rapidly pivoted to develop a novel vaccine against the virus, demonstrating the transformative potential of this groundbreaking approach. In a bold move, BioNTech paused its cancer research and redirected all its resources toward combating the global pandemic.

However, trying to save the world – even just a little bit – is not a job for one company to face alone. Recognizing this, BioNTech partnered with U.S. pharmaceutical giant Pfizer to accelerate the development of a COVID-19 vaccine. The collaboration proved to be a historic success, earning the research team global acclaim and numerous awards for their remarkable achievements.

The pandemic not only solidified BioNTech's reputation as a leader in biotechnology but also opened up new horizons for its future endeavors. Beyond continuing its work on vaccines and advancing personalized cancer therapies, the company is now exploring other medical applications where mRNA technology could play a useful role.

Vision, adaptability, curiosity, perseverance, resilience and collaboration – both local and global – are at the heart of BioNTech's story. At one point, investors and advisors urged Sahin to abandon his unconventional path and to approach his research and business like everyone else. But he refused to budge, arguing that there was no sense in doing things the way others had already failed. The qualities demonstrated by BioNTech provide a solid basis for truly groundbreaking innovation in the 21st century. Because sometimes, making a breakthrough means taking a few detours – whatever the industry or field of research.

Jürgen Brand



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