

TRUMPF

THE MAGAZINE FOR SHEET METAL EXPERTS

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A stadium roof like no other:
how TRUMPF machines made
the impossible possible

02 Subbiano

Curiosity, creativity and quality:
how a natural disaster set one company
on a path to global success

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TRUMPF revolutionizes sheet-metal
fabrication with artificial intelligence

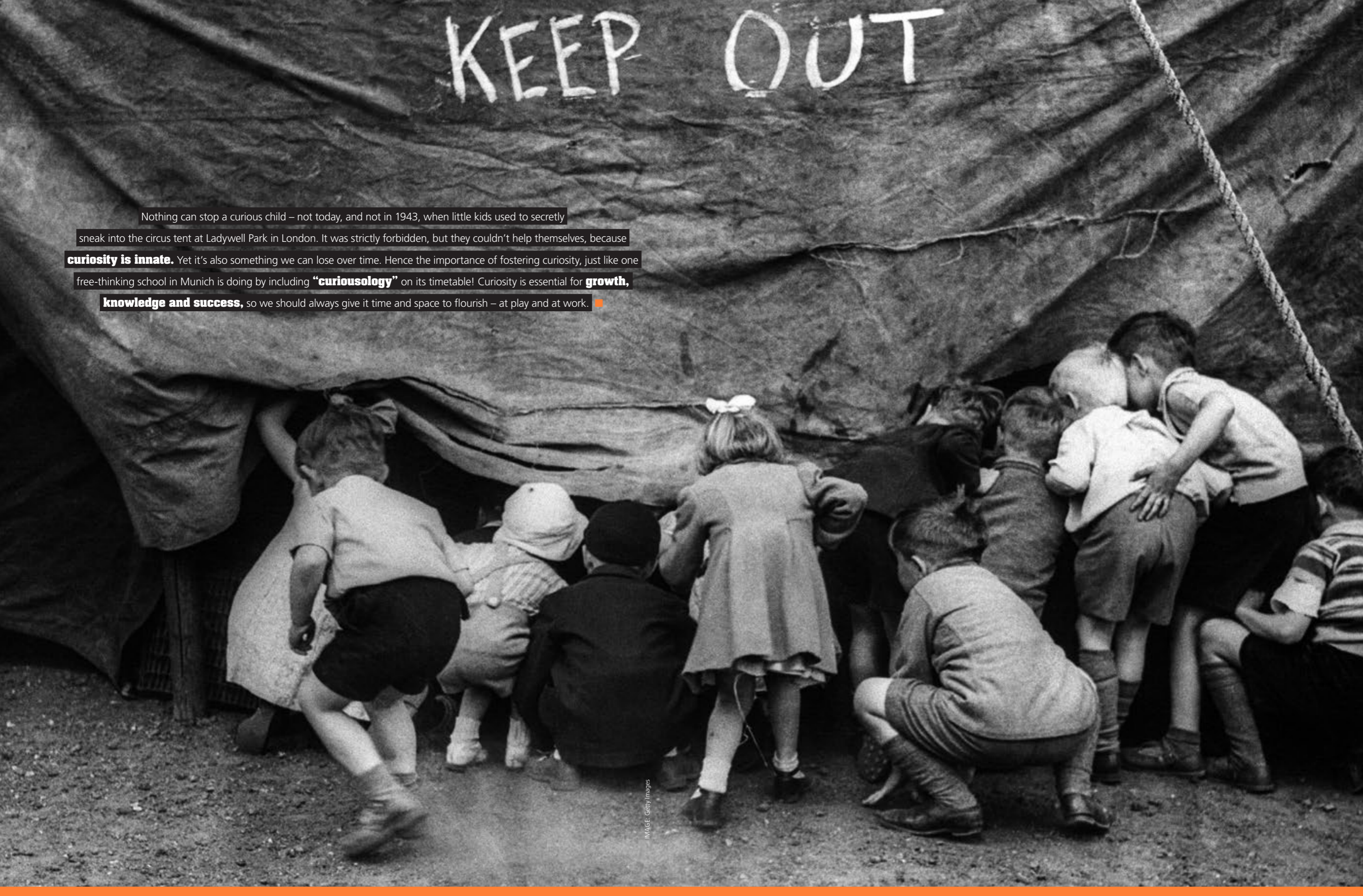




It's no secret: Earth's supposedly "eternal ice" is melting – and researchers are frantically trying to learn whatever lessons they can from these millennia-old glaciers before it's too late. **Glaciology**, the science of ice and snow, originated in 19th-century Switzerland. Since then, it has given us important insights into climate science and the wider cosmos. For example, the presence of ice on Mars and on various moons that circle the planets of our solar system has made glaciology relevant for space travel, too. **Curiosity is critical for entrepreneurs.** And not just about the here and now, because the **past** can teach us a lot about the **future.** ■

KEEP OUT

Nothing can stop a curious child – not today, and not in 1943, when little kids used to secretly sneak into the circus tent at Ladywell Park in London. It was strictly forbidden, but they couldn't help themselves, because **curiosity is innate**. Yet it's also something we can lose over time. Hence the importance of fostering curiosity, just like one free-thinking school in Munich is doing by including “**curiosology**” on its timetable! Curiosity is essential for **growth, knowledge and success**, so we should always give it time and space to flourish – at play and at work. ■





Hard, harder, hardest: Even the most devoted crossword fanatics often find themselves stumped by the Sunday edition of the New York Times. For the past 30 years, puzzle master **Will Shortz** has been setting fiendishly difficult tasks that only the most seasoned experts can hope to solve. He was also responsible for creating the mind-bending riddles used by the Riddler in the 1996 Batman movie. The villain gives the police cryptic clues to his upcoming crimes in the form of what might be the toughest puzzles in film history. Back in normal life, crosswords, sudokus and other games help us keep boredom at bay, **train our brains** and give us a **sense of achievement**. But perhaps the thing we find most fascinating is the same thing that occupies the minds of so many entrepreneurs: finding a **clear solution**.



Curiosity is the key to the future



Dear readers,

Albert Einstein once said of himself: “I have no special talents. I am only passionately curious”.

We owe some of humanity’s most groundbreaking insights to his curiosity, including relativity and quantum theory. Following in his footsteps, this issue of TRUe is dedicated to the topic of “curiosity”. After all, the future of sheet-metal fabrication belongs to companies who can identify and exploit future trends before anyone else – and that requires curiosity.

But before I attempt to spark your curiosity about the contents of this issue, I’d like to say a couple of things about the topic of the hour, namely the war in Ukraine. Everyone here at TRUMPF is shocked and saddened by the dramatic situation unfolding there. The management board condemns the Russian aggression and the suffering it has already inflicted on the civilian population. In response, it has decided to provide 100,000 euros of emergency humanitarian aid to help refugees escaping from Ukraine. We can only hope that those responsible will come to their senses and that peace will soon return to Europe.

But to return to happier topics, and to this issue of TRUe, what should sheet-metal fabricators be curious about in order to achieve commercial success? In our case, the answer would mostly be technologies that increase automation and digital connectivity and that make production more flexible and efficient. That’s because mature smart factories virtually eliminate non-productive time and downtime, because everything is in perfect flow (p. 29).

Our U.S. customer A. Zahner gave an impressive demonstration of the stunning effects of digital connectivity when it created the SoFi stadium in Inglewood, California (p. 12). During the 2022 Super Bowl final, TV viewers all over the world marveled at the roof of this magnificent stadium, which was built at a cost of some five billion euros. The roof consists of 37,000 metal panels – each of them unique – and features some 30 million perforations made using TRUMPF machines. By teaming up with our experts and our

in-house software, A. Zahner succeeded in programming the machines to position the holes in ways that would allow light to enter the stadium exactly as they wanted it to. Thanks to our machines and the solution we helped develop, the whole process took just a few weeks rather than the years it would have taken with conventional programming.

Yet this huge project is only one example of how important software solutions have become to our industry. Customers’ wishes are becoming more individual, and their production needs are becoming more complex. That’s why we’ve launched a new software package for production scheduling and control called Oseon (p. 46). Oseon allows users to fully automate the flow of materials without linking it to a large-scale storage system, paving the way for productivity gains of up to 20 percent. The software also automatically provides workers with digital information on their current job and suggestions on how to perform each task – right there on the shop floor, with no paper, and no switching between different media.

Here, as so much of the time, our aim is to offer customers the best solution to meet their needs. That’s the idea behind our smart factory consulting service, which aims to help customers worldwide increase their production throughput by up to 20 percent (p. 29). It’s also the idea behind our new machines for entry-level users, which aim to offer you, our customers, the perfect solution for wherever you are today (p. 17). These systems may have slightly fewer features than our high-end machines, but they still offer the same outstanding levels of reliability, safety and precision. As a result, we can now offer a technologically sophisticated alternative to companies who previously relied on low-cost machines from China.

I hope this editorial has once again sparked your curiosity about TRUMPF’s latest innovations – and I hope you enjoy reading this issue of TRUe!

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

TRU^e

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When the city of Florence was hit by major flooding in the 1960s, it marked the start of an international breakthrough for Italian lighting specialist AEC Illuminazione. Since then, the company has built a global reputation for its superb sheet-metal luminaires.



01 ...in California

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Unique in every respect: the roof of the SoFi stadium in California consists of 37,000 different panels perforated with some 30 million holes distributed at irregular intervals. Curious to know how they did it? Check out our in-depth report!



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...in Hilchenbach

Keeping an open mind: the SCHRAG Group originally planned to build a completely new site – but it ended up turning its Seevetal location into its most cutting-edge profile factory yet. TRUMPF's smart factory consultants sparked the company's curiosity with a surprising and compelling suggestion.



04 ...in Ditzingen

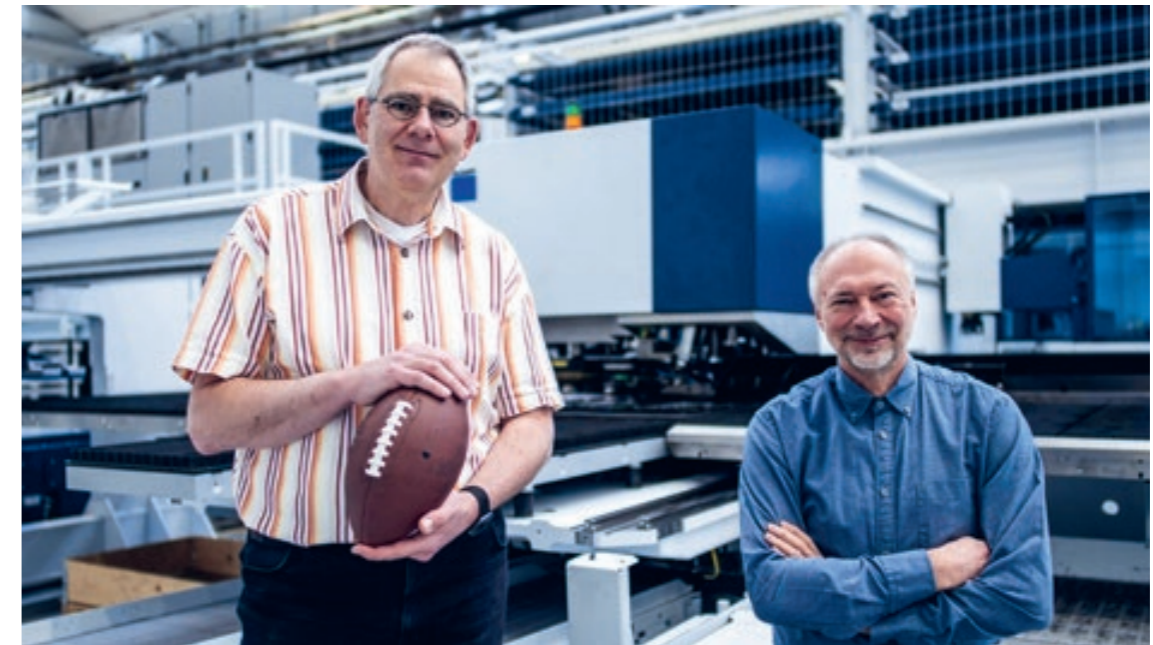
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What if our machines were capable of learning? That's what TRUMPF's "Data and AI" team is working on – and their solutions are already making customers' lives a whole lot easier.



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Built at a **cost of some 5 billion euros**, the SoFi Stadium sports and entertainment complex is said to be the most expensive stadium in the world. The venue of the 2022 Super Bowl also represents a remarkable feat of sheet-metal fabrication. To build the SoFi, three TRUMPF machines cut and punched **37,000 unique panels** featuring some 30 million holes distributed at irregular intervals. This extraordinary achievement was only made possible thanks to a **customized software solution from Ditzingen**, says sheet-metal fabricator A. Zahner.

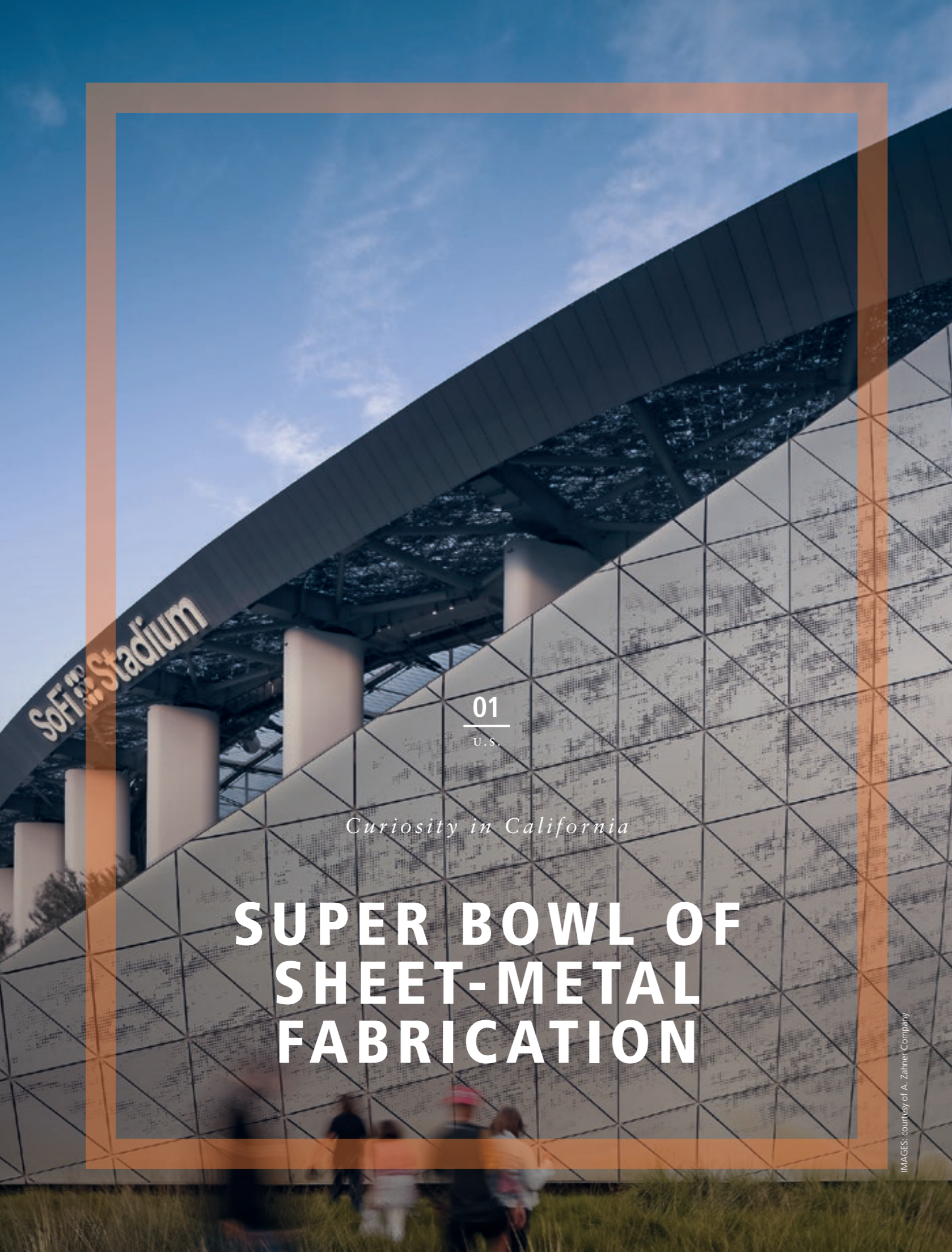


Sports challenge accepted: TRUMPF programmers Hans-Jörg Schmid and Roman Schwarz from the software customization team

A. Zahner doesn't shy away from even the wildest of architectural visions. Over the past few decades, the sheet-metal fabricator from Kansas City, Missouri, can proudly claim to have created facades for some famous and truly remarkable buildings. Intricate, curved, and occasionally hovering tantalizingly above the ground, its designs range from the playful to the austere – and no two projects are alike. Their creations include museums, theaters, public buildings, Google's new headquarters and, of course, the SoFi stadium. "All those projects involved sheet metal, but that's where the similarities end!" says engineer James Coleman, Zahner's Vice President of Innovation.

Wild shapes and melted guitars

Family-owned A. Zahner employs some 200 people and is currently run by the fourth generation of the family. It has specialized in sheet-metal fabrication for the past 125 years, but it really began to make a name for itself in the 1990s when it was commissioned to design the exterior of the Museum of Pop Culture in Seattle. According to world-leading architect Frank Gehry, who designed the building, its wild contours are reminiscent of a melted guitar. "Computers were really slow back then, so the project really pushed the limits of what was possible," says James Coleman.



01
U.S.

Curiosity in California

SUPER BOWL OF SHEET-METAL FABRICATION

IMAGES: courtesy of A. Zahner Company

Ready for the 2028 Summer Olympics

A. Zahner has been consistently pushing the envelope ever since. The SoFi American football stadium, which was completed in September 2020 in Inglewood near Los Angeles, is a prime example of their singular accomplishments. The arena, which seats just over 70,000 people, is home to the National Football League's Los Angeles Rams and Los Angeles Chargers. On February 13, 2022, it played host to the Super Bowl, the hugely popular sports event that is obligatory TV viewing for more than 100 million Americans and many millions of fans worldwide. The SoFi Stadium is already booked for a whole series of other large-scale events, including the opening and closing ceremonies of the Los Angeles 2028 Olympic Games.

The world's biggest video screen

That event will undoubtedly fuel even greater worldwide enthusiasm for the stadium, which was designed by international architects' firm HKS, based in Dallas. The soaring, stylish roof nestles on top of tall columns; from above, the oval canopy with its tapered point looks like an enormous sail. The stadium's canopy roof is made of ETFE, the same translucent plastic that was used to build the Allianz Arena in Munich, Germany. The panels can be opened and closed in the unlikely event of rain in Los Angeles.

Seemingly impossible: over a period of 18 months, three A. Zahner employees worked in two shifts to cut and punch 37,000 different panels featuring some 30 million holes distributed at irregular intervals.

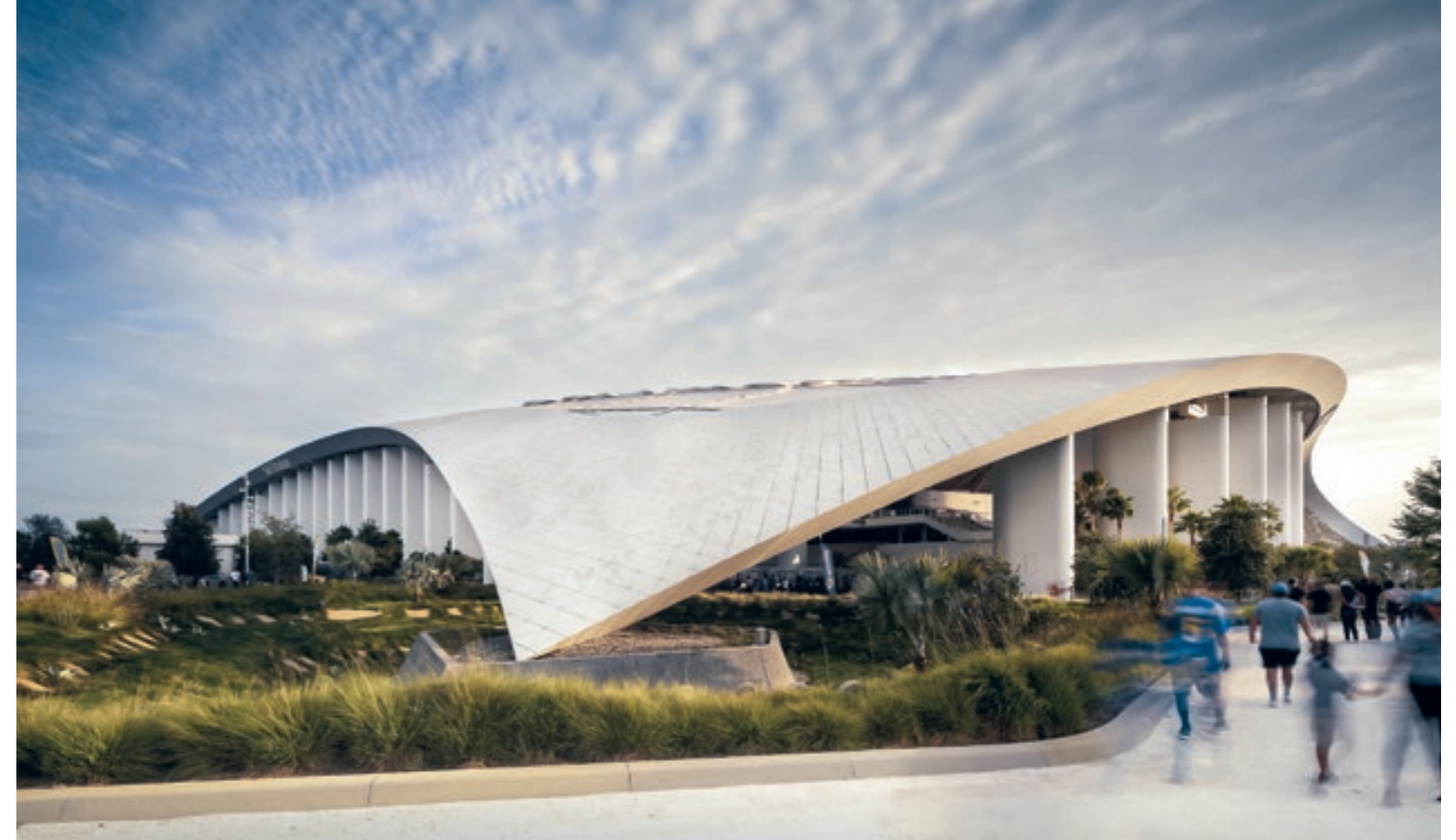
But the real highlight are the around 80 million LED pixels beneath the roof which, according to the architects at HKS, form the biggest video screen in the world. Aircraft pilots and their passengers can watch a live stream of events in the stadium from the air, while fans in the stadium itself may struggle to avoid their attention being drawn away from the pitch and onto the captivating sight above their heads.

37,000 unique panels

But the ETFE roof canopy and LEDs are not the building's only remarkable features. The roof is framed by some 37,000 custom aluminum panels, each of which is unique. Every panel has its own shape and pattern of holes, which any fabricator must surely have regarded as an impossible task. The architects used a complicated logarithm to distribute holes across each panel in an apparently arbitrary fashion, focusing primarily on aesthetics and the way in which light would fall through the resulting canopy. "Producing those panels in any kind of conventional way would have taken forever, however many programmers we had," says Coleman. "It quickly became clear that we needed a different solution."

From 15 minutes to 7 seconds

TRUMPF to check out their TruPunch 5000 and TruTops software. While I was there, we also talked about programming – so I knew that if anyone could help, it was them!" TRUMPF programmers Hans-Jörg Schmid and Roman Schwarz from the software customization team teamed up with Coleman to find a way to customize the TruTops software. "We kind of fooled the machine to let us



Soaring, stylish roof: the stadium designed by architects' firm HKS will also host the opening and closing ceremonies of the 2028 Olympic Games.

“Originally, it would have taken us 15 minutes to do two panels, but we eventually got that down to **seven seconds.**”

James Coleman, A. Zahner, Kansas City

import the 3-D architecture,” Coleman says – and the results were remarkable: “Originally, it would have taken us 15 minutes to do two panels, but we eventually got that down to seven seconds. I was able to complete the programming of the entire building in a matter of weeks.”

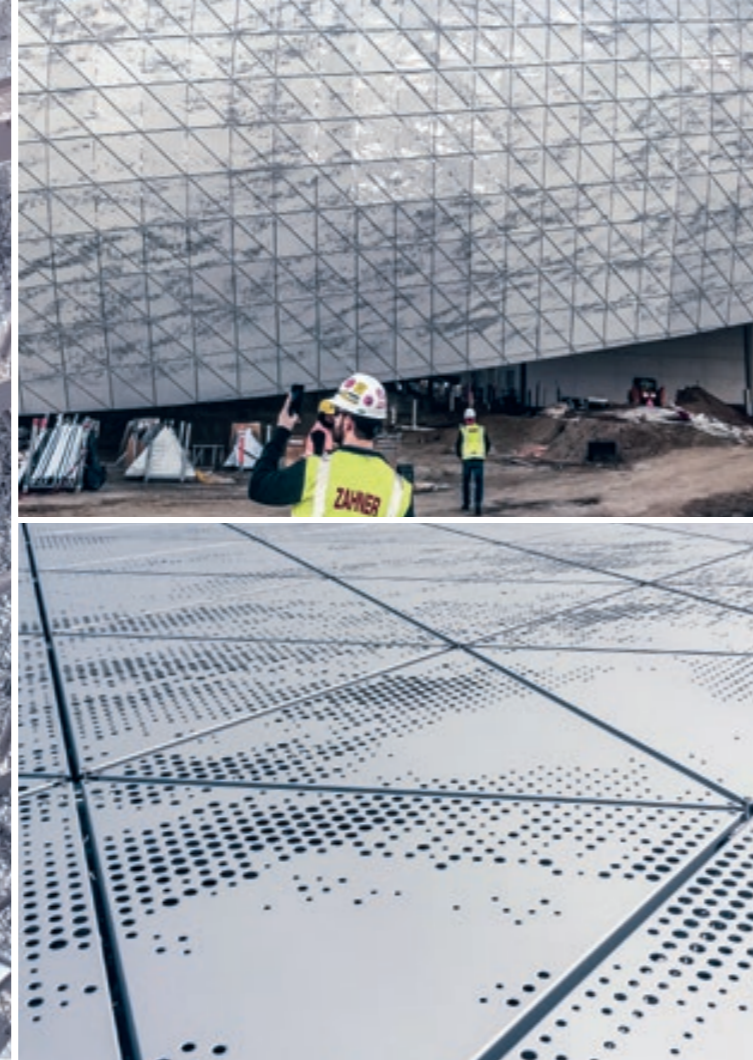
Three parts missing – but why?

The next step was to actually fabricate the panels. Three A. Zahner employees spent a total of 18 months working in two shifts on three TRUMPF machines. “That was a tiny workforce for such a massive stadium,” says Coleman. “But we still got the job done in 18 months and even finished ahead of schedule!” As well as its unique pattern of holes, each panel was also provided with an



Unlimited creativity: In the past, it would probably have been necessary to limit the designers' creative flair, says engineer James Coleman, Zahner's Vice President of Innovation. But nowadays the company can tackle even the most unusual designs.





Light and shadow: the SoFi roof canopy is an all-round solution that protects against wind and rain and provides shade while still letting in plenty of light.

individual dot code for logistics purposes. “The whole thing had to be carefully organized, otherwise the construction site would have turned into a giant jigsaw with 37,000 pieces,” says Coleman with a smile. He is understandably proud of what they achieved: “Only three of the panels had to be fabricated a second time. Not because they turned out wrong, but simply because the parts were so small that they accidentally ended up in the recycling bin with the other punching scrap.”

Setting new standards

The customer was absolutely delighted, says Coleman: “And it showed architects everywhere what amazing things are possible.” In the past, it would probably have been necessary to limit the project’s creative flair by restricting the panels to just 50 different designs and producing thousands of each design in order to finish on time. “But what we offer now actually encourages architects’ creativity rather than forcing them to water down their designs.” Even so, insists James Coleman, none of their impressive work on the SoFi Stadium would have even been possible without TRUMPF.

Inside and out: the architects’ goal was to build a stadium that was open on all sides yet still capable of protecting people from the scorching Californian sun.

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“ We got the job done in
18 months and even **finished
ahead of schedule!** ”
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James Coleman, A. Zahner, Kansas City



IMAGES: courtesy of A. Zahner Company

01

A closer look:

TruLaser Series 1000

After 125 years in the business, sheet-metal fabricator **A. Zahner** has built up an impressive array of machinery. But for those companies who are just getting started in sheet-metal processing, or perhaps looking to expand, TRUMPF also offers entry-level machines such as the TruLaser Series 1000 for **2D laser cutting**. We checked out what options are available.

In brief

TruLaser Series 1000 – laser cutting machines for entry-level users

TRUMPF has increased its range of machines in the entry-level segment and now offers a number of new solutions that are specially tailored to the needs of users entering the business for the first time. These models offer a slightly trimmed-down version of the features available in TRUMPF's higher-end machines, but they still provide the same outstanding levels of quality and reliability. The **TruLaser Series 1000** is a new range of machines for 2D laser cutting that harnesses tried-and-tested TRUMPF functions to achieve high precision and productivity.

Easy to use

The new TruLaser Series 1000 is simple and intuitive to use. Programming the machine is quick and easy and doesn't require any specialist prior knowledge. Hundreds of sets of cutting data for different materials and sheet thicknesses are already stored in the operating software. Users can select a suitable cutting program at the touch of a button and get straight down to work.

New Highspeed Eco function

The machine cuts sheets significantly faster than conventional 2D laser machines. The Highspeed Eco function uses a nozzle developed by TRUMPF to direct the cutting gas directly onto the metal. This increases the machine's feed rate by up to 70 percent while simultaneously reducing gas consumption by around 60 percent.

Multiple materials with minimal set-up time

The TruLaser Series 1000 makes it easy to cut a wide variety of materials, including mild steel, stainless steel, aluminum and copper. This means companies can use it for a wide range of applications. It also comes with an automated nozzle changer that automatically switches to a different cutting nozzle when the material changes. Eliminating that manual step makes life easier for operators and makes set-up times even faster.

CoolLine technology

The CoolLine feature automatically sprays water onto the workpiece; as the water vaporizes, it provides optimum cooling during cutting. This allows users to carry out high-precision cutting of sheets up to 25 millimeters thick.

Perfect place to start

The new machine is around ten percent cheaper than the previous model. The only features that TRUMPF has omitted are those that are clearly oriented toward highly automated high-volume production. The design of the machine has deliberately been kept simple so that it can meet the needs of entry-level users and of companies that are already operating in one or two shifts.



Laser safety

To prevent laser light from escaping, the machines feature laser-safety viewing windows or auto-retracting protective barriers – all designed by TRUMPF to ensure that no harm comes to the operator's eyes.

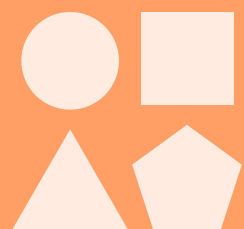
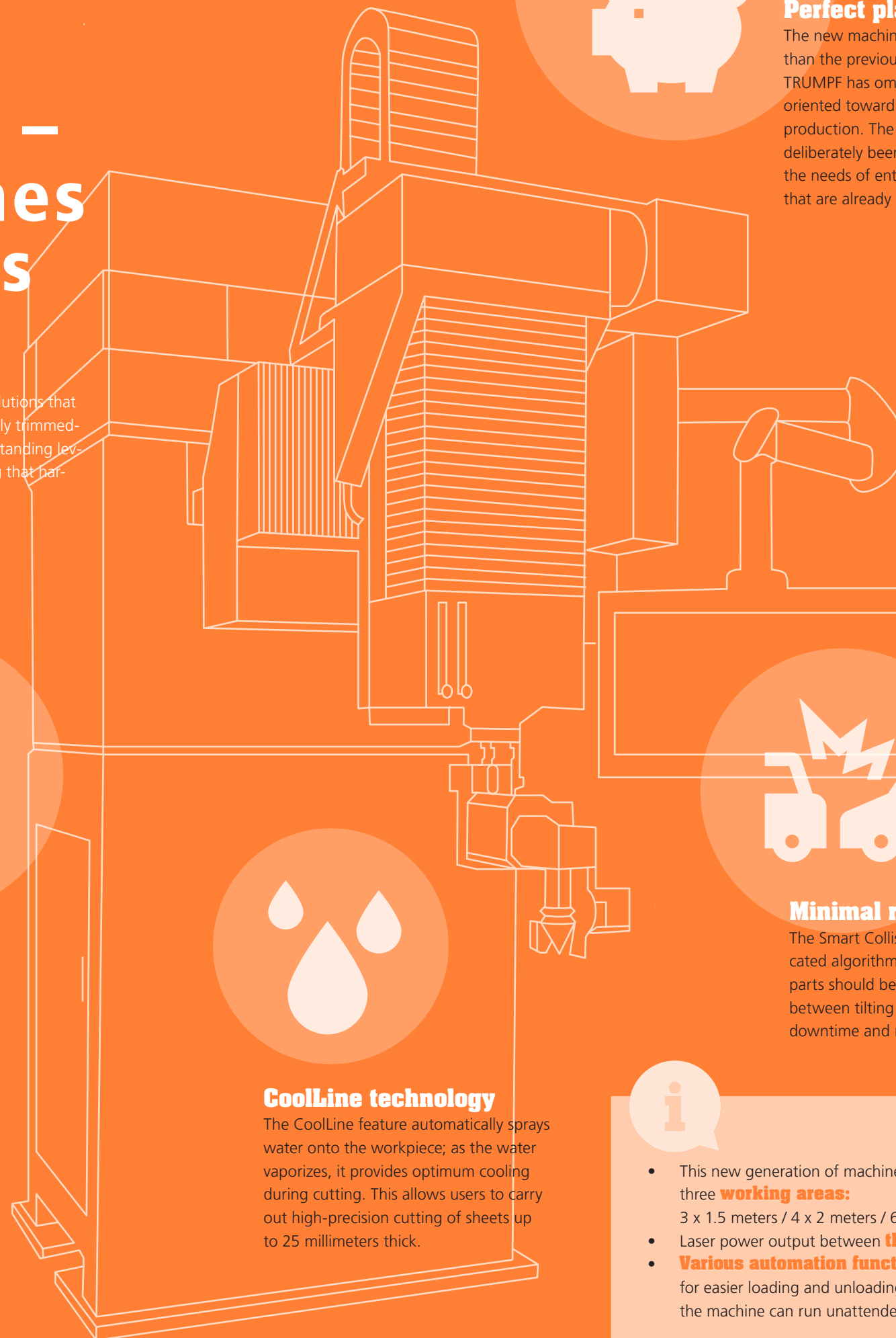


Minimal risk of collision

The Smart Collision Prevention feature uses a sophisticated algorithm to determine the order in which the parts should be cut in order to avoid any collisions between tilting parts and the cutting head. This reduces downtime and makes production more efficient.



- This new generation of machine is available with three **working areas:** 3 x 1.5 meters / 4 x 2 meters / 6 x 2.5 meters
- Laser power output between **three and six kilowatts**
- **Various automation functions** can be added to the machine for easier loading and unloading. At its highest level of automation, the machine can run unattended.



Italy is as famous for world-class design as it is for pasta. But making the perfect dish requires not just passion, but also the right combination of the best ingredients. This is the recipe followed by **Italian lighting specialist AEC Illuminazione**, which combines pioneering designs, visionary concepts and prudent investments in smart production processes.

Sometimes disaster also spells opportunity – and that was certainly true of the devastating floods that hit Florence in November 1966. The center of the city was severely damaged by mud and silt, so the municipal authorities commissioned the company AEC Illuminazione to reconstruct the city’s lighting fixtures. “We furnished the entire center of Florence with decorative candelabra virtually overnight. Producing those kinds of luminaires in bulk was quite a challenge back then!” says Giacomo Bianchi, operation manager at AEC since 2020. This turned out to be the springboard to success for AEC Illuminazione, with other Italian cities suddenly queuing up to acquire their own cast-iron lighting fixtures from Subbiano in Tuscany.

Fast, bright and beautiful

AEC seldom works with cast iron nowadays. Its customers are more interested in simple yet sophisticated designs made of aluminum and stainless steel. Founded in 1957, the family-owned company is one of the world’s most successful suppliers of public outdoor lighting. Its extensive range of products includes beautifully designed, energy-efficient and sustainable lighting concepts for road tunnels, bridges, underpasses, cities and stadiums.

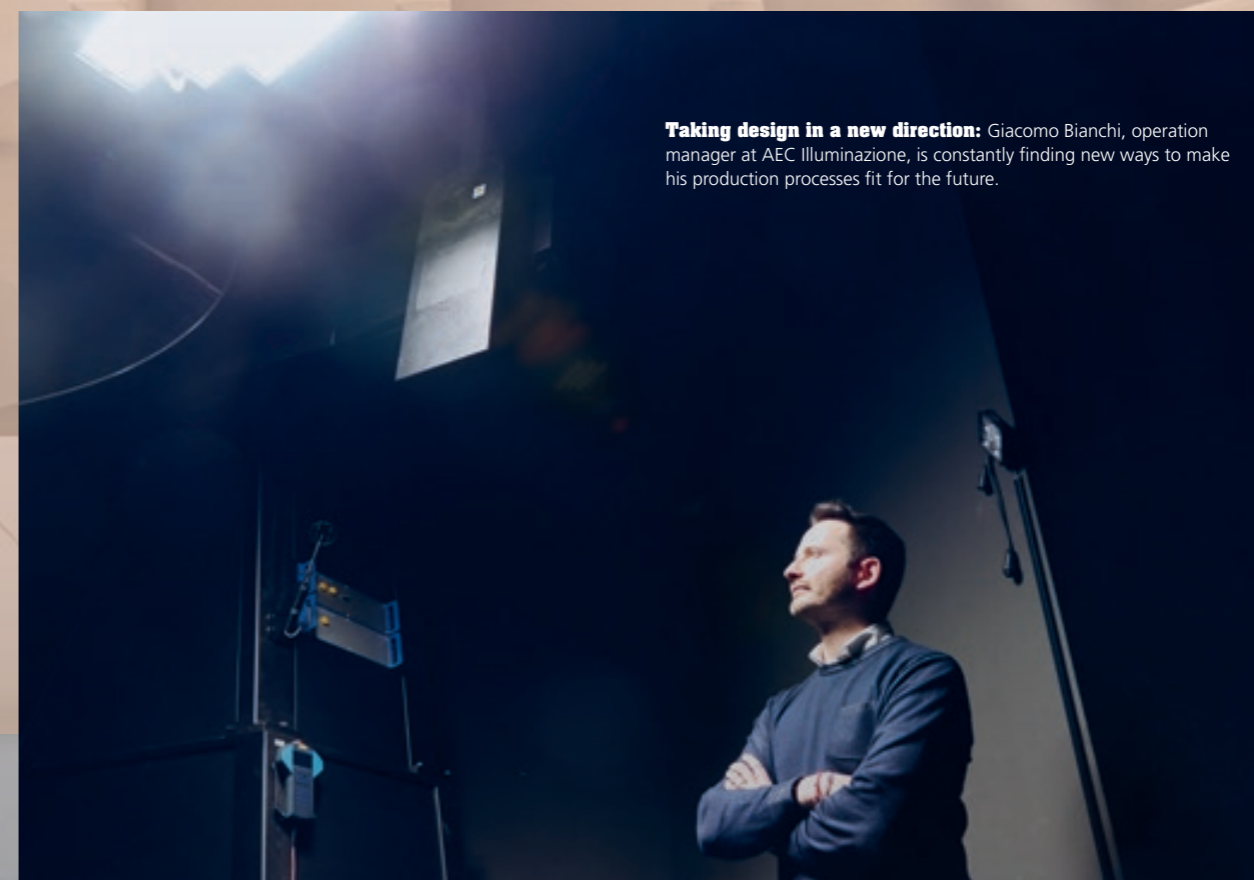


02
ITALY

Curiosity in Subbiano

LIGHT FOR THE WORLD

IMAGES: Fredrik Dulay-Winkler



Taking design in a new direction: Giacomo Bianchi, operation manager at AEC Illuminazione, is constantly finding new ways to make his production processes fit for the future.

Faster with automation

But looks alone are not enough: “We’ve definitely built a reputation for exceptional design and outstanding quality. But success today depends just as much on being able to get your products to market quickly,” says Bianchi. To meet that challenge, the company began making major investments in production automation back in 2006. That was when AEC laid the foundations of its close partnership with TRUMPF. Its first acquisition was a TruLaser 3030 fiber 2D laser-cutting machine, and this was soon joined by a TruMatic 1000 for punching and cutting jobs and two manual bending machines. The new machines greatly accelerated the manufacturing process and, in 2017, AEC Illuminazione decided to go one step further by replacing the old bending cells with new automated ones. “Sticking with TRUMPF was the obvious choice. We were satisfied with the machines we had, so why would we switch to a different manufacturer?” says Bianchi.



Aluminum, steel and light

AEC chose a TruBend Cell 7000 and the somewhat larger TruBend Cell 5000. “Making our company as vertically integrated as possible is a core part of our corporate philosophy,” says Bianchi. “It’s about bringing as many production steps as possible in-house. This reduces our dependence on suppliers, gives us full control over quality, and enables shorter delivery times. The two bending cells have made us even more self-sufficient when it comes to meeting our customers’ needs.” AEC Illuminazione also appreciated the high productivity and outstanding processing quality of

the TRUMPF machines, especially since the company primarily works with aluminum and stainless steel. Even though almost all its luminaires are suspended from posts or steel girders high up in the air, it refuses to tolerate even the slight scratch on any of its housings. “We supply designer products – and that means top-quality workmanship, technical expertise and a beautiful design,” says Bianchi.

Sports arenas and tunnels

AEC Illuminazione regularly demonstrates its technical prowess through innovative developments such as its T-LED 3 tunnel lighting, which floods the darkness with energy-efficient light in a tunnel in Oslo, Norway. “Just like all our other luminaires, this model features high-performance reflectors made from ultra-pure

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Giacomo Bianchi, operation manager at AEC Illuminazione

IMAGES: Frederik Dulay-Winkler



As a design enthusiast and CEO of AEC Illuminazione, Alessandro Cini (right) inspires customers all over the world with elegant, technically pioneering lighting concepts made with Italian flair. Giacomo Bianchi’s efficient and superbly coordinated manufacturing processes ensure the company’s products get to market quickly.

aluminum. Aluminum offers optimal protection against corrosion, especially in tunnels where the material is exposed to high humidity and contamination,” says Bianchi. “We also use this type of reflector in stadium lighting, most recently at the Alberto Picco stadium in La Spezia in northern Italy.”

Managing production peaks

To produce the luminaires’ stainless-steel housings and sturdy mounting frames, AEC cuts and marks the parts with a laser before bending them into shape. “Until recently, we had to send the parts to a different company for bending. But purchasing our two bending cells means we can now do it in-house,” says Bianchi happily.

The TruBend Cell 7000 mainly tackles smaller parts with widths of up to ten centimeters as well as a wide variety of mounting parts. “We produce around half a million products a year, each of which features two or three mounting fixtures. That adds up to a lot of work!” says Bianchi. His initial plan was to use the TruBend Cell 5000 primarily for bending larger housings and mounting devices, but fortunately he also had the foresight to equip the large bending cell with the necessary tools to enable him to shift parts from the TruBend Cell 7000 to the TruBend Cell 5000 whenever capacity gets tight. “Being able to absorb production peaks by



combining the two machines is a great help, and this whole set-up meets our strategic goals perfectly. We now have a rapid solution for fabricating even more parts in-house at a consistent level of quality," he says enthusiastically.

Smart connectivity, rapid feedback

The two bending cells are part of a comprehensive plan to restructure AEC's production processes. Bianchi was therefore keen for TRUMPF to equip the machines with the interfaces required to connect them to its manufacturing execution system (MES), which the company installed in 2021. "It's great to have fast machines and highly efficient automation components, and they certainly boost our productivity. But that alone is no guarantee of shorter throughput times and on-time delivery," he says. The decision to carry out so many of the steps in-house poses its own challenges, because the resulting production processes are highly complex. If something goes wrong in one of the production steps, it can quickly end up disrupting the entire manufacturing process. The worst-case scenario is then having pallets of finished parts sitting around in the aisles waiting to be processed. The way to avoid that is by maintaining a consistent flow of clear and transparent information. To achieve this, Bianchi has now connected up 85 per cent of the company's machines. The MES generates production



The perfect angle: outstanding workmanship lies at the heart of all AEC's products – and that's exactly what TRUMPF's high-precision bending cells provide.

Giacomo Bianchi primarily envisaged using the TruBend Cell 5000 to bend larger housings and mounting devices.

IMAGES: Frederik Dulay-Winkler

“ We deliver **designer** products – and that means **top-quality workmanship**, technical expertise and beautiful design. ”

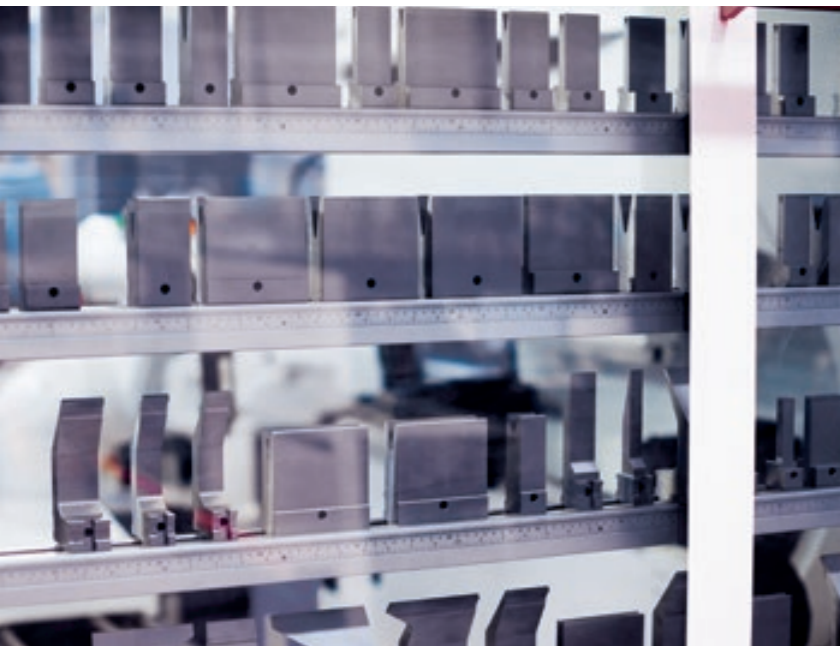
Giacomo Bianchi, operation manager at AEC Illuminazione

schedules and ensures smooth operation of the manufacturing environment. The design engineers can send their CAD drawings straight to the machines, where the data is imported and turned into finished parts as and when they are needed. The MES also collects machine data and key metrics for quality monitoring, machine utilization and production status. "By connecting everything together, we've created a truly transparent production environment. Tailoring our production schedules to the needs of our employees and machines helps to shorten throughput times and improve on-time delivery over the long-term," says Bianchi.



Curious to find new approaches

Keen to take things to the next level, Bianchi put together a team whose mission was to identify and unleash even more optimization potential. When the team started work two years ago, it consisted of three ambitious young engineers. Today, it has 18 enthusiastic and open-minded members who apply their boundless curiosity to



To manage production peaks, Giacomo Bianchi invested in tools that allow parts to be produced on both the TruBend Cell 7000 and the TruBend Cell 5000.



The TruLaser 3030 fiber 2D laser-cutting machine laid the foundations of AEC Illuminazione's close partnership with TRUMPF. Its connection to an automated storage system made production much faster.



developing optimization strategies for logistics, supply chains and cost-efficient business practices. “We actually benefit from the fact that AEC Illuminazione has such flat hierarchies,” says Bianchi. “If you’re serious about questioning your existing processes and potentially turning them on their head, you need to have everyone acting in unison. It’s important that managers are willing to trust their staff and quickly sign off on the necessary capital investments, especially if your company has a long-term focus and the improvements might not be immediately noticeable. It’s usually easier to do that in family-owned companies than

in large corporations.” Bianchi’s ongoing change process has put the company on target to achieve its smart factory goals. He aims to continue down this path by making sure every single one of his machines gets connected over the next 12 months. He will also be purchasing new machines to make the company even more vertically integrated, creating space for new manufacturing processes by expanding the Subbiano site. But, despite all this upheaval, AEC Illuminazione will always remain firmly rooted in the tradition of superb Italian design.



Giacomo Bianchi is optimistic about the future. By the end of this year, all his machines will be connected up, marking a major step toward a smart factory.

IMAGES: Frederik Dulay-Winkler

02

A closer look:

Laser safety

AEC Illuminazione uses a wide range of TRUMPF machinery, including bending machines, a punch-laser machine and a 2D laser-cutting machine. Whatever machine they’re working on, AEC workers know they are well protected. **TRUMPF relies on various technologies to protect** machine operators’ eyesight. Here, we explain how companies can choose machines that meet **laser safety standards.**

In brief

Better safe than sorry: identifying hazardous lasers

From poorly built enclosures and fake safety glass to deliberately deactivated light barriers, working with the wrong laser could put you at real risk. Unfortunately, not all providers meet the understandably strict requirements of **laser safety**. The risks are particularly high with solid-state lasers which, if not installed properly, may emit radiation in ways that could cause eye injuries, blindness and burns.

Here are **five ways** you can tell whether laser safety standards have been met:

1 Keep radiation in check

As long as a machine enclosure doesn't have gaps, it will protect users against laser radiation. This is the case with systems that can be loaded and unloaded outside the actual machine frame, such as TRUMPF 2D laser-cutting machines. But it's trickier when it comes to punch-laser machines; these require more expertise to get the design right, because operators must be able to load and unload parts from the work table where the laser-cutting head is installed. **Auto-retracting protective barriers** intercept hazardous radiation. Raised while the machine is operating, they retract once the job is finished to enable the operator to approach the machine.

2 Protective hoods

In order to intercept as much radiation as possible at source, reputable manufacturers take additional steps to ensure the safety of machines that do not have sealed enclosures. For example, TRUMPF punch-laser machines make use of **hoods that fit over the processing heads**. Meanwhile, laser tube-cutting machines feature **several layers of slatted blinds** on the unloading side to completely enclose the working area. The aim of this curtain-style design is to prevent laser light from escaping when the machine ejects a tube from the processing area.

3 Visible through safety screens

Many machines allow operators to monitor the fabrication process through a viewing window. To protect users from harm, it is essential to use a material that **does not transmit radiation**. The risk doesn't only stem from the infrared light of the original cutting beam, but also from the light of other "secondary" beams that may be generated at other frequencies during laser cutting with a solid-state laser. For example, ultraviolet (UV) rays can form when processing metals, so the window must also be able to shield users from UV light. **Laser safety viewing windows** are labeled with the protection level and other key data.

4 Light barriers and sensors

Laser-cutting and welding machines must immediately cease operation and switch off the laser beam when someone enters the processing area. That requires the use of **light barriers and safety switches**. These machines should also have sensors to monitor the cable that transmits laser light to the cutting head; if the cable is damaged, the sensors should automatically deactivate the laser using the relevant safety devices. Sensors in the laser light cable can also detect whether the cable is seamlessly connected to the cutting head, ensuring that no radiation escapes at any point.

5 Extraction, filtering and proper disposal

Laser processing generates hazardous substances, including **tiny particles and gases**. These could damage the equipment and cause harm to people and the environment. That's why laser machines need an exhaust system to capture hazardous substances and channel them into a **filter system**. Exhaust systems ensure contaminants are extracted from the air and disposed of properly.

Customer details

AEC ILLUMINAZIONE SRL
Via A. Righi, 4 – Z.I. Castelnuovo
52010 Subbiano – Arezzo (Italy)

Machinery

- TruBend Cell 7000
- TruBend Cell 5000
- TruBend 5130
- TruBend 7050
- TruMatic 1000
- TruLaser Fiber 3030



03

GERMANY

Curiosity in Hilchenbach

SHAPING THE FUTURE TOGETHER

IMAGES: FLUMU GmbH



Will that really work? SCHRAG Group CEO Thomas Goswin (front left) believes in automation and was planning to make it the centerpiece of a brand-new site – but the TRUMPF smart factory consultants had a different idea.

SCHRAG CEO Thomas Goswin was determined to boost his **edging profile business** by building a **new factory**. To plan the new production facility, he enlisted the support of TRUMPF’s smart factory consultants.

Time is money in the construction industry, says Thomas Goswin – and customers expect products to reach their building site just a few days after they place the order: “Our customers want great quality and good prices, but they also need things delivered quickly. One or two days can make all the difference.” Headquartered in Hilchenbach in the German state of North Rhine-Westphalia, the SCHRAG Group develops and manufactures parts for the construction of large industrial buildings. With four production sites in Germany, plus subsidiaries in the Czech Republic and Poland, SCHRAG has spent years as one of the market’s leading players. Determined to keep things that way, Goswin regularly scrutinizes the strategic focus of his group of companies and individual business units. That was how he spotted the potential to optimize his edging profile operations, which are the company’s biggest business segment. “We can gain a competitive edge by making our processes more efficient,” he realized. “And we can achieve that through automation.”



When it came to analyzing the company’s processes and finding ways to optimize them, it all came down to trust, in-depth discussions and lots of workshops!

Making the right plan

Yet automating the fabrication of edging profiles is no easy feat. “We generally produce made-to-order, custom parts,” says Goswin. “But a team of our employees managed to identify some parts that are ordered on a fairly regular basis.” These turned out to be the purlins and rafters that are used to support the roofs of industrial buildings. “Our idea was to pull those parts out of our existing facilities and fabricate them in an automated process in a brand-new factory,” says Goswin. “Our aim was to build Europe’s most modern production facility for lightweight profiles on a greenfield site.” They quickly identified a suitable location, says Goswin, but there were still plenty of challenges ahead: “Automation is not something we specialize in, so we decided to call in experts to help us build the new site and restructure our existing locations accordingly.”

Equal partners

Goswin’s contact at TRUMPF told him they had a smart factory consulting team that advises sheet-metal fabricators on how to create their own smart factories using machines from multiple vendors. The team offered support throughout the process, and factory planning was one of their areas of expertise. “I liked the fact that the TRUMPF consultants work in the world of sheet metal,” says Goswin. “I didn’t have to explain the difference between edgings and bent parts, because we already speak the same language.” The project got underway in Hilchenbach in February 2020. The SCHRAG project team included all the site managers, the technical director, the head of IT, and various other colleagues

from the production, sales and IT departments. "My aim was to get as many colleagues on board as possible to draw on their expertise. I wanted everyone to feel involved right from the start," says Goswin. Smart factory consultants Robert Herold and Dominique Hensel kicked off the process by carrying out a detailed analysis of the current situation at the company's sites. They used analysis tools to study the flows of material, information and production, working closely with the SCHRAG team at all times. Based on their results, they then helped the SCHRAG project group to come up with solutions to increase efficiency at the sites.

Rethinking the plan

At the same time, they were mulling over the construction of the new site. But the more production data they had in front of them, the more the project team started to think there might be a better alternative. Why not simply expand the existing Seevetal site and upgrade it for automated manufacturing instead of investing in a completely new site? "The Seevetal site near Hamburg already specialized in the production of purlins and rafters," says Robert Herold. "And it also had a vacant lot!" Dominique Hensel immediately saw the benefits: "We realized we could create greater added value for the SCHRAG Group by expanding the Seevetal site and optimizing our existing sites than by building a new site." The plan won the backing of everyone involved, including Goswin: "I went into the planning process with an open mind. We were all convinced by the arguments put forward by the consultants, which were backed up by profitability calculations and the evidence we had jointly put together on the current situation."

Combined process and technology expertise

So the dream of creating Europe's most modern production facility for lightweight profiles was still on the table, but just in a different location. To achieve their new goal, the smart factory consultants and the project team began drawing up detailed plans for the new factory in Seevetal. The first task was to create the right conditions for the automated manufacturing of standardized parts. To do that, the TRUMPF consultants recommended investing in a highly automated roll-forming system. But that wasn't all. Since special profiles



Custom processing of special profiles will continue to play an important role in the future.

"I was determined to find the **best solution** - and we achieved that by working as a team! "

Thomas Goswin, CEO of SCHRAG

often form part of the scope of delivery in major jobs, and splitting up jobs is inconvenient, the team also decided to install a press line for special profiles, including a 12.5-meter press from TRUMPF. Both production lines would be served by a new coil storage system. To ensure efficient pick-up and delivery of materials and parts, the plan also included a truck bypass road around the plant. A new office building was the final element in the newly expanded site, which is due to start operations in 2022.

Dominique Hensel is delighted with the results: "This project opened up a whole new dimension for us. It showed that our combined process and technology expertise can produce great results even when we move beyond the standard TRUMPF portfolio." Goswin is equally enthusiastic: "I admit I was initially skeptical when TRUMPF said that its consulting services were objective and independent of any specific manufacturers or machines. But I was determined to give the smart factory consultants the benefit of the doubt, and I'm glad I did! It was a great team effort - and it produced the best solution for our company." SCHRAG's decision to combine automated and conventional manufacturing in the same factory has now given it a unique selling point in the market, which has inspired Goswin and his team to consider taking this approach even further. "By relieving the pressure on our individual sites, we have gained even more leeway for new automation and digitalization solutions. Our goal now is to further optimize our cross-site processes and improve the connectivity between SCHRAG sites," says Goswin. When it comes to taking his company to the next level, he knows he can rely on TRUMPF's smart factory consultants.

IMAGES: FUMU GmbH

03

A closer look:

TRUMPF's smart factory consulting service

TRUMPF's smart factory consulting team helps customers to create **leaner processes** with **digitally connected production systems**. The main focus is not on selling machines, but rather on supporting customers as they transition to a **smart manufacturing** solution that matches their needs.

In brief

Four steps to a smart factory

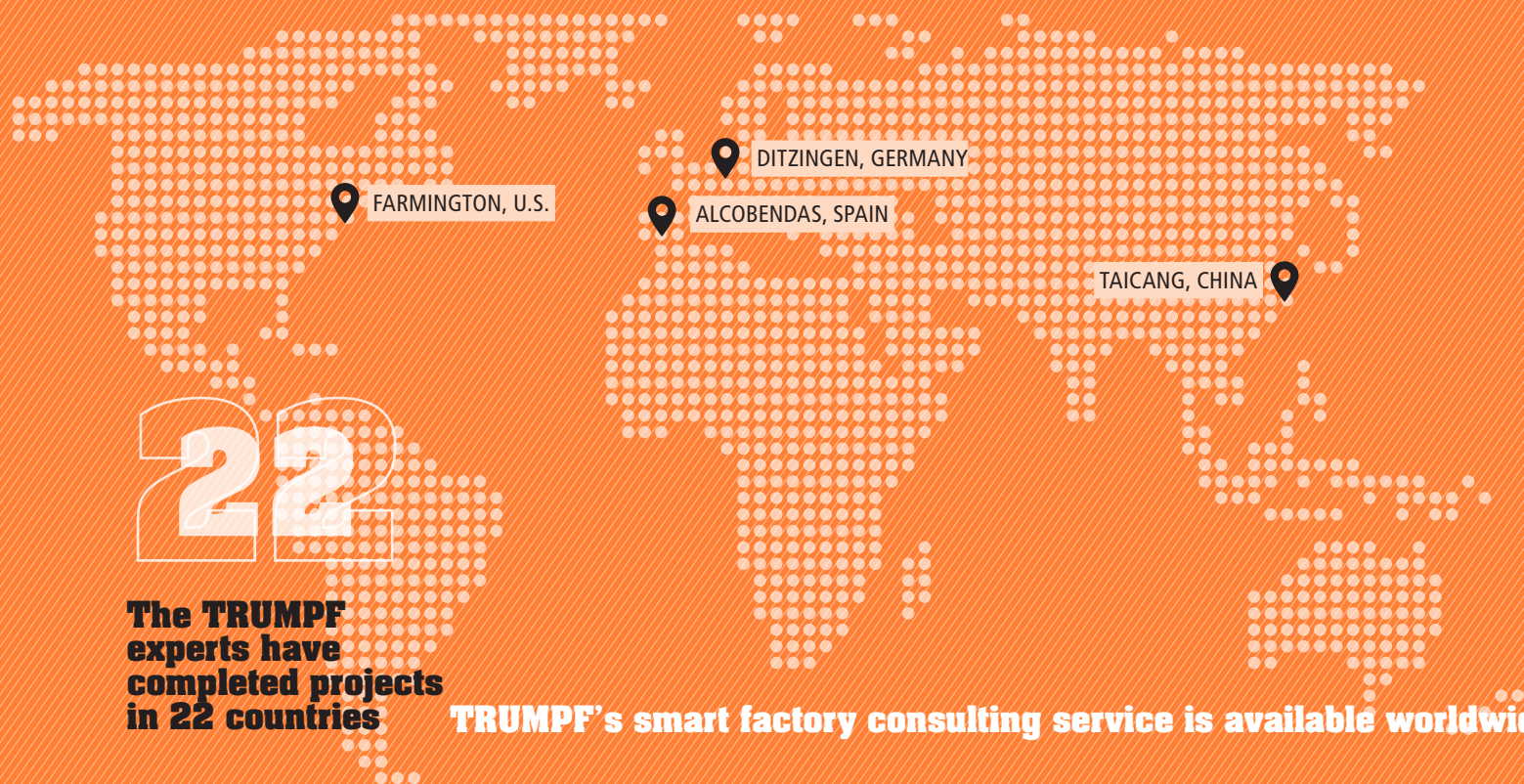
TRUMPF's smart factory consulting service assists sheet-metal fabricators with all the challenges they face on the way to a smart factory – from planning new production facilities and optimized processes through to implementing a digitalization strategy. But why bring in external consultants? And what's so special about TRUMPF's approach to smart factory consulting?

How can external consultants help me?

A neutral, outside view can accelerate a company's efforts to identify **unexploited potential** and **weaknesses**. In many cases, a few simple measures are enough to significantly boost **productivity**.

What's special about the TRUMPF smart factory consulting team?

The team has in-depth expertise in the sheet-metal fabrication industry. It brings **years of experience** to the table and successfully completes some 200 projects a year. Since many companies tend to face similar challenges, the TRUMPF experts can quickly identify problems and suggest **suitable solutions**.



200

The team handles some 200 projects a year

Customers who have worked with **TRUMPF's smart factory consulting team** have achieved the following results:

- 43%** shorter lead times
- 35%** increase in machine utilization
- 20%** more throughput thanks to lower storage and search times

01

Set goals, create transparency, introduce standards

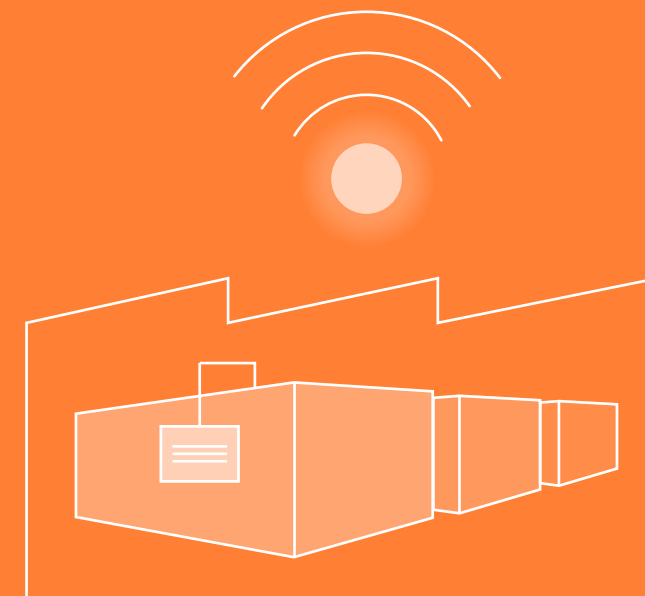
Success can be a long time coming if you don't have a concrete goal. That's why the first step should be to create transparency, define strategic fields of action and set a common goal. This will depend on the challenge in each case: Is the aim to get production processes better organized? Is there too much non-productive time? Or is it a combination of the two? Once the goal has been set, TRUMPF's smart factory consultants will work together with the company to find a sustainable solution. For example, it is often helpful to introduce standards on the shop floor to make production workflows more efficient.

02

Taking stock. And looking ahead.

The next step is to analyze the company's productivity. The experts scrutinize all the

Create, plan, implement, monitor. And then repeat. TRUMPF's smart factory consultants are the right people to talk to when it comes to optimizing processes, analyzing your business or setting up a new production facility. In four simple steps, they help customers navigate the path to the right connectivity solution.



04

Long-term improvements rather than quick fixes

Creating change for a customer is not an isolated task but rather an ongoing process that can sometimes take weeks or months. The consultants are always at the customer's side, providing whatever support they require at each particular stage. They take a long-term approach to ensuring that the company achieves a successful and sustainable transformation. And they always make sure to employ methods and solutions that match each company's specific needs.

03

Getting down to work

A plan is only as good as its execution. That's why the TRUMPF smart factory consulting team continues to prioritize collaboration as they move from theory into practice, with the experts supporting the customer's efforts to implement the new measures. These might

company's equipment, not just the TRUMPF machines, and the results are often a real eye-opener! After that, it's time to define the actual project schedule with concrete milestones and clearly formulated interim targets. The experts also work with the company to create new routines that enable its employees to put the plan into practice with minimal additional effort..



04
GERMANY

Curiosity in Ditzingen

TRUMPF AND AI

IMAGES: Andreas Sporn

What if **our machines were capable of learning?** What if they could automatically detect and eliminate errors and autonomously optimize processes, allowing them to operate even faster and more efficiently? TRUMPF has launched its first solutions based on **artificial intelligence (AI)** and customers are already seeing huge benefits. **Jens Ottnad** and his **Data & AI team** are busy making the technology even better – and they're curious to discover just how far it can go.



Panning for gold: experts train AI by collecting and analyzing huge amounts of data. Using this data wisely is an art, say Jens Ottnad and technical customer advisor Philip Hofmaier.

The ultra-smart TruLaser Center 7030 is the first TRUMPF machine to combine all the different laser-cutting processes in one machine – from blanks to stacked, finished parts. Sensors monitor its operation, checking that cut parts are properly ejected from the sheet by the pins and correctly transported for sorting by the suction cups. Whenever it encounters a hitch, the machine simply tries again. Over time, it learns from the data that it collects and processes from both successful and failed attempts.

The human-machine combination

It may sound easy, says Jens Ottnad, but it's actually incredibly challenging. "Occasionally, we try out a simple part that we're sure the machine will be able to handle, a part that our predictive model confirms should be no problem. But then for some reason it doesn't work, and you're left standing there like an idiot wondering what on earth went wrong!" Problems like this can only be solved by a human based on their experience and on the available



AI does the job: using AI-based image processing, the Sorting Guide removes and sorts parts and reports them to the TruTops Fab software.

data. “Humans understand the interplay between all the factors in the background. That’s why AI will continue to be a combination of data and human experience for a long time to come,” says Ottnad.

Incredibly complex

Each time the machine learns something new, the engineers gain even more respect for the challenges that TRUMPF customers face. “They solve incredibly complex problems on a daily basis, cutting parts into thousands of different shapes based on countless parameters, and using all kinds of materials under constantly changing conditions,” says Ottnad. This, in turn, generates huge volumes of data, which need to be collected, carefully organized and implemented in a scalable manner. “That’s the secret of successful AI.”

AI turns data into gold

Sometimes, it feels very much like panning for gold, says Ottnad. “There’s a very good word to describe unstructured data, and that word is ‘garbage!’” A machine’s ability to learn depends very much on the quality of the data you feed it with – and sometimes it can be really hard to get hold of the data you need. “Collecting data is easy for Google and Facebook – every user’s mouse is like a sensor for them.” That’s not an option for TRUMPF, however. “We’ll never have access to big data. The world is full of smartphones, but there are comparatively few TruLaser machines.”

Digging for treasure

To develop its AI solutions, TRUMPF therefore relies on in-house data and data provided by its customers. “Useful AI applications are definitely a collaborative effort,” says AI expert Ottnad. “The task of compiling a million if-then statements is too much for even the smartest of minds.” Instead, TRUMPF feeds customer parameters into the machines’ learning process – though only with the customer’s consent and in strict compliance with data protection regulations. “Some customers take more convincing than others, because not everyone can see the benefits of making this kind of investment in data.”

AI keeps customers happy

One thing’s for certain: it’s not about tracking people or using their data for commercial purposes. “We’re not working on AI just for the sake of it, we’re doing it to make our customers happy!” says Ottnad. “It’s important to understand that the actual cutting is getting faster and faster. It’s everything else around it, like sorting, that slows down the process.”

High-tech versus paper

The TRUMPF Sorting Guide is one example of how valuable AI can be in production – and just how much all the other aspects can slow the machine down. “When we visit customer sites, we often see situations where people are using a high-performance machine to cut parts and then manually sorting those parts into plastic boxes and sticking on A4-sized labels!” says Ottnad, shaking his head. “We’re talking about complex intra-logistics processes here, and they’re still using paper?!”



IMAGES: Andreas Sporn

“ Humans understand the interplay between all the factors in the background. And that’s why **AI** will continue to be a **combination of data and human experience** for a long time to come. ”

Jens Ottnad, R&D Head Data and AI

Less time, less waste, fewer errors

The TRUMPF Sorting Guide – which helps workers remove and sort sheet-metal parts – is a completely different story. Using a camera, the AI-based image-processing system identifies parts and displays all the relevant information on-screen – including recommendations on how the parts should ideally be sorted. It’s still the worker who makes the final decision, however, and the Sorting Guide adapts itself accordingly. At the same time, the machine keeps track of all the parts and automatically notifies the TruTops Fab production software. This leads to big savings in time and materials as well as a substantial reduction in errors.

Shazam and the Service app

Many of us are familiar with Shazam, a smartphone app that can identify a piece of music and the artist after just a few bars. Perhaps we also use plant identification apps such as PictureThis,

Complete overview: the Sorting Guide displays all the relevant information.

which can name practically any plant, no matter how rare, based on just a photo. Apps like these are great, but they only work if every song or plant can be correctly identified under any sound or lighting conditions. The same applies to the Service app from TRUMPF, which uses AI to make ordering spare parts quick and easy. The app identifies parts using an artificial neural network that TRUMPF trains with a continuous stream of new images. Based on this data, the neural network develops algorithms capable of detecting specific parts. All the employee has to do is take a picture of the part they need, and the order is placed in a matter of seconds.



It may sound simple, but it isn’t

“It’s incredibly difficult to create an image-processing system that can handle any lighting, shape or angle,” says Ottnad. He opens his computer and pulls up an image captured by the Sorting Guide camera. “For example: is that a blank or a finished part? Or is it just the steel roof of the factory?” It’s bewilderingly hard to tell, but it turns out that it is, in fact, a photo of the roof!

Humbled and fascinated

People like Jens Ottnad, who work with AI on a daily basis, quickly find themselves humbled by human capabilities. As a former gymnast, Ottnad understands only too well the immense challenge of getting a robot to perform a somersault in any environment, given the incredibly complex processes this involves. For him, that’s what makes AI so fascinating – and what gives it such enormous potential. “I think we’re still very much at the start of this journey, and I couldn’t tell you exactly where it’s heading,” he says. But you can see at a glance that he’s excited to find out.



Fascinating facts and exciting innovations



30,000 trees boost efforts to fight climate change

By 2027, TRUMPF will have planted 30,000 trees in forests in Bavaria and Baden-Württemberg managed by German forestry company Fürst Wallerstein. Over the next 30 years, the trees will capture and store **more than 7,500 metric tons of CO₂**. “Trees are the world’s most natural carbon sink, so I’m delighted to see us investing in them!” said Nicola Leibinger-Kammüller at the project launch. “This marks another important step forward in our climate strategy.” TRUMPF achieved carbon-neutral production worldwide at the end of 2020. By 2030, the company aims to cut emissions at its worldwide locations by around half compared to 2018 and to reduce emissions in its upstream and downstream value chain by 14 percent. To achieve these goals, it will invest some 80 million euros between now and 2030 in pursuing energy efficiency measures, producing its own renewable energy and purchasing green energy.



New training center with its own smart factory

TRUMPF is investing some 14.5 million euros in the creation of a **new training center with its own smart factory** at its headquarters in Ditzingen. The Lernfabrik, or “learning factory”, is due to open in spring 2023. It will provide space for growing numbers of apprentices and students on the dual vocational training scheme. “Good training opportunities are crucial to tackling the shortage of skilled workers. The new training center will be one of this region’s most advanced teaching and learning environments. It reinforces our commitment to corporate social responsibility and to Baden-Württemberg’s status as an outstanding location for industry and education,” says Oliver Maassen, chief human resources officer at TRUMPF. The center will include a large events space, a digitally connected manufacturing facility, seminar rooms, workshops and various creative/collaborative zones.



TRUMPF strengthens its Additive Manufacturing division

TRUMPF has acquired all the remaining shares in the TRUMPF SISMA S.R.L. joint venture from its Italian partner **SISMA S.p.A.**, a leading manufacturer of high-tech machines. This step will strengthen the Ditzingen-based high-tech company’s **Additive Manufacturing division**. TRUMPF previously held 55 percent of the shares in the joint venture. It will continue to pursue SISMA’s industrial laser metal fusion (LMF) business as well as its activities in the dental and medical sectors. Both companies have already signed a corresponding agreement. Following the sale of its stake in the joint venture and its LMF business, SISMA now plans to focus on the jewelry and fashion indus-

try and sell LMF machines from TRUMPF in these markets. TRUMPF SISMA was established as a joint venture in 2014 and is based in Schio in northern Italy. It employs some 60 people in the development and production of metal 3D printing machines based on laser metal fusion technology. The transaction was completed in late 2021.

IMAGES: TRUMPF



TRUMPF and EIB join forces for favorable financing

TRUMPF Bank has received a 50-million-euro loan from the **European Investment Bank (EIB)** to help its customers. The EIB supports projects focusing on innovation, skills, climate action and strategic infrastructure, passing on funds to companies through credit institutions such as TRUMPF Bank. The loan will make it easier for TRUMPF’s European customers to purchase highly innovative, connected industrial machinery for resource- and energy-efficient manufacturing. “We are proud that, as a small bank, we have managed to secure the EIB as a financing partner. By passing the favorable loan terms on to our customers, we will strengthen our competitiveness in the European capital market,” says Sabrina Mebus, managing director of TRUMPF Bank.



Investment in quantum technology cooling start-up

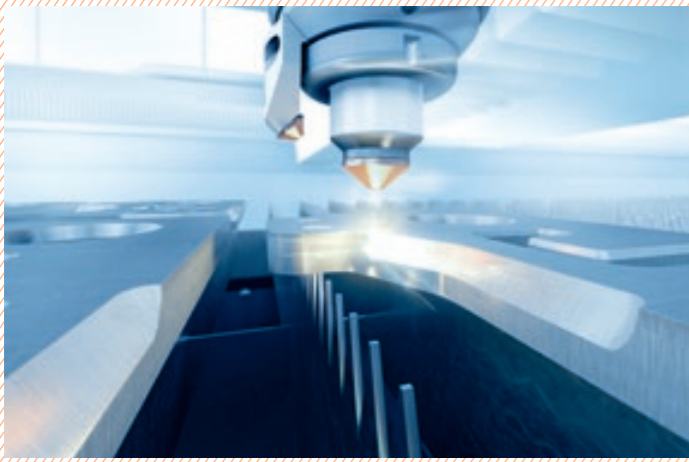
TRUMPF Venture GmbH is investing in **quantum technology start-up Kiutra**. Kiutra develops magnetic cooling systems that can reach ultra-low temperatures without the need for rare and expensive liquid gases. These kinds of magnetic refrigerators play a key role in the research and development of quantum technologies. Kiutra is enjoying growing success with its refrigeration systems while also making a valuable contribution to global advances in quantum technology. “Systems based on quantum technology, such as photon detectors, often require temperatures near absolute zero (-273 degrees Celsius). Our investment will also help advance research and development in the wider quantum technology sector,”

says Dieter Kraft, managing director at TRUMPF Venture GmbH. The funding round was led by TRUMPF Venture and Verve Ventures, a Swiss deep-tech VC firm. Alongside existing investors, the two companies are investing a mid-seven-figure sum. Kiutra intends to use the new capital to expand production capacity and grow its workforce while also further developing its products for the growing quantum technology market.



Consortium led by Q.ANT receives 50 million euros in research funding

A consortium led by start-up Q.ANT has received some 50 million euros in funding. The funding will be used to construct a demonstration and test system for photonic quantum computer chips and quantum computer components. This will enable the consortium to conduct research into algorithms and technologies for photonic quantum computing and prepare for industrial scale-up. “We’re on the cusp of the quantum computing era, and the global race to secure market share in this future technology has begun. The funds that have been earmarked for this research alliance are a key enabler on the path toward building quantum computers in Germany,” says Q.ANT CEO Michael Förtsch.



Six benefits of EdgeLine Bevel

TRUMPF has launched a new technology that automatically prepares parts for welding. Known as EdgeLine Bevel, it helps users achieve significant time and cost savings. The method creates angled cuts known as bevels on the contours of parts. EdgeLine Bevel is particularly helpful in the following six cases.



01
Thick sheets

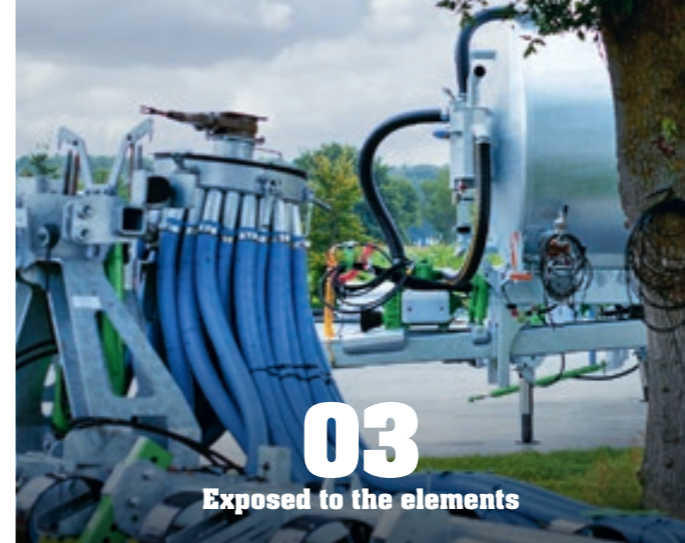
Bevels are hard to avoid when it comes to welding together parts made of thick sheet-metal. The **risk of undercut** is particularly high in these situations. This is where too much energy enters the part during welding, causing the material to sag at the edges of the weld seam. The part loses stability and safety requirements can no longer be guaranteed. EdgeLine Bevel makes it possible to process sheets up to eight millimeters thick. It's a hugely useful technology for preparing the weld edges of thick sheets.



02
Looking good

EdgeLine Bevel helps create flush seams by **avoiding protruding welds**. This gives parts a smooth, even surface and, in most cases, eliminates the need to grind parts after welding. Bevels can also be created on a part's inner contours, which are impossible for manual angle grinders to access. This can further enhance a part's appearance. The new method is particularly suitable for parts that have many visible seams, for example when fabricating machine frames.

IMAGES: TRUMPF



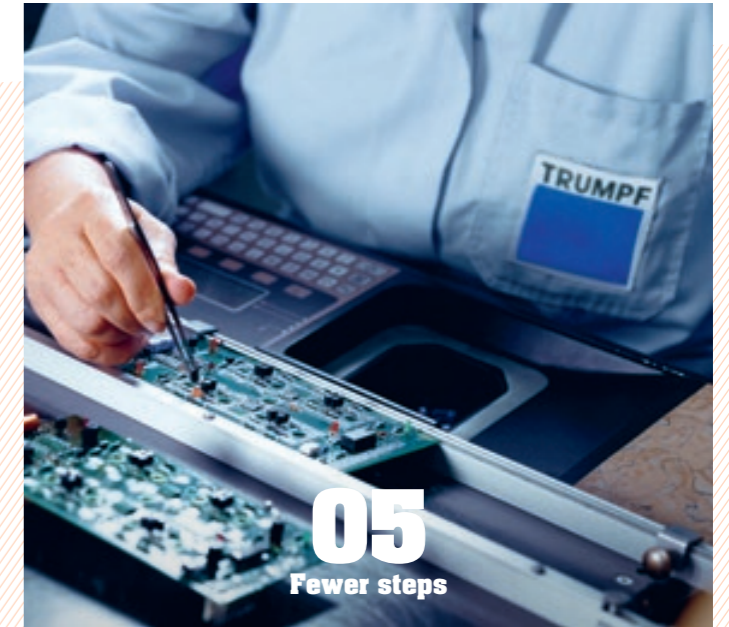
03
Exposed to the elements

Parts that are used outdoors must have completely leak-tight welds. Any gaps or overlaps could allow moisture to penetrate the seam and quickly raise the **risk of crevice corrosion**. EdgeLine Bevel creates gap-free welds without any post-processing, which makes it ideal for outdoor applications. It's the perfect choice for fabricating weatherproof parts for agricultural machinery.



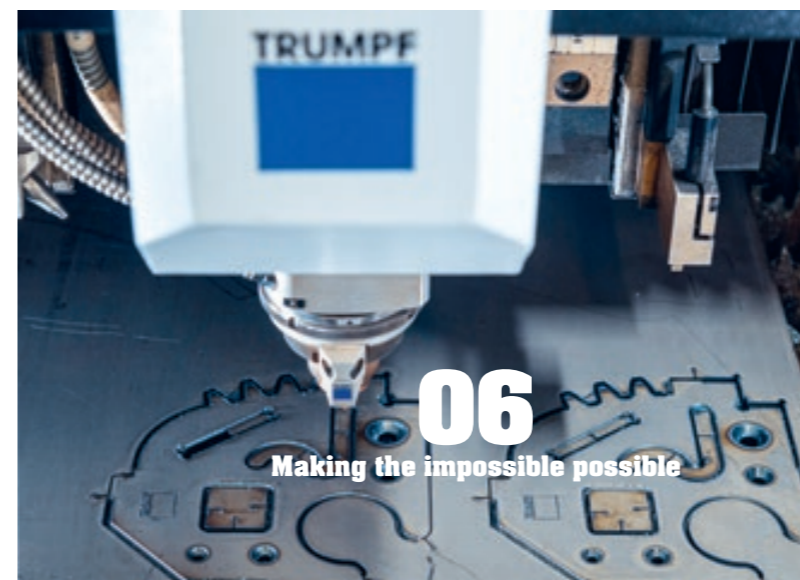
04
Every gram counts

EdgeLine Bevel **supports lightweight construction**. Bevels prevent deposits from forming at the edges of the weld, which ultimately makes parts lighter. They also eliminate the need for the flanges normally required for fillet welds. This makes EdgeLine Bevel particularly useful for applications that need to be as light as possible or that are subject to dynamic loads, especially in mechanical engineering, automaking and aviation.



05
Fewer steps

EdgeLine Bevel can be used to **automatically create not just bevels, but also countersinks**. These are required to screw together parts such as electronic enclosures. Countersinking is a very time-consuming process for workers. Once a part has been cut, the countersinks must be created using a drill; alternatively, a punch-laser machine must be used from the outset. EdgeLine Bevel eliminates this additional step in the process.



06
Making the impossible possible

EdgeLine Bevel opens the door to new types of parts that used to be virtually inconceivable. If users wish to bend parts and then use heat conduction welding to weld them to a part with a circumferential, visible seam without rework, current laser-welding processes limit them to thin parts made of sheet metal no more than two millimeters thick. The part must be cut so that the material that the laser melts during welding does not protrude too much. In addition, it can only be 70 percent of the sheet thickness used, which is why this method only works with thin sheets. If the part has bevels, it is possible to leave more material protruding, thereby raising the limit to three to four millimeter-thick metal. This new flexibility in laser welding gives designers **more creative freedom** to design innovative components. It also simplifies the joining process.



TRUMPF offers **EdgeLine Bevel** for the standard versions of its TruLaser 3000 and TruLaser 5000 Series machines. Users who already have one of the latest-generation TRUMPF laser-cutting machines can also retrofit this new technology. Thanks to its quick and easy programming, EdgeLine Bevel is also a good choice for companies that only occasionally make use of bevels.

Check it out! SERVICE 4.0

Creating a **sheet-metal fabrication process that's fit for the future** requires not just innovative machines and technologies, but also outstanding customer support. Experts from the TruServices team assist customers by providing **smart support services** along the entire value chain.

Level 1 LAYING THE FOUNDATIONS

Ready, set, go!

At this support level, TRUMPF lays the groundwork for its customers to make their production fit for the future with appropriate solutions and expertise.

CALCULATE THE COST

Customers who are interested in a TRUMPF solution can get an overview of the costs and financing options online. They can also request a concrete financing offer from the TRUMPF Bank. Experts there know the sheet-metal fabrication market inside out, so they often offer more attractive solutions than conventional banks.

0044

VIRTUAL TRAINING CENTER

Knowledge leads to success: TRUMPF's digital learning world presents customers with almost 400 online and offline courses on all aspects of the company's machines and technologies – from entry-level machines for laser cutting to the fully connected smart factory.

Level 2 EVERYDAY SUPPORT

TRUMPF solutions are renowned for being robust and reliable. But it's still occasionally possible that a machine might break down or fail to perform as expected. That's when TRUMPF's **technical customer support** comes into play.

Level 3 EVEN BETTER TOGETHER!

The TruServices team provides **digital solutions** to increase the availability of customers' machines even further. These solutions rely on receiving data from the customer's production line.

CONDITION MONITORING

The new Condition Monitoring service offers sheet-metal fabricators the option of having their machines monitored by the TRUMPF Predictive Service Center. Once again, the customer's machines are digitally connected

SERVICE APP

The TRUMPF Service app supports customers around the clock. The app has all the machines and software products of each company stored in the system, so users can report malfunctioning machines in just one click. TRUMPF staff can also use the Visual Assistance function to connect to the user's camera and provide tips.

MYTRUMPF

The **MyTRUMPF** online customer portal is the digital interface that connects users to TRUMPF. It provides an easy way for customers to perform tasks such as ordering spare parts and tools, managing their machinery and downloading software updates and programming data.

MyTRUMPF is currently available in 64 countries

TECHNICAL GUIDE

Is a customer's machine displaying an error code? The solution might well lie in TRUMPF's Technical Guides! These are compact sets of instructions that help users fix problems by themselves – step-by-step. Some 800 different Technical Guides are currently available in multiple languages.



to TRUMPF and TRUMPF automatically informs the customer if it detects any anomalies.

SERVICE AGREEMENT TRANSPARENCY

How can you look into the future without a crystal ball? Simple! By digitally connecting your machines to TRUMPF in order to send us your machine data. If an error should occur, TRUMPF will use the data to find the cause.





05

FUTURE

Green steel

LEADING THE WAY!

Germany's number one steel company **thyssenkrupp Steel** aims to be producing with a completely **climate-neutral** process from 2045 onward. In an operation similar to open-heart surgery, the coal-fired blast furnaces in Duisburg will gradually give way to new **hydrogen-based** direct-reduction plants. With the first of these scheduled to fire up in 2025, we checked out the state of progress.

The carbon emissions of thyssenkrupp Steel are enough to give climate activists more than a few sleepless nights. At around 20 million metric tons annually, carbon emissions at the steel giant's Duisburg plant make up around 2.5 percent of Germany's carbon footprint. Overall, the German steel industry accounts for as much as seven percent of the country's total carbon emissions. In other words, steel production poses a significant problem for the climate. On the other hand, however, it also offers enormous potential for savings. "We're going to turn this around!" promises Marie Jaroni, 37, head of decarbonization strategy at thyssenkrupp Steel.

“Firing up a **carbon-free** plant will mark a real milestone.”

Marie Jaroni, head of decarbonization strategy at thyssenkrupp Steel

Heavy industry leads the way

Strange as it may seem, a 200-year-old heavy industry might be about to play a pioneering role. "If decarbonization can work here in Duisburg – both from a technical and social point of view – it will send out a powerful message to other sectors as well," says Jaroni, who has a doctorate in metallurgy. "We'll be showing them that they can follow the same path of transformation." For her 25-strong team, there can be no stronger motivation than that. "Firing up a carbon-free plant will mark a real milestone," Jaroni adds. However, the real moment of triumph will be another – namely, when thyssenkrupp Steel shuts down the first of the four conventional blast furnaces it currently has in operation.

Leading the transformation: Steel manager Marie Jaroni is responsible for coordinating the huge task of decarbonizing production. This includes construction of the future facility, securing supplies of hydrogen and making sure the workforce is behind the transformation process.



Hydrogen instead of coke

The coke-fired blast furnaces used by the steel industry are responsible for around 85 percent of the total carbon emissions generated by steel production. This can be eliminated by modifying the process used to produce high-quality steel. "In order to remove the oxygen from iron ore, you need a reducing agent," Jaroni explains. "In conventional steel production, carbon in the coke removes oxygen from the ferrous oxides, thereby producing CO₂." This process also works with hydrogen as a reducing agent – though not in conventional blast furnaces. Indeed, a facility for this will have to be built. "The technology already exists for natural gas and is used wherever natural gas is cheaper than coal – in the U.S., for example, or in Saudi Arabia." However, to operate such a plant with pure hydrogen rather than natural gas is something completely new, she says.

An investment that will pay off

To drive this climate-friendly transformation, the group is investing the princely sum of 7 billion euros over the period to 2045. In just three years from now, the first direct-reduction plant will reach up into the skies of Duisburg, where the conventional blast furnaces now stand – a little higher, Jaroni says, but more slender. And, as she explains, this is an investment with a guaranteed return: “Long term, it will still cost us less than if we were to do nothing.” Indeed, the company already faces the substantial expense of having to purchase carbon offsets as part of emissions trading. “And, if we do nothing, the day will come when Germany no longer has a steel industry, because it will have shifted abroad, to places where production is less expensive and less subject to regulations. Besides, we would also have to deal with the damage and the costs of climate change, which are far greater than the investment we’re budgeting for this transformation.”



Conversion: Some 20 percent of the Duisburg site will have to be rebuilt for the shift to green steel. All in all, the location is five times as big as the Principality of Monaco.

No substitute for steel

Naturally, steel is not something we can easily dispense with. Germany’s per capita consumption currently comes in at around 420 kilograms per year. Steel is, after all, found in a vast range of products: washing machines, dryers, cars, motorbikes, radiators, tin cans, wind generators and electric motors, to name but a few. Industry uses around 10 million metric tons of flat rolled steel a year. “You can’t meet that kind of demand through recycling alone,” Jaroni says. Not only would it be impossible to produce the quantity required; reprocessed steel is also unable to meet the quality standards that many industries demand.

A location with big advantages

The Duisburg site is therefore undergoing a massive program of reconstruction. As Jaroni explains, this is a wiser and more sustainable strategy than shifting production abroad: “This is Europe’s largest autonomous and fully integrated steel facility. We have all the different production stages at one location.” Rather than offshoring production to Australia, where hydrogen is produced, or to Brazil, where there is iron ore, thyssenkrupp Steel has therefore decided to remain at its current location in Duisburg, which is ten square kilometers in area – five times as big as the Principality of Monaco. Besides, in the current geopolitical situation, there is now – sadly – a pressing need to preserve domestic steel production as a strategic industry and to reduce Germany’s dependency on other countries.

Much will stay the same

“About 20 percent of the facility will have to be reconstructed – primarily the furnaces,” Jaroni explains. “But out of a total of



IMAGES: thyssenkrupp Steel Europe AG



The workforce is onboard: “Everyone knows that the present business model won’t fly anymore,” says Marie Jaroni.

eight production stages, only two will have to be converted.” What sounds easy is in fact highly complex. Indeed, in view of such challenges, Jaroni describes her job as one of the most interesting in industry right now. Jaroni is in charge of coordinating this huge task, which includes not only construction of the new direct-reduction plants, securing supplies of hydrogen and attaining certification for the green steel but also working together with government and, last but not least, ensuring that the 26,000 employees of thyssenkrupp Steel are behind the project.

Organic chicken or battery bird?

It is also her job to tell the customer that green steel will be more expensive than the conventional product. However, as Jaroni explains: customers accept this: “They know their product will then be more valuable in the eyes of the end consumer.” It’s just like an organic chicken, she adds: everyone accepts that it is more expensive than a battery-reared bird. As for the workforce at thyssenkrupp Steel – they don’t really need much persuasion: “At the end of the day, everyone knows that the present business model won’t fly anymore.”

“ It will still **cost us less** than if we were to do nothing. ”

Mark Stagge, Head of Public & Media Relations, thyssenkrupp Steel

7%
of the annual carbon emissions in Germany are generated by steel production in Germany

420 kg
per capita consumption of steel in Germany per year

7
billion euros to be invested by thyssenkrupp up until 2045

TEC+ SHORT CUTS

Innovations, technologies and future trends



New nano joint technology

TRUMPF's new "nano joints" technology **increases productivity on the shop floor.** Unlike micro joints, nano joints only create tiny retaining tabs, so users can save material by arranging parts right next to each other on the sheet. With micro joints, workers have to apply force to break parts out of the nest and then spend time smoothing and finishing the edges. Less force has to be applied to release parts that use nano joints. This makes part removal quicker and eliminates the need for finishing. Nano joints also speed up cutting by letting the laser travel all the way around the part – unlike micro joints, which require the laser to leave its path.



TRUMPF cuts XXL sheets with less waste

The new **TruLaser 3080** fiber laser-cutting machine cuts parts from sheets **up to eight meters long.** It is particularly adept at cutting large, heavy parts weighing up to 7,850 kilograms, such as facade components and trailers for trucks or cranes. The TruLaser 3080 fiber can also be used for small and medium-sized parts, so operators can easily harness its full capacity and achieve significant gains in production output. Parts can be nested in ways that make optimum use of almost all the raw material. "There are only a few companies in the sheet-metal fabrication market that can cut oversized parts precisely to size. We pride ourselves on being a solution provider,

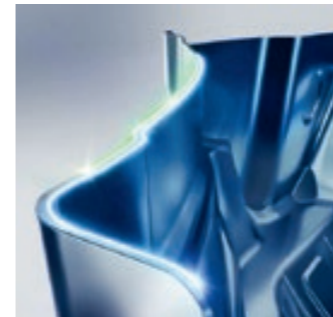
and this machine really does give our customers a competitive edge and helps them process even more jobs in less time," says TRUMPF product manager Patrick Schüle. The machine can handle sheet thicknesses up to 50 millimeters and process a variety of materials ranging from copper to mild steel. It comes with an automatic pallet changer that automatically inserts a second sheet as soon as the laser has completed its first cutting pass. This allows the machine to cut parts for several hours without workers having to add any additional raw material. The TruLaser 3080 fiber can therefore be used in multi-shift operation without requiring complex automation.



TRUMPF introduces the most powerful industrial disk laser

With a hefty 24 kilowatts of output power, the latest generation of **TruDisk high-power solid-state lasers** is the most powerful on the market. Suitable for cutting, welding and machining surfaces, these disk lasers are a great choice for jobs that require a combination of high power output and maximum beam quality – for example when cutting thick sheet metal and steel, or welding thick sheets. "Our primary target group for welding applications is **heavy industry,**" says Evangelos Papastathopoulos, TRUMPF product manager. "TRUMPF's BrightLine technology gives customers so much flexibility that they can cut thick and thin materials almost at the touch of a button! That's our unique selling point – and it offers real added value for our customers."

IMAGES: TRUMPF



TRUMPF boosts 3D cutting speed with BrightLine Speed

TRUMPF's new BrightLine Speed technology allows users to **cut sheet metal faster and more efficiently.** One of the key goals of this innovative solution is to improve the 3D cutting of hot-formed parts, such as those used in the production of B-pillars and door frames for the automotive industry. "BrightLine Speed allows us to increase cutting speed by up to 60 percent for sheets up to four millimeters thick," says TRUMPF product manager Ralf Kohllöffel. Laser cutting with BrightLine Speed only uses half as much gas as conventional methods. The laser requires less energy and the cutting process is up to 15 percent more productive at the same output power.



Improving production with the help of Condition Monitoring

Condition Monitoring is a new **TruServices package** that helps sheet-metal fabricators to improve their production using machine data. TRUMPF's **Predictive Service Center** receives up-to-date condition data from all the digitally connected machines on a customer's shop floor. This allows TRUMPF experts to analyse key data, for example on the temperature or pressure of individual machine components. If TRUMPF detects an anomaly that could potentially cause a malfunction or downtime, it informs the customer proactively and sends them recommended solutions, either by email, through a notification in the Service app, or in a phone call from a technical expert. This allows customers to solve problems before they lead to unexpected downtime or cause a machine to produce unusable parts.



Perfect material flow with TRUMPF's new Oseon software

Oseon software helps companies achieve **fully automated material flow in their production facilities** without having to invest in a large-scale storage system. Operators use Oseon to schedule their production processes, and the machines on the shop floor continuously send process data back to Oseon. The software also receives information on each batch and on the location of carts and automated guided vehicles (AGVs). The system works by labeling pallets with barcodes which workers scan when they load a machine, thereby "wedding" the pallet to the batch. Once the cart is empty, they simply push it into one of the special docking stations developed by TRUMPF. Alternatively, the material is transported from A to B by an AGV. As soon as the cart or AGV has

"docked", the docking station sends the corresponding information to Oseon. This provides the software with all the data it needs to organise efficient material transportation. Oseon can also automatically send transportation jobs to workers with carts and to AGVs. Oseon is a great choice for any sheet-metal fabricator looking to boost the competitiveness of their production activities. The software can be used with machinery that is still in the earliest stages of digital connectivity as well as in **smart factories,** whatever the size of the company. Thanks to its open interfaces, Oseon is also suitable for users who want to include machines from other providers in their connected manufacturing system alongside TRUMPF machines.

Oseon: everything in perfect flow

Is it possible to use a single software package to keep track of all the processes in sheet-metal fabrication – and to boost productivity by up to 20 percent in the process? TRUMPF thinks it is, and its flexible, open-interface software solution Oseon Flow illustrates why! As well as reducing downtime and nonproductive time, the software also improves capacity utilization and makes life easier for employees. Wolfgang Liertz, head of product management fabrication software, explains why switching to Oseon is a sensible move even if sheet-metal fabricators are still using older machines and manual logistics processes.

Mr. Liertz, what's the idea behind Oseon and how do customers benefit?

Oseon is a new software product from TRUMPF that combines production scheduling and control with warehouse and transport management. Customers can use it to improve digital connectivity on the shop floor and make productivity gains of up to 20 percent. Oseon offers support in multiple areas. The software makes manufacturing data more transparent by allowing workers to monitor all the processes on tablets and monitors in real time from wherever they are. It boosts flexibility by automatically and seamlessly synchronizing the flow of materials with the production schedule. And it helps production staff by allowing them to see all the relevant information on a job and the tasks assigned to them without leaving their work environment – and without using paper or switching between different media.

Companies are increasingly looking for ways to make manufacturing more flexible and to produce small batches cost-effectively. How can Oseon help?

Oseon creates the conditions customers need to fabricate small batches and to adapt their production lines quickly and flexibly. The software's biggest benefit is that it allows customers to synchronize material flow with their production schedule. In other words, it uses the production schedule and the latest data from the production line to determine the order in which materials should be transported to the machines. What's more, it organizes the transportation of these materials in an automated fashion, so they are always in the right place at the right time. This massively increases flexibility. Companies can adapt their production quickly and easily without experiencing the kind of productivity losses that occur when workers are left searching for new raw materials, for example. It makes it much easier to incorporate rush jobs into the schedule, and Oseon even makes small batches profitable.



Wolfgang Liertz, head of product management fabrication software

How does Oseon organize the transportation of materials so efficiently? With sensors?

The shop floor contains many sources of information that Oseon can use. The production schedule provides the basis for a smooth flow of materials, but Oseon also has real-time access to all the key production data. TRUMPF machines automatically report the status of each job, and it's even possible to integrate other manufacturers' machines in the process. In addition, the pallets that workers load with parts are labeled with QR codes, so they can simply use their tablet to scan the code and "wed" the pallet to their current job. Oseon always knows which cart or automated guided vehicle (AGV) is currently transporting which material. There's also an option to install smart

parking spots for carts on the shop floor. These docking stations are equipped with sensors that can detect which cart is currently parked there. That enables Oseon to find the best route in each case. The software then automatically creates transportation jobs that can either be carried out by an employee with a cart or by an AGV. So everything flows perfectly smoothly.

TRUMPF smart factory in Ditzingen



IMAGES: TRUMPF



The smart factory synchronizes machines, workplaces and material flows, and workers can keep track of the processes on their tablet.

TRUMPF offers three packages: Oseon Go, Oseon Grow and Oseon Flow. Why have different levels? And who are they aimed at?

TRUMPF wants each customer to get something that is perfectly tailored to their needs. That's why there are three different packages. Depending on each customer's goals, we can offer them the right level of digitalization and automation. The final version, Oseon Flow, is targeted at fully automated production – the smart factory. But even with the basic Oseon Go package, companies still have plenty of opportunities to optimize their own processes using digitalization and to increase their productivity. It allows companies to expand their digital connectivity gradually, at their own pace.

Does the new software replace TRUMPF's current TruTops Fab system?

Oseon includes TruTops Fab. We developed Oseon in close collaboration with TruTops Fab customers, so the software is very user-friendly. Experienced staff who are already very familiar with TruTops Fab can either continue to use the system as before or switch to Oseon. So, ultimately, all our customers will benefit from the new, intuitive solutions that Oseon offers.

Oseon organizes material transportation automatically in the connected factory. Materials are transported from A to B by workers with carts or by automated guided vehicles.



Up to
20%
gains in productivity

You said that Oseon also gives workers all the key information they need. How does it do that? And what's special about the methods it uses?

Production often comes to a halt because workers don't have the information they need on the current job. Normally, that would mean searching for the relevant routing slip or looking up the details in the production scheduling program, which takes time and effort. But Oseon gives them clear information directly within their work environment, exactly when they need it. It also displays digital instructions for each step in the process on their tablet. The big advantage of Oseon is that it gives workers an intuitive solution that is tailored to whatever job they're doing at the time. Most commercial software requires expert knowledge and numerous clicks to switch between production jobs and intra-logistics, for example. But Oseon provides seamless access to that information, which significantly reduces the risk of error and also makes it quicker for new employees to get down to work.

Who benefits the most from Oseon?

Oseon supports all companies in the sheet-metal fabrication industry, regardless of their size or level of connectivity. The extent to which users benefit obviously depends on the customer's goals. There's a real opportunity to improve the situation for workers who previously suffered from a lack of transparency on the shop floor, puzzling over where their job is, how many parts have already been produced and which machines are still free!



CLEVER SAVINGS: TRUMPF PART OPTIMIZATION

Better quality at less cost: TRUMPF's part optimization workshops teach users how to get the best out of their machines and parts in order to make production more economical and efficient.

Each issue, TRUe takes a look at a different part to illustrate how this process works.

This issue: reducing the number of parts

Sometimes things start out simple and end up getting complicated. That was the case with the device mount attached to the TruMatic 6000 punch-laser machine. It is used to hold various things, including lubricant distributors, pneumatic valves and switches. At first, all that was required was a simple mount, but gradually it amassed additional tabs, angles and mounting plates. The end result was an assembly comprising five extensions, each of which had to be cut, bent, welded, threaded and attached to the other elements.

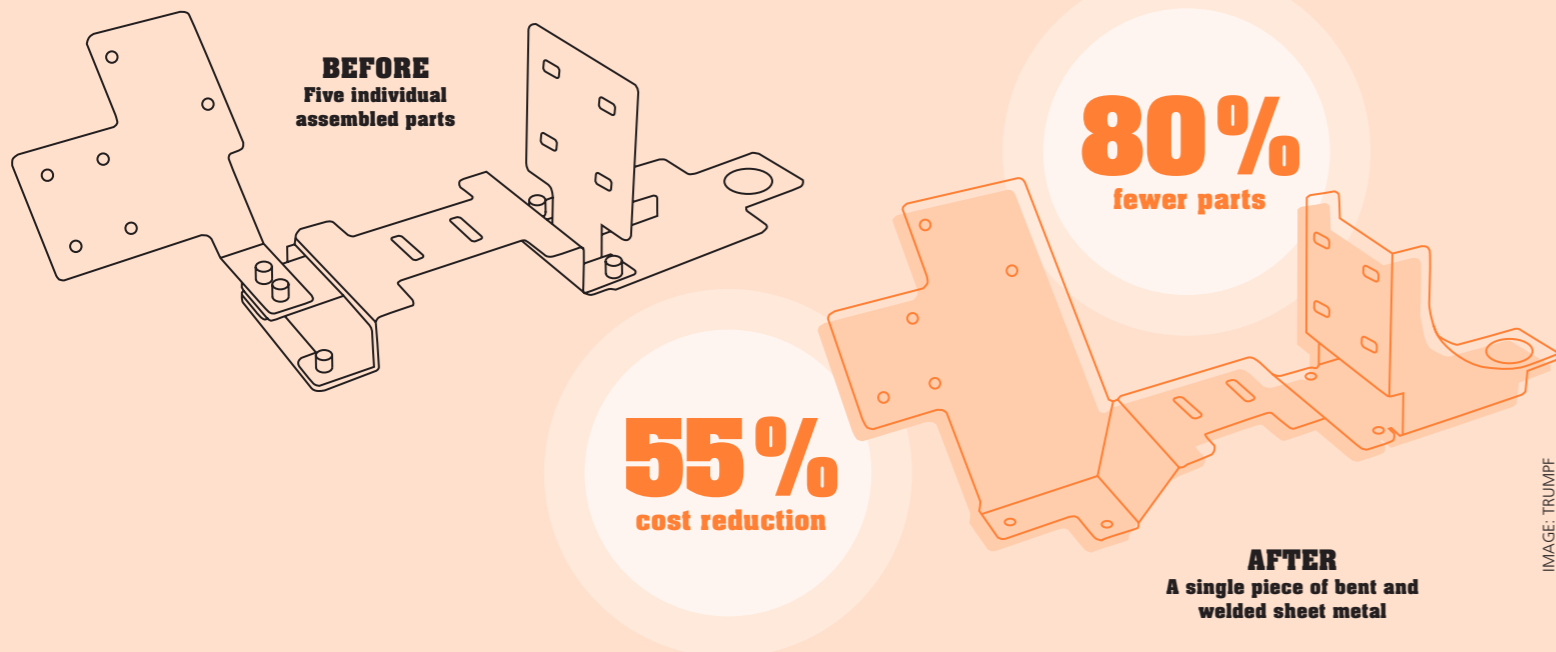
Yet reducing the number of parts in this case was actually quite simple, says Jörg Heusel, head of TRUMPF part optimization: "Assemblies that consist of multiple individual parts can



Jörg Heusel
Head of part consulting
at TRUMPF

often be manufactured much more economically from a single sheet that is bent several times. If you take a close look at your parts, you'll find your products contain many elements that could easily be combined with a little bit of redesigning. Getting rid of entire process chains, or even just individual steps, is a good way to save time and money."

Combining multiple parts can create profiles that might seem difficult to bend. But as long as you keep the angles above 90°, it's actually not difficult to bend them. In the case of the device mount, for example, engineers replaced the step with a trapezoid shape. With a bit of smart thinking, they were able to reduce the number of parts from five to one and reduce the cost by 55 percent.



Technology transformed into art. Presenting parts in a new light is something we do in every issue of TRUe. This picture shows the **nozzles of a laser-cutting machine** as you've never seen them before. By taking the cutting nozzles out of their familiar environment, photographer **Lucian Mitiu** helps us see them from an entirely new perspective.

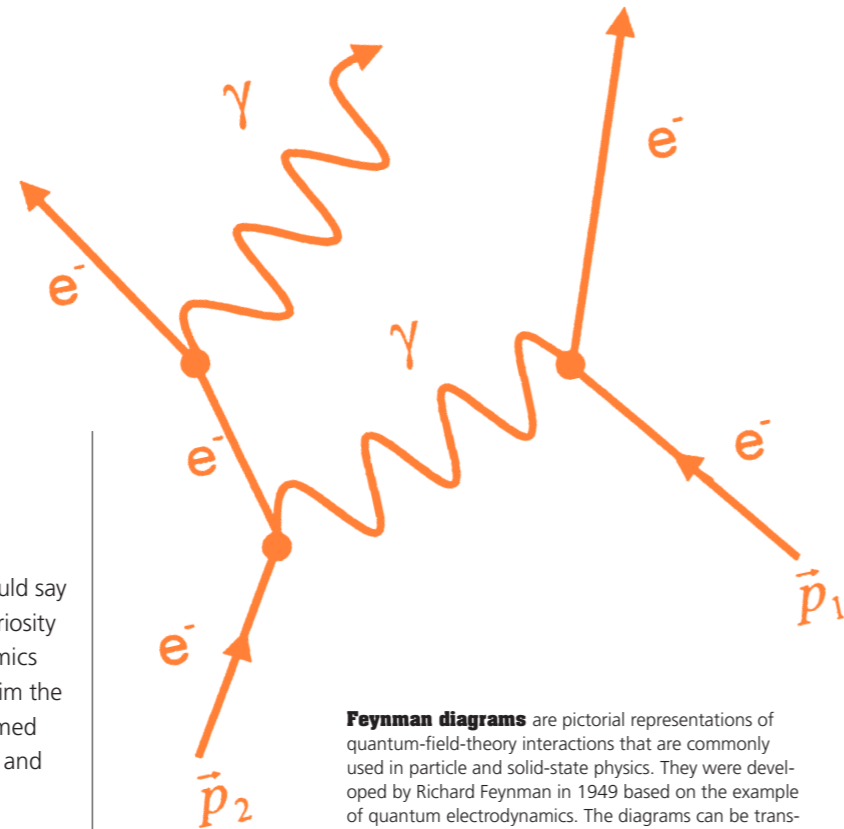
Truth in a glass of wine

Dear physicists, I'm not sure if you agree but, ultimately, I would say it's **curiosity** that really holds the world together. It was curiosity that led Richard Feynman to discover quantum electrodynamics shortly after graduating from MIT, which eventually earned him the Nobel Prize in Physics in 1965. His inventive capabilities seemed boundless, ranging from systems of pictorial representation and spectacular theories to the first quantum computer.

Feynman was certainly a curious fellow, always eager to learn but often uncivil and quick-tempered. But he was always open to discovering better methods of doing things. He learned Chinese characters astonishingly quickly and worked on translations of old Mayan hieroglyphics with pure brainpower, even as computers began their inexorable advance. While working at Los Alamos under Robert Oppenheimer, where he helped develop the atomic bomb as part of the Manhattan Project, Feynman couldn't resist cracking the safes where his colleagues kept top-secret U.S. documents. During that period in New Mexico, stuck in the back of beyond, he also learned to play bongo and conga drums. He eventually became so good that, during a summer spent lecturing in Rio, his students permitted their odd American professor to enter the University's samba competition with his frigideira, a percussion instrument based on a frying pan.

As a child, he loved lazing in his dog-chewed armchair, writing in notepads and humming, completely lost in his own thoughts. While other children played ball in the yard, little Richard was already busy assembling radios. He once fed 110 volts through an old rheostat resistor until it caught fire and he had to hold it out of the window of his apartment building, much to the annoyance of his mother. Lucille Feynman got another shock many years later in 1979 when she heard that her son had been named "The Smartest Man In The World" by Omni Magazine. "Our Richie? The world's smartest man? God help us!"

Feynman made a rather more positive impression on his students and colleagues. The Feynman Lectures on Physics were extraordinary performances. He had the amazing gift of being able to



instantaneously identify and communicate the inner workings of any natural phenomenon. In his famous lecture entitled "The Universe in a Glass of Wine", Feynman used a glass of claret to explain how the entire world works – from physics, geology, biology, and chemistry right through to the psychology, sociology and anthropology of winemakers themselves. His students' lecture notes from the 1980s were turned into textbooks which sold millions of copies. And his autobiography "Surely You're Joking, Mr. Feynman!" became a runaway best-seller far beyond the confines of physics, thanks in part to its rich collection of anecdotes. Nowadays, his witticisms can still be enjoyed on various Twitter accounts set up in his name after his death.

Feynman had the kind of mind that often produces "oddballs" – or perhaps that should be the other way around? His last words were "I'd hate to die twice – it's so boring!" Not long before his death in 1988, he worked on the commission that submitted a report to Ronald Reagan on the Space Shuttle Challenger disaster. Feynman neatly illustrated NASA's poor handling of the mission with some iced water: he dropped an O-ring in the glass, watched it lose shape, and then pulled the rubber ring out again with his hardware store pliers. He concluded that the rings used as seals in the shuttle's solid rocket boosters had lost their elasticity due to the cold – and that this ultimately led to the Challenger disaster that fateful day in 1986. Anyhow, all that remains now is to take my glass of Bordeaux and raise a toast to the wonders of curiosity. Cheers!


Daniela Müller



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