

TRUf

THE MAGAZINE FOR SHEET METAL EXPERTS

01 Shijiazhuang

How a courageous entrepreneur
is shaping the future
with full automation

02 Rosheim

Living for lasers:
how genuine passion
generates progress

01 #2016 OPENNESS

03 Baiersdorf

Of fathers, sons and robots:
how to convince
test customers

04 Ditzingen

How to make the impossible
possible – revolution
made by TRUMPF

01 #2016 OPENNESS

TRUf





Openness is a word that is extremely open to interpretation, and you can look at it from both a philosophical and a socio-political standpoint. But whatever your perspective – **openness is always positive.** And when it is something like the 15,003-meter-long opening of the Gotthard Tunnel, it is also just **extremely impressive.** ■

On November 9, 1989, people could **experience openness firsthand.**

At precisely 7:41 p.m., German news agency dpa reported that the East German border was open. This was a real **goosebumps moment** – not just for Germany, which could finally become a single country again, but for the whole world. 🇩🇪





Openness can mean simply having the courage to **think another way.** That is precisely what farmers in the Sahara in North Africa have done, combining something extremely traditional with something extremely modern. This lets them harvest the very best from the scorching sun: a **big slice of the future.** ■



EDITORIAL

New name, new look, new agenda: “TRUe,” our new customer magazine, reflects a manufacturing environment that is increasingly connected, and in which **machines, software and services** are inextricably linked. The new publication is a result of merging our “TRUMPF Express” and “TruServices Journal” into a **single magazine**.



Through its capitalization of the first three letters, the name “TRUe” both pays tribute to its predecessors and refers to our product portfolio. We also like the English meaning of the word, which we believe represents both our company and the magazine.

From now on, each issue will have a focus topic. In this one, the attitude of “openness” is a common thread running through all the articles. **For me, openness is above all about being ready to try something new** – a quality we need if we are to meet the challenges of a changing marketplace. Around the world, people are trying to exploit the opportunities presented by digital connectivity. Everything is becoming more customized, including the orders received by companies in the sheet metal processing industry. In the future, manufacturing small batch sizes should be just as fast and cheap as mass production.

You can see TRUMPF’s solution to this challenge on the left, where the picture shows our demonstration factory for Industry 4.0 applications in Chicago. Scheduled to open in the summer of 2017, the factory is a flexible, smart factory that is designed to digitally connect all manufacturing components vertically and all parties involved in the process horizontally, supporting entirely new business models. One example is pooling, whereby a manufacturing facility that is at full capacity can simply forward an order to another facility that has reported spare capacity. This is just one of our many ideas, and our customers are full of innovation as well, as this issue testifies. Let’s use this shared openness to create something special!

Mathias Kammüller

DR.-ING. MATHIAS KAMMÜLLER

TRU[®]

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How to become the **pioneer** for an entire region: a young man was quick to recognize **international market potential** and his progressive mindset managed to transform a whole company.

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... in Rosheim

Innovation by conviction: Jacques Kammerer has always been a passionate advocate of new technology. His Alsace-based company is taking the next step toward **Industry 4.0** by introducing digital connectivity.

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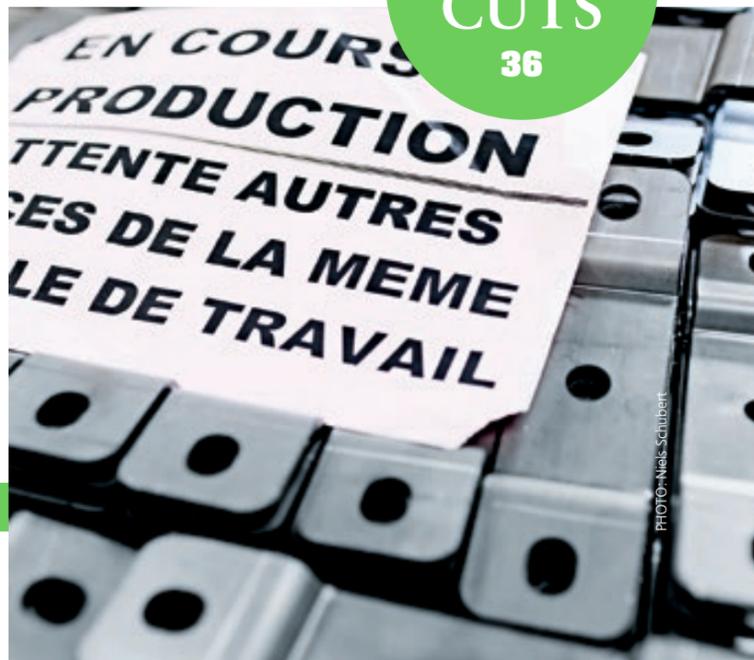


PHOTO: Niels Schubert



04

... in Ditzingen

Ditzingen has risen to a seemingly impossible challenge: to develop a completely new machine concept for laser cutting. Brilliant ideas, courage and innovative methods came together to deliver a **technological revolution**.

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03



01
CHINA

Openness in Shijiazhuang

AUTOMATED SUCCESS

In a country where tradition is highly valued, **entrepreneurial innovation** is taking on an ever greater role. Dolanit's Qi Wang is one of the young Chinese entrepreneurs who not only recognized the **trend toward automation**, but are already realizing it today.

PHOTO: Wang Gangfeng



Dolanit is a company located in Shijiazhuang, in China's Hebei Province, some 300 kilometers from Beijing. Here, Qi Wang is carrying on his father's legacy: Jianyun Wang founded the company in 1986. At that time, the approximately 30 employees used such simple tools as guillotine shears and hand welders to manufacture primarily sheet metal cladding for switch cabinets. Dolanit has been part of Huijin Corporation since 2014. Qi Wang now has a staff of 150. He is proud of the fact that his company was the first in the entire province to introduce a linked automation solution with a large-scale storage system and three connected machines. That the company would grow, however, had already become apparent long before this.

In 2004, the young businessman joined the company his father had spent several years building and expanding. A new business area emerged for Dolanit just a short time later, in 2005, when the Chinese government began subsidizing railway development in order to speed up technological advancement and modernization. Qi Wang recognized the potential of this market early on and was open to it. "Our focus was on the stainless steel covers for the air conditioning in the trains," he says. To manufacture these components, Dolanit's machinery would have to be modified – not only did it take too long to transport material between the punching and laser machines, but the quality couldn't always be guaranteed. After conducting in-depth research, Qi Wang found the solution: a TRUMPF punch laser machine.

.....
 “ He found **the solution**
 to his problems
 on a trip abroad. ”

Even in Shijiazhuang, an 18-hour flight from Ditzingen, Qi Wang had heard about TRUMPF's technological expertise. "The name is very well known in Chinese manufacturing industry, as TRUMPF is synonymous with highly advanced machinery," says Qi Wang. He purchased his first TRUMPF machine, a TruMatic 7000, in 2011.



PHOTO: Wang Ganfeng

As a result of rising payroll costs, Qi Wang was also looking for ways to continue running and expanding his company profitably. In the course of an important business trip in 2013, he was able to take a closer look at automation, which was prevalent in Germany, and the resulting advantages: companies that had fewer employees than his, but that achieved higher productivity. That was the solution to his problems.

In 2014, he took a great leap. He fitted not only his TruMatic 7000, but also a 2D laser machine, the TruLaser 5030 fiber, with loading and unloading units. He connected both of these machines and the next link in his sheet metal process chain, the TruBend Cell 5000 automated bending cell, to a Stopa compact store. With this radical redesign, Qi Wang boosted his company's productivity by 30 percent while halving his payroll costs. "At that time, automation was considered a luxury in sheet metal processing, so this quickly and significantly boosted our reputation," reports Qi Wang.

To ensure not only that his machinery was state of the art, but also that those who operate it, as well as the rest of the staff, were regularly updated on the latest technology, Qi Wang introduced special internal training courses for all employees. He modeled this change on the experts at TRUMPF, who had offered similar courses right after the machines and storage were installed, making it possible to bring the automated factory unit online much more quickly. This determination is typical of Qi Wang.

"Today's 25- to 30-year-olds aren't particularly eager to work in industry," says Qi Wang. "I chose it because, like my father, I aim to become number one in our market." In addition to air conditioning components, his company makes ATM enclosures and switch cabinets. Competitive pressure is intense, which is why the consistent and high quality of his products is decisive for Qi Wang. Since automating his company's production, he was able to acquire many lucrative follow-up orders and also attract new customers. The company is growing and it has an excellent reputation, and all signs point to future progress, too. Qi Wang hopes to tap new markets – like he first did with the trains. Openness by tradition, you might say.

Qi Wang is both tradition-conscious and progressive. He is taking his father's life's work into the future, and relying on automation to do so. Many Chinese entrepreneurs are now taking this path – and the government is supporting them with numerous funding programs and subsidies.



PHOTO: Wang Gangfeng

01

In brief:

Automation systems

For Dolanit in China, **automating the production chain** helped it win new major customers and projects. Having the right high-bay storage system is crucial. **STOPA warehouse storage systems** do more than just store materials – they can perform all of the tasks needed to operate a well-run manufacturing logistics center. In conjunction with other automated functions, they can be used to create an **entirely new kind of company.**

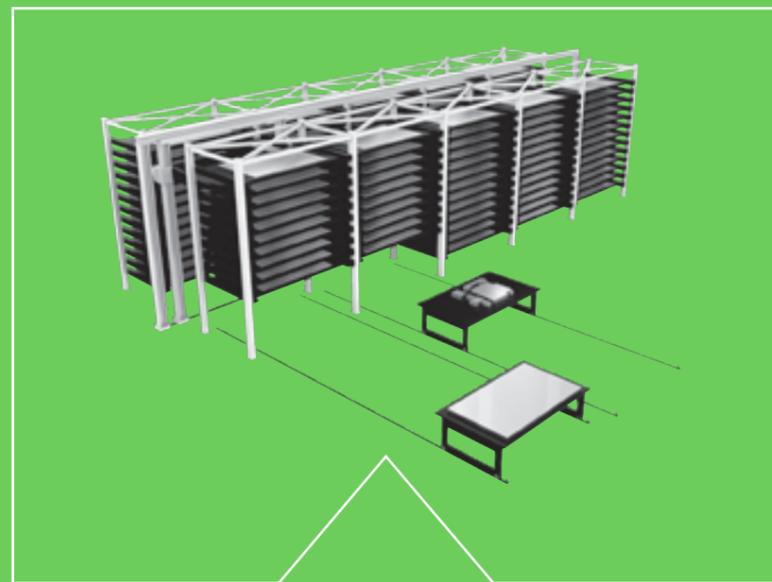
Short & concise

Automation systems

01

STOPA COMPACT

24/7 availability



03

LIFTMASTER STORE

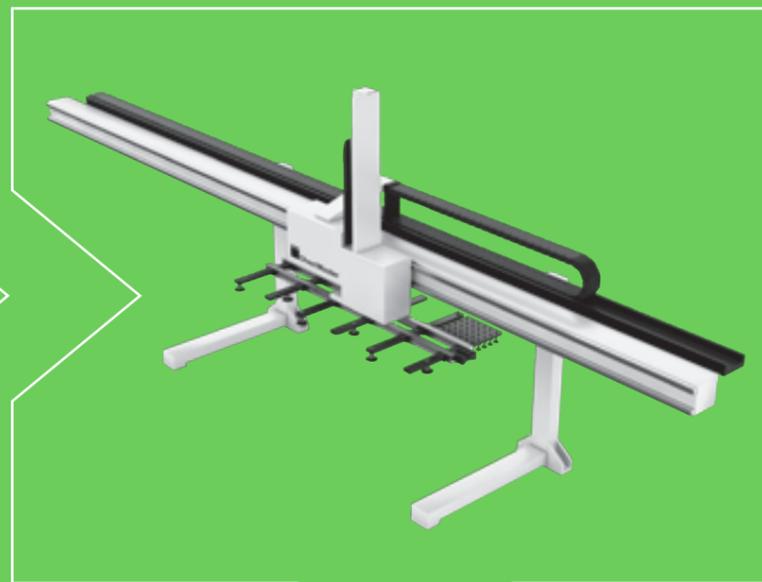
100 seconds for a complete loading/unloading cycle, including switching pallets



02

SHEETMASTER

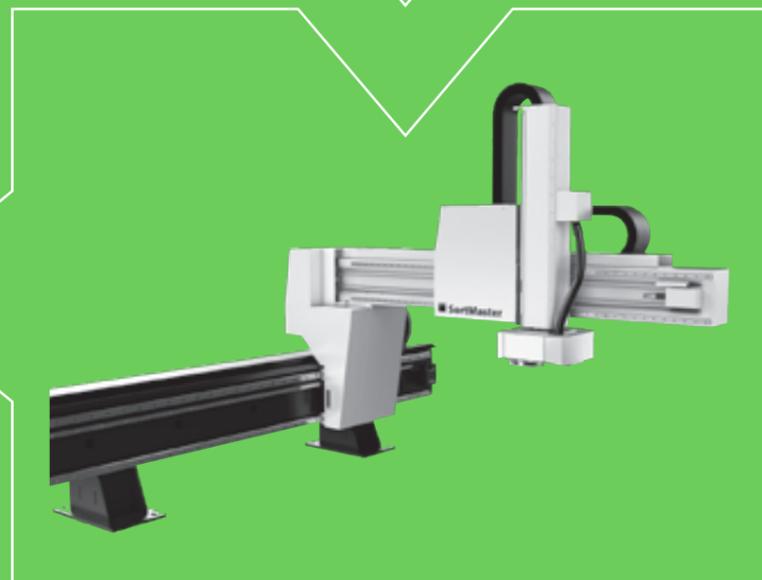
Boosts capacity utilization by up to 50%



04

SORTMASTER

Max. total part weight 100 kg



The customer

Hebei Dolanit Electrical Technology Co., Ltd.

General manager: Qi Wang

Xiangjiang 209

High Tech Industrial Development Zone

Shijiazhuang, China

huijinaf@hjs.com

www.dlntcn.com/eng/index.html

Machinery

Automation system:

STOPA COMPACT storage system

Directly linked to:

- TruLaser 5030 fiber
- TruMatic 7000
- TruBend Cell 5000

Indirectly linked to:

- TruPunch 1000
- TruBend 5130
- TruBend 7036

Everything is managed by the TruTops Fab Storage module.

Individual machines:

- TruLaser 3030 Prime Edition
- TruLaser Robot 5020

Results at Dolanit

After installing a **TruMatic 7000** punch laser machine in 2011, Dolanit achieved the following results:



Further growth through add-on functions

Functional enhancements and automation options can be retrofitted at any time, because TRUMPF builds machines that are specifically designed to grow along with your business.

TRUMPF contact

retrofit.tws@de.trumpf.com

www.trumpf.info/8ckjs6



PHOTO: Niels Schubert

02
FRANCE

Openness in Rosheim

THEY KNOW WHAT THEY'RE DOING

The work never stops at **Laser Alsace Production (LAP)** in Rosheim.

Jacques Kammerer and his machines understand one another intuitively. The pioneering entrepreneur has taken the first steps toward **building a digital production network**, in partnership with TRUMPF. But forklift trucks still run around the factory.

Jacques Kammerer has always had a tendency to do things differently. After obtaining a degree in physics, specializing in optics, he worked for five years in a research group focusing on laser technology. His aim was to stake out the limits of what is physically possible. After this phase as a researcher, the scientist switched tracks and became an entrepreneur. "Making new discoveries, moving forward, staying a step ahead – these are the motivating forces of my life," he says. This enthusiasm convinced his bank to lend him the money he needed to set up LAP. "I succeeded because I steadfastly believed in my dream project. I was determined to create LAP, and that determination paid off." His factory is equipped with the state-of-the-art machinery and Jacques Kammerer knows all about the innovations taking place in his sector of industry.

A life devoted to progress

Kammerer is up to date on the latest technological developments, but until recently most of his administrative processes were still carried out manually. Realizing this, he saw that there were advantages to be had from implementing Industry 4.0 – or the industry of the future, as it is known in France.

In early February 2016, members of the TRUMPF Smart Factory consulting team traveled to Alsace for a week to help Kammerer realize his vision with the support of their expertise in connected manufacturing. The team noticed two things about Kammerer's modern production facility. One was the lack of interfaces between the various (non-integrated) software systems, making it complicated and time-consuming to transfer information and data. The other was that the French company's production process resembled a black box: there was absolutely no information available about the current status of jobs or about capacity utilization. These are things that Kammerer now intends to change. "We have formulated tangible goals as part of a two-year plan, which is currently being implemented." An important point for him was that, as he says, "I don't want to have to become an IT expert." The solution is a TruTops Fab ERP system, which he is implementing as the first building block. It will be followed by other components of the TRUMPF TruConnect portfolio, such as the TruTops Boost programming system, a detailed planning tool and, at a later date, the AXOOM platform to allow the integration of suppliers.

Contrary to what might be assumed, there are actually more people working at LAP than before: new positions have been created in the sales department, for example. This is because the distribution of functions has changed. Today, it takes just one person to operate three machines simultaneously. The machines



Less manual work, more programming:
To ensure digital connectivity runs smoothly, Jacques Kammerer needs employees with different skillsets.





know what they're doing. On the other hand, additional staff are employed in order acquisition. This reallocation was necessary, explains Kammerer, "because digital connectivity is only cost-effective if there are enough orders to make it worthwhile." Since he started using automated technology a year ago with two new machines and a storage system, he has managed to increase sales by 27 percent and the workforce has grown by 10 percent. He expects digital connectivity will bring an additional 15 percent of sales growth.

A good partnership

The love of innovation that drives Jacques Kammerer does, however, call for a large measure of flexibility. The market is constantly changing – not only the machines but also the customers. "I don't know where we'll be in five years' time, but we're ready for anything and everything," says Kammerer.

He has a clear objective: to reduce manual interventions in the machining process to the strict minimum. The desired result can be realistically accomplished within two years – even if this seems a short time for such an ambitious plan. Jacques Kammerer describes TRUMPF as the perfect partner for this project, especially because of the software solutions and innovations like AXOOM: "I can get everything I need from a single source – machines, a storage system, software and the appropriate business platform. What's more, they're the best and most advanced machines on the market. The ideal fit for me and my demanding standards."

The modern high-bay storage system is based on the latest advanced technology and was the first step toward digital connectivity. Suitably integrated software interfaces are now being added in gradual stages.



PHOTOS: Niels Schubert

02

In brief:

Consulting for Networked Production

Easy entry, user-friendly implementation: Jacques Kammerer from LAP has discovered the benefits of **digital manufacturing** for himself. At TRUMPF, no two solutions are the same, because **TruConnect** combines individual components into **customized solutions**. Overleaf you can read about how this works and which products are available.

Short & concise

Consulting for Networked Production

SMART FACTORY EXPERIENCE

During a half-day company-wide event, people with an interest in smart factories can learn all about the technology's potential. A guided tour gives the participants precise insights as they experience networked manufacturing at TRUMPF. All remaining questions can be asked and clarified during a subsequent expert discussion.



SMART FACTORY CHECK

The one-day manufacturing check helps participants decide which parts of their operations would benefit from the switch to a smart factory. First, all indirect processes are analyzed – from customer queries and drawing up offers through to programming and invoicing. Then the processes for which connectivity offers particularly high optimization potential are defined.



SMART FACTORY CONSULTING

During a five-day consultancy, a detailed smart factory concept is created. This includes proposed solutions, potential savings, the required investments, and a plan for implementation. First, an exact process analysis is carried out for manufacturing. After that, the main fields of action are identified and the monetary potential evaluated. Finally, the customer receives a concrete recommendation for action including suitable solutions from the TruConnect portfolio.



PERFORMANCE COCKPIT



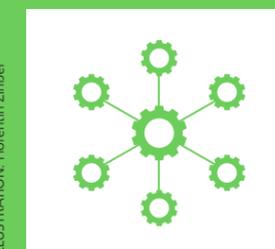
VISUAL ONLINE SUPPORT



MOBILECONTROL APP



TRUTOPS FAB



CONNECTIVITY-ENABLED MACHINE



AXOOM

ILLUSTRATION: Florentin Zinßer

Recommendation for action for smart factory at LAP

01 Improvement of transparency via workflows and order statuses

Investment EUR 90,000
Potential savings EUR 200,000 p. a.
Payoff time 0.45 years

02 Connecting of programming workspaces

Investment EUR 30,000
Potential savings EUR 75,000 p. a.
Payoff time 0.4 years

03 Automation of tendering process

Investment EUR 20,000
Potential savings EUR 20,000 p. a.
Payoff time 1 year

About the customer

Laser Alsace Production

CEO: Jacques Kammerer
Parc d'Activités du Rosenmeer
Zone Sud 5 rue Jean Marie Lehn
67560 Rosheim, France
Phone: +33 (0)388 480500
info@lap.fr

www.lap.fr

Machine portfolio

- TruLaser 5030
- TruLaser 5030 fiber
- TruLaser 5040
- TruLaser Tube 7000
- TruBend 5320
- TruBend 7036

TRUMPF contact

truconnect.consulting@de.trumpf.com
www.trumpf.info/9uld0e



PHOTO: Niels Schubert

03
GERMANY

Openness in Baiersdorf

MOVING UP A STEP AT A TIME

It takes guts – and an openness to new technologies – to transform a one-man business into a thriving medium-sized company with 43 employees. **Herberger Metallwaren**, based in Baiersdorf near Erlangen, is proof that progress pays, and has been testing the new **TruPunch 1000** exclusively for TRUMPF.

.....
 “ A vacation job turned
 into a career – and I
 found **my vocation.** ”

Thomas Herberger had a wager with his father Eugen. The founder of Herberger Metallwaren insisted that no robots and no lasers would ever be seen on the premises of his factory during his lifetime. Only four years later, his son proved him wrong and won the wager. This simple anecdote illustrates just how fast the Herbergers’ family business has changed in the past few years.

The family has been active in the metalworking industry for more than 50 years. Herberger Metallwaren has grown steadily from its origins as a one-man business to today’s medium-sized company. But, as in the old days, the workshop still smells of oil and metal, sparks fly from the welding benches, and the rhythmical pounding and humming of the machines almost sounds like music. Wherever you go, you can hear the characteristic thudding of security boots on the industrial floor covering. It’s a very busy place. Thomas Herberger can’t complain that they have too little work. On the contrary, they no longer work solely for customers in the surrounding local region but now receive orders from customers all over Bavaria and even from more distant regions.

Not afraid of change

It is relatively easy to pinpoint the date when Herberger Metallwaren went through a major reorientation: the year was 1998 and Thomas Herberger had just turned 18. While still an adolescent, the native Franconian spent a large part of his school vacations and free afternoons in his father’s factory, sorting sheets of gray metal and spray-painting them in numerous bright colors. After his elder brother had chosen to pursue a different career path, it was up to the younger son to decide whether or not join the family business.



For the paterfamilias, this decision was crucial to the future of the company. As Thomas Herberger explains, “At that time, my father was contemplating the purchase of CNC machines for sheet-metal processing, but only on condition that I took responsibility for programming them. That was when I decided to join the family business.” Because unlike the company’s founder, the meanwhile managing director didn’t start out as an apprentice tradesman. He has a degree in mechanical engineering, and admits that he has a particular affinity for computers and software. There are no less than five flickering monitors in his office, and when he’s seated at his desk all you can see of him is his head bent over the keyboard.

Components delivered directly to the box

Two of the monitors are dedicated to the TruPunch 1000 trial. Whenever he has a free moment, Thomas Herberger hurries over to check the latest results – apparently satisfactory. “The machine has more than fulfilled the expectations we had based on the technical data,” he reports. “This is mainly due to the large part removal flap. We specialize in the production of housings and enclosures, which means dealing with large components that until now had to be sorted by hand. The TruPunch 1000 delivers them directly to the box.”

PHOTO: Niels Schubert

The managing director has not yet pronounced his final decision on whether he intends to keep the machine after the end of the trial period. But the chances are good, given that its compact dimensions enable it to be installed in a tight corner of the production hall. “Generally speaking, we could make good use of the TruPunch 1000.” Another option Herberger has yet to decide on is whether to make use of the new machine concept’s key characteristic: that it can be upgraded to a punch laser machine. He is not averse to the idea, given that he already has a TruDisk laser for his TruLaser Cell, and the test machine could be integrated into the existing laser network as a TruMatic 1000 fiber.

Busy bees: When Herberger Metallwaren was first created, it was a one-man business. Today, **43 employees** work around the clock in two shifts for Thomas Herberger.



Ongoing progress with a touch of improvisation

Thomas Herberger intends to continue the collaboration with TRUMPF to assure his company's future. The next major step is digital connectivity. He has been working on this project for two years, day and night, including countless telephone conversations with the TRUMPF Service team.

His strategy increasingly revolves around creating a central control unit for planning and monitoring the installed machinery. To obtain the best possible connectivity and transparency, he has opted for a TruTops Fab solution – once again remaining faithful to TRUMPF. He has thought through every aspect of this project and wants to find an all-round solution. By ensuring the highest possible quality of data at the start of production, he aims to improve the transparency and end-to-end control of the entire process chain and automate many process steps.

Here we have it again – the openness to new ideas that Eugen Herberger appreciates so much in his son. While the company's founder has still not gotten used to the robots, he is obviously proud of his son's achievements and the flourishing company he has helped to develop.

“ The next step is **digital connectivity.** ”



Thomas Herberger and his team place **high demands on the quality** of the components they produce. Their customers know this, hence their continuing trust over many years and even decades.

03

In brief:

TruPunch 1000

The TRUMPF design engineers enjoy working together with test customers like **Herberger Metallwaren**, because they are used to working with TRUMPF machines. The latest addition to the portfolio, the **TruPunch 1000**, is being put through its paces on a daily basis by Thomas Herberger and his team. As well as being the ideal entry-level punching machine for professional users, its novel modular design enables it to be upgraded to a punch laser machine in line with operational requirements.

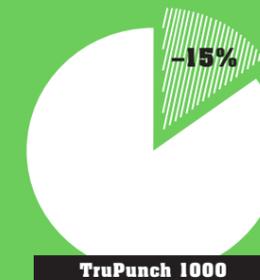


Short & concise

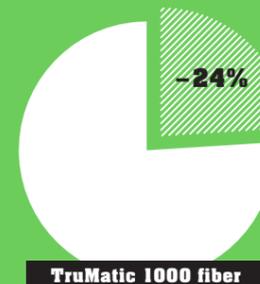
TruPunch 1000



Footprint



The footprint of the TruPunch 1000 is **15% smaller** than that of older comparable machines.



The TruMatic 1000 fiber takes up **24% less** floor space than its predecessor, the TruMatic 3000 fiber.

The customer

Herberger Metallwaren

Managing director: Thomas Herberger
Industriestrasse 18
91083 Baiersdorf, Germany
Phone: +49 9133 2413
info@metallwaren-herberger.de
www.metallwaren-herberger.de

Machinery

- TruPunch 1000
- TruLaser Cell 3000
- TRUMATIC L 3030
- TruMatic 7000
- TruBend 5085
- TRUMABEND V 1300 FMC
- TRUMABEND V 50
- TruMark Station 5000

TRUMPF contact

www.trumpf.info/bw74u2

TruPunch 1000



ECONOMIC PUNCHING TOOL:

The entry-level solution for cost-effective sheet-metal processing.

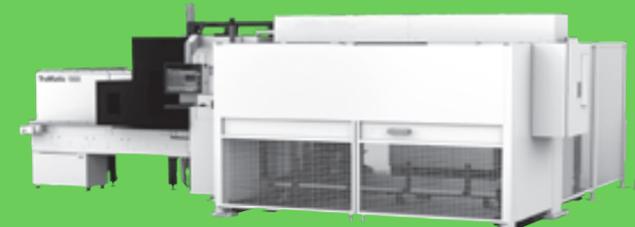
TruMatic 1000 fiber



A SUCCESSFUL DUO:

By combining the punching machine with a 3kW TruDisk solid-state laser, you obtain a punch laser machine, making it possible to process a far wider range of parts.

TruMatic 1000 fiber with SheetMaster Compact



AUTOMATIC SOURCE OF HIGHER REVENUE:

As part of an automated system, ergonomic punching machines and punch laser machines are more productive and cost less to operate.

Conclusion:

The cost savings offered by the new machines make **the transition** to new manufacturing technologies **simpler than ever before.**

Openness in Ditzingen

CAN'T BE DONE? OH YES IT CAN!

With openness and a pioneering spirit, TRUMPF engineers developed the first laser machine that can handle the entire machining process – from raw sheet metal to fully sorted parts. **The TruLaser Center 7030** isn't merely a new iteration, it's a completely new machine – and an extremely efficient one, at that. We spoke with three developers from the team that created this revolutionary machine.

PHOTO: Niels Schubert





Part of the team: Jens Ottnad, Peter Epperlein and Felix Riesenhuber have been supporting the project in recent years.

Felix Riesenhuber, Peter Epperlein and Jens Ottnad were heavily involved in designing, developing and implementing the new TruLaser Center 7030. In an interview, they spoke with us about the highs and lows of the past few years and told us what it takes to develop such a novel product.

How and when did the TruLaser Center 7030 project come about?

Felix Riesenhuber: TRUMPF had long wanted to develop the next generation of laser-cutting machines. The initial idea for the TruLaser Center 7030 emerged in 2012, and the project was officially approved in 2014.

What was so special about the project?

Peter Epperlein: We knew going into it that we would have to question existing development methods if we wanted to achieve a true leap in innovation with this mature technology. That's why we fundamentally shifted our perspective – away from current machine design and toward an unobstructed view of our customers' production tasks.

In other words, you not only developed something new, but you did it in a new way?

Epperlein: Exactly. Of course, it was a brilliant idea that sparked this radical new development. But to achieve overall success we needed lots more ideas, and these had to specifically tackle the problems we were facing. The novel aspect was that all specialist departments worked in parallel and agreed on things among themselves in very short intervals. It was the first time we had applied agile methods across the board in a mechatronics project.

Riesenhuber: We also formulated clear efficiency and process reliability targets for the machine, and used these to assess each development stage.

How did you do that specifically?

Riesenhuber: We had to make productivity measurable, and we had to do it using real parts under real production conditions. To that end, we developed standard sheet layouts that model the range of parts our customers use. Customers from a variety of industries helped us with this by providing several hundred set-up plans, which we then analyzed statistically based on a variety of relevant parameters. The result was a representative production program – the "original standard" by which we

PHOTOS: Niels Schubert

measured productivity, production problems and the impact of those problems. This standard made it possible, for the first time, to model the existing technology and to evaluate new ideas from our customers' real production perspective. And even more importantly, it enabled us to define, in the design phase, the permitted costs of the solution and its performance in the part program. Our firm goal for this was to achieve savings of 15-30 percent in machining costs for our customers, and every solution had to be measured against this goal.



The team of people from the product group, development, purchasing, production, sales, service and project organization departments meets at regular intervals to discuss how **development on the TruLaser Center 7030 is progressing.**

.....
 “ There came a point
 when we knew we were working
 on **something really big.** ”

That sounds like hard work ...

Jens Ottnad: It's fair to say that team effort won out over the lone genius approach of the past. That said, we needed to have geniuses on the team – otherwise we never would have achieved our goal. The development team's creativity was directed at a shared goal, resulting in the success you see here.

And how big was the team?

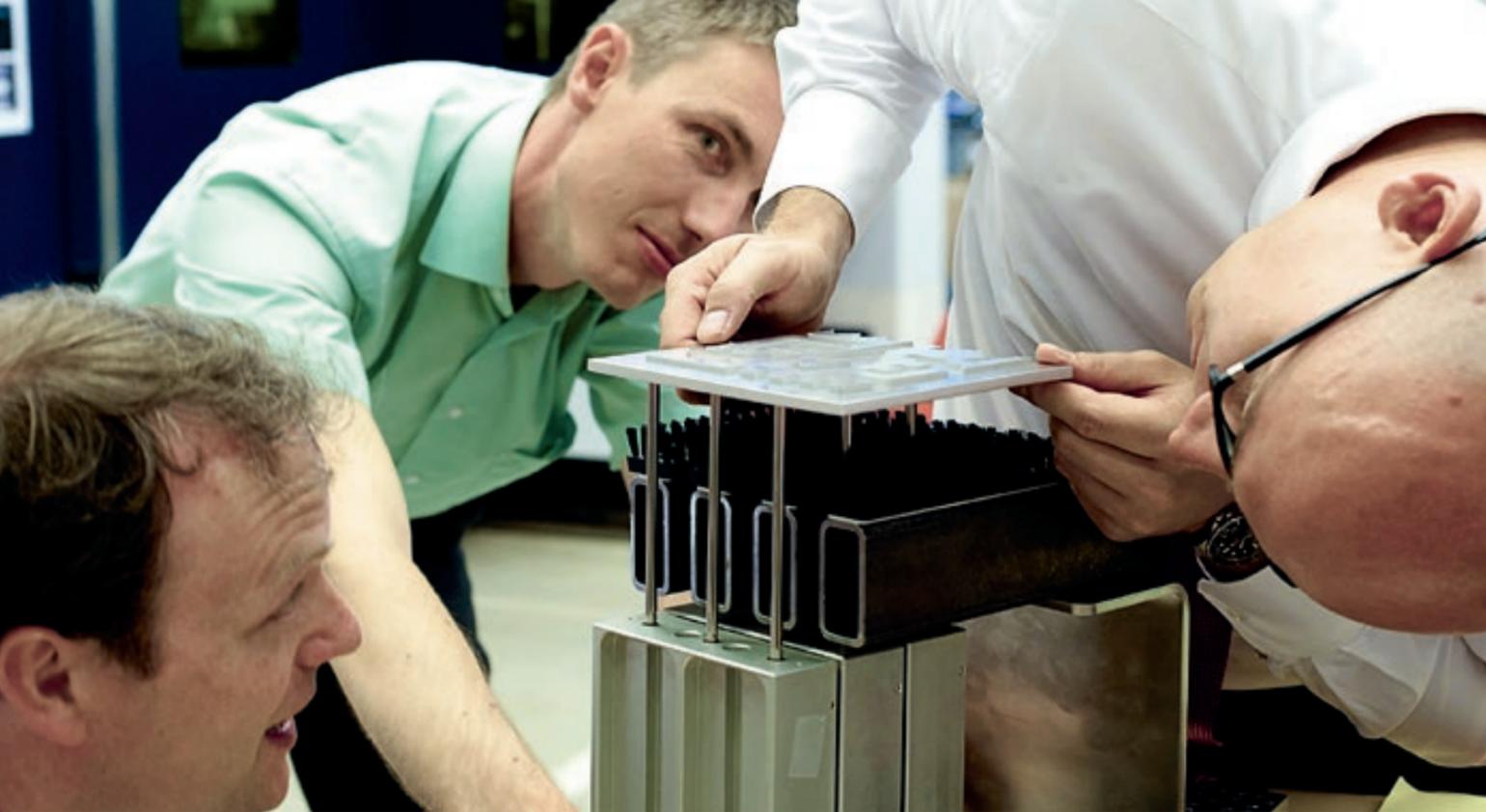
Ottnad: The TruLaser Center 7030 core team is made up of more than 100 employees from the service, sales, product group, development, purchasing, production and project organization

.....
 “ We didn't want to
 accept any compromises; we
 wanted to solve all the problems
 with **laser cutting.** ”

departments. It was only because of this manpower, and because everyone at TRUMPF was fully behind the project, that we were able to turn our ambitious plans into reality. We also had a strong program management that was very effective in coordinating all these different departments to achieve one goal, and in turning an extensive portfolio of individual highly innovative development projects into this marketable product.

Going into the project, did you realize how innovative this machine would be?

Epperlein: Well, the job defined in the technical specifications was clear, really – we essentially had to solve all of our customers' problems and turn the laser-cutting world upside down! Many were skeptical at first, but then when we saw how the first solutions performed when applied to the functional model, and when we discovered we could reliably automate the cutting process for parts of unprecedented complexity, we knew we were working on something really big!



In brief:

TruLaser Center 7030

The new TruLaser Center 7030 is a fully automated manufacturing cell based on a **unique machine concept** that combines **hybrid functions and dynamic processing capabilities**. It ensures reliable sheet-metal processing with minimum operator intervention, thus offering **unbeatable cost advantages**. And yet it occupies no more space than a TruLaser 5030 fiber.

You managed to realize the TruLaser Center 7030 in just two years – an extremely short time for such a herculean task. Did you suffer any setbacks?

Ottnad: We first tried to combine proven processes in new ways, but we quickly realized that this wasn't enough, so we started over again from scratch. We didn't want to accept any compromises. This radical step was difficult in the beginning – and of course there was a lot of pressure. With every additional design cycle, the plans became more and more definite. We broke out of our comfortable routines and were unusual ideas, and we developed completely new technologies whenever the state of the art offered us no solutions

What are the biggest advantages of the TruLaser Center 7030 over conventional laser-cutting machines?

Epperlein: There are essentially three core innovations that make the machine unique. First there's the flat workpiece support with the SmartGate, which adjusts flexibly during the cutting process to widely varying parts, and machines them extremely quickly and reliably. Then there's the SmartLift, with its more than 150 pins, which achieves extraordinary removal forces of up to one ton of parts from the scrap skeleton. And to complete the picture, there's the SortMaster Speed, which absorbs these forces in a controlled manner and, with its more than 2,500 mini suction devices, quickly and reliably unloads all kinds of parts, from those with delicate contours to those with large surface areas. This makes the TruLaser Center 7030 the first 2D laser machine that can handle – and automate – the entire machining process. From loading and cutting to unloading and sorting finished parts, everything is integrated in a single machine, and the program is largely automated.

Was there an "aha moment" during the development phase?

Ottnad: It was overwhelming just how much creativity, selfless commitment and team spirit people's enthusiasm for the project awakened. The excitement didn't let up until the machine cut a piece of sheet metal for the first time. That filled me with great pride.

Riesenhuber: The existing idea behind the flatbed laser machine hadn't been modified in more than 20 years. We're quite certain that this machine will change the world of laser machining forever!

.....
" **It's a proud moment**
when the machine
performs its first cut. "
.....



PHOTOS: Niels Schubert

Short & concise

TruLaser Center 7030

01

LOAD RAW SHEET

The LoadMaster Center transfers each sheet from the loading carriage to the brush table, and clamps it to the workpiece support.

02

CUT PARTS

While the workpiece support moves the sheet forward on the Y-axis, the cutting unit processes it at high speed along the X-axis.

02b

UNLOAD AND STACK PARTS

An arrangement of pins presses the parts out of the scrap skeleton, which are picked up individually by suction pads, sorted, and stacked in the parts deposit.

04

UNLOAD PARTS

In parallel with the cutting process, the machine unloads the parts and sorts them into bins or onto pallets, ready for further processing.

02a

EJECT CUT PARTS INTO BOX

The flexible SmartGate ejection slot reliably removes small parts, slugs and cutting waste: its 30° angle prevents the scrap skeleton from getting stuck.

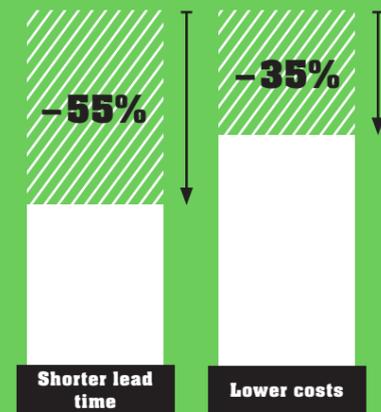
03

REMOVE SHEET SKELETON

The workpiece support transfers the scrap skeleton to the cart.

Economical in every way

When compared with an automated 6kW solid-state laser machine, the TruLaser Center 7030 offers clear benefits: for each sheet processed, lead time can be reduced by up to 55 percent and costs by 35 percent.



* From raw sheet metal to sorted parts ready for further processing

What customers stand to benefit from the TruLaser Center 7030?

All customers wishing to automate their processes can benefit from the new TruLaser Center 7030, which can cut sheets up to 12 millimeters thick. It is a universal tool not restricted to thin-sheet applications, but in either case its full economic benefit is realized in shift operation (1.5 or more shifts per day).

TECHNICAL DATA

Working area

Nominal working area X-axis	mm	3,000
Nominal working area Y-axis	mm	1,500
Nominal working area Z-axis	mm	120
Max. workpiece weight	kg	120

Dimensions and weight (approximate)

Length	mm	10,100
Width with/without loading carriage	mm	6,500/10,000
Height	mm	3,050
Weight	kg	31,800

Automated unloading

Max. part size via SmartGate	mm	160 x 160
Max part size via SortMaster Speed	mm	2,000 x 1,500
Min. part size via SmartGate	mm	30 x 30
Min. part size via SortMaster Speed	mm	90 x 60

TRUMPF contact

www.trumpf.info/vgkbo0

BIZ+ SHORT CUTS

Interesting, fascinating & surprising facts.



Applied physics

The **Deutsches Museum in Munich** is the biggest technology and natural sciences museum in the world. Since May 2016, visitors have been able to get hands on in a new **workshop for experimental physics**. Here, a working TRUMPF TruMark 1110 marking laser showcases the laser as a tool, hopefully leaving visitors big and small inspired with the possibilities of this focused light.



Show of the future

For the second time in a row, in 2016 TRUMPF is once again involved as a partner for the **CODE_n** global innovation platform. CODE_n provides new companies with the opportunity to present their **digital business models** and network with established partners from industry, science and research. The main gathering of the CODE_n community was the inaugural new. New Festival, held in the **Karlsruhe Center for Art and Media (ZKM)**, September 20-22. As sponsor of the Photonics 4.0 cluster, TRUMPF focuses primarily on start-ups looking for smart new ways to use light, for instance in laser systems, image processing or optical sensors.

► www.code-n.org



First violin

Model mechanic Annabelle Pichl plays first violin in the truest sense of the phrase – her **final project to finish her industrial mechanics training at TRUMPF** is probably the first violin to be made out of sheet metal. The body of the violin is made entirely of stainless steel, while the neck was milled by apprentice Nick Rampp. The chinrest is plastic and was 3D-printed in the training workshop. All in all, superb teamwork sounds good – and shows off the versatility of sheet metal.



Experiencing Industry 4.0

The TRUMPF Group's biggest demonstration center worldwide, located at its headquarters in Ditzingen, has a new visitor center: the ground and upper floors of the entrance area are now home to the **TruConnect Forum**. Here, visitors and customers can freely wander the interactive exhibition space, which brings to life various aspects of Industry 4.0. Multiple media walls showcase the **opportunities and prospects presented by connected manufacturing**, with interactive exhibits to show companies how they can implement it today.

PHOTOS: Deutsches Museum, Munich; Archiv, Daniel Stauch



Fantastic!

TRUMPF's 2014/15 annual report, "Achtsam – Attentive" has been awarded the coveted **Red Dot Award 2016**. This is a great honor: the design competition is one of the most prestigious worldwide and the annual report was competing against submissions from 46 countries. The 26 members of the jury were particularly impressed by the excellent implementation of the concept: six individual and varied reports, which communicated TRUMPF's **corporate values** of strong roots, clear entrepreneurial spirit and a forward-looking mindset. If you would like to read its successor, "Filigran – Filigree," please visit:

► www.trumpf.info/kebmyo



Sales up 3 percent

On June 30, 2016, the TRUMPF Group's fiscal year 2015/16 drew to a satisfactory close with an increase in sales of 3 percent for the high-tech company. Sales totaled 2.8 billion euros, compared to 2.7 billion euros in the previous year. At 2.8 billion euros, the order intake was about the same as the previous year. The fiscal year results were due to general factors such as the weakening economic situation in China and Brazil, sanctions against Russia and the strength of the Swiss franc. The increase in sales can be attributed to **positive developments in regional markets such as Spain and France**. In both countries, TRUMPF enjoyed two-digit growth in sales. In Germany,

sales rose around 5 percent to just under 600 million euros. There were also significant increases in sales in Japan and the Asia-Pacific region. This was in contrast to China, where economic growth has slowed and sales were down around 2 percent on the previous year.



The future in 25,400 square meters

In order to meet the increasing demand for 2D laser machines and automation components in China, TRUMPF is expanding its site in Yangzhou. By March 2017, the site will receive two new production and assembly areas as well as a cafeteria and a demonstration center with offices and training spaces. This will add a total of 25,400 square meters to the site, which is located 300 kilometers west of Shanghai.

PERFORMANCE COCKPIT: MACHINES LAID BARE

These days, all sheet metal processing machines ought to be quick and efficient – at least in theory! But getting to the bottom of how they actually perform in everyday manufacturing practice is a much more difficult question. Gathering and analyzing performance metrics is most often an unwieldy, expensive and time consuming manual process. The solution is the TRUMPF Performance Cockpit.

The clever thing about this solution is that users can see all the optimization options at a glance. Data is gathered, analyzed and made available online via an individually configurable dashboard, which provides a constant overview of all performance indicators. The data is hosted by TRUMPF subsidiary AXOOM. Since the Performance Cockpit is web based, you can use it anywhere you go. It will work on any device, from a PC to your tablet or smartphone – and can also be used outside of your company's IT network. This allows it to provide a high degree of transparency with regard to machine productivity, materials, tools and manufacturing programs.



went to waste, and so analyze and optimize the usage of materials. There is increased transparency in tool usage, too. For instance, the software can determine the number of hits performed by a punching tool in a given period. This makes it possible to track usage and plan the exchange of the tool when necessary. On top of this, the solution lets users monitor all planned manufacturing programs for disruptions and resolve any problems quickly.

Safety first!

To install the software – a product from TRUMPF's TruConnect range – there is no need for an on-site visit from a technician. Instead, TRUMPF performs a one-off installation of the necessary connector kit on the machine via a remote connection. All the user needs is an internet connection and an up-to-date browser. Once the installation is complete, users can log in to their cockpit and begin their analysis. The whole process is fast and secure, since TRUMPF and AXOOM handle all data with the utmost confidentiality and store it in accordance with the latest security standards. Customers have full control over their data at all times, and it is released only to TRUMPF and AXOOM. The Performance Cockpit is available in German and English, and provides transparency for the following machines:

TruLaser 3000/3000 fiber, 5000/5000 fiber, 7000/8000

TruPunch 1000, 2000, 3000, 5000

TruMatic 6000/6000 fiber, 7000

“ By using the **Performance Cockpit**, companies can quickly see whether optimization measures have in fact boosted productivity and where they can make further improvements. ”

Daniel Müller, overall project manager for the Performance Cockpit

Everything, everywhere, all the time

Wherever they happen to find themselves, sheet metal machine operators can see data such as when the machine was running as well as any disruptions or downtimes. This can be analyzed either for the machine in general, for individual shifts or for a specified time period. Daniel Müller, overall project manager for the Performance Cockpit, says: “By using the Performance Cockpit, companies can quickly see whether optimization measures have in fact boosted productivity and where they can make further improvements.” The Performance Cockpit also provides information and statistics about material usage. A single click supplies the type and thickness of the material used, allowing for better planning of the next order of materials. Users can also see how much of each type of material

IT PAYS TO REGRIND!

“ For the best edges and component quality, you really do need **to regrind your tools regularly.** ”

Philipp Herwerth, Head of Sales Punching Tools International

Punching tools that are reground as a precaution last longer and deliver optimum results.

As a rule, uncoated tools should be reground after 60,000 to 80,000 hits, and coated ones after 120,000 hits. There are several indications when a tool needs to be reground: the radius of the cutting edge is between 0.1 and 0.25 mm; the tool is noticeably loud; or there are unusually large burrs on the sheet metal.

The earlier a tool is reground, the less the regrind amount, since there is less wear on the tool. This extends the punch's service life accordingly.

Regrinding by 0.1 mm after 60,000 hits:	Regrinding by 0.15 mm after 80,000 hits:
60,000 x 65 regrinding cycles (regrinding length of punch 6.5 mm) ▶ 3.9 million bits	80,000 x 43 regrinding cycles (regrinding length of punch 6.5 mm) ▶ 3.4 million bits
Regrinding early delivers 500,000 more bits.	



QuickSharp is a fully automated tool grinding device that allows users to regrind punching tools easily and safely. It also offers a function to automatically transfer the new tool length into the integrated tool management. This minimizes time spent on data administration.

Regrinding takes place while the machine is in operation. A smart universal clamping device allows for the regrinding of punching pins as well as MultiTool punch and die inserts. Meanwhile a special adapter also makes it possible to regrind MultiShear punches. Even beveled punches such as the whisper or roof punches can be easily processed with the help of a clamping device. Once the automatic regrinding process is complete, the punch is immediately ready for action. Operation of the process is easy and intuitive thanks to clear controls and the digital display.

Find out how QuickSharp works here:
www.trumpf.info/1wmxz0

QUALITY – FOR YEARS AND YEARS

Original replacement parts by TRUMPF meet the strictest quality standards. With Xchange, TRUMPF even goes beyond the warranty to guarantee the quality of original replacement parts.

TRUMPF original replacement parts stand for quality – right down to the smallest detail. That’s why when customers need to replace a part, Xchange provides them with vouchers for a large percentage of the price, even long after the original purchase.

Depending on the part in question, the period covered by Xchange can be four or even ten years. Once the customer has sent in the part to be replaced and it



has been fully examined, they receive a voucher for the replacement part. The amount of the voucher depends on the age of the part to be replaced.

Xchange covers more than 5,000 high-quality original replacement parts. Customers can see whether it applies simply by looking for the Xchange logo on the packaging or consulting the delivery paperwork.



EXPERIENCING THE SMART FACTORY



.....
“ We want to take our customers on a journey through the smart factory and provide them with ideas, inspiration and support. The **Smart Factory Experience** gives them the opportunity to build on the first impressions gained at trade fairs. It is a particularly good way to get groups to explore the topic together. ”
.....

Julian Elsässer, consultant for connected industry

TruConnect is TRUMPF’s technology for connected manufacturing, combining the precision of TRUMPF machines with the logic of IT. No two solutions are the same, since the individual components are specially combined for each individual customer. As a result, each company gets its own personalized smart factory. Users benefit from a modular solution that provides them with an efficient way to structure and optimize their processes.

In order to give interested customers a more thorough understanding of the benefits of digital connectivity, Julian Elsässer and his colleagues from TRUMPF Service offer the “Smart Factory Experience” at TRUMPF in Ditzingen. This is a half-day event in which customers see what is meant by Industry 4.0 and how TruConnect can help them. It also gives them a first-hand insight into how TRUMPF has implemented Industry 4.0 solutions in its own manufacturing operations.

The program features a presentation on Industry 4.0, a guided tour of sheet metal manufacturing in Ditzingen and an expert talk with the opportunity for questions and discussion afterwards.

Those interested in the Smart Factory Experience should contact truconnect.consulting@de.trumpf.com

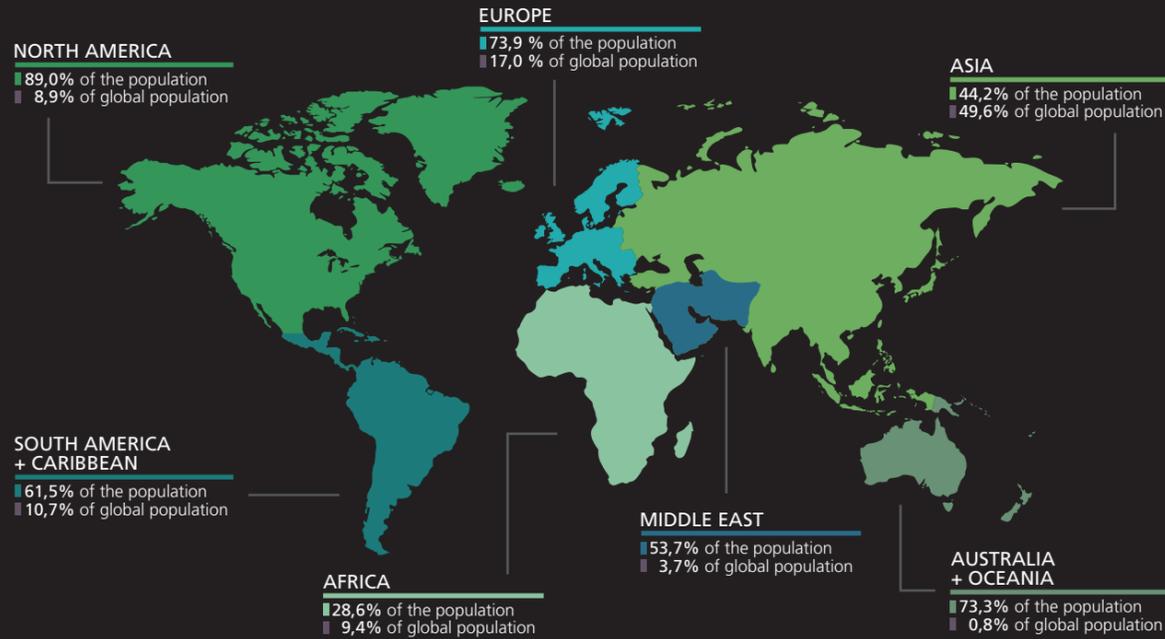
Aha!
**FASTER.
 BIGGER.
 MORE DIGITALIZED.**

Digitalization touches every area of our lives. It has already transformed our private communications, and now it is getting ready to take industry by storm. Manufacturing processes are becoming more efficient and

transparent. New business models are springing into being. And often we don't even see just how fast this is happening. With the world's population heading for ten billion, the number of active internet users is growing by

the day. Every passing second brings a stream of data, social media feeds and digital traffic. This infographic supplies you with all the most exciting and impressive numbers, data and facts. Prepare to be amazed and informed.

World wide web – the internet is everywhere



For the 7.45 billion people who currently live on the planet, the internet is becoming more and more important. The world's population will be booming over the coming years, and so will internet use: in June 2016, more than half the world's people were online. The distri-

bution of users is not without its surprises: though the proportion of internet users in North America is very high, standing at 89 percent, this amounts to only 9 percent of total users. Asia has proportionally fewer users, yet these account for almost half of global users.



In June 2016 there were 3.6 billion people using the internet. That's nearly half of the current global population – and as many people as there were on the planet in 1970.

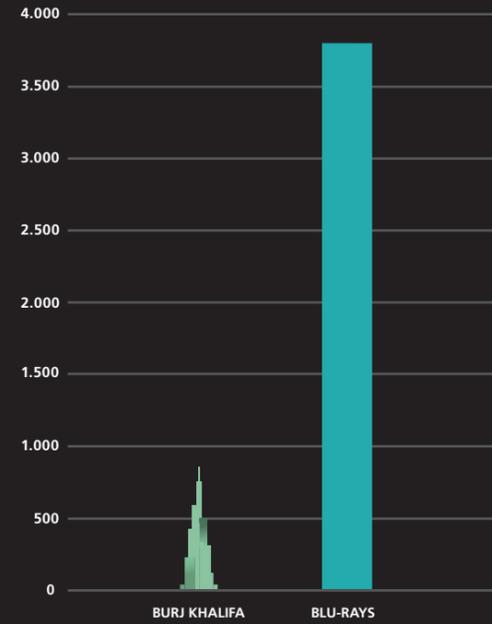
ILLUSTRATION: Florentin Zimber

Big data, small buildings

Every day, we generate vast quantities of data online – more than 3 billion gigabytes to be exact. That sounds pretty impressive in itself. But if you were to save this mountain of data onto Blu-Ray discs and stack them one on top of the

other, you would get a tower 3,836.16 meters tall. To put this into perspective, the Burj Khalifa in Dubai, currently the tallest building in the world, is 828 meters tall.

* Based on XL Blu-Rays with a storage capacity of 128 GB.



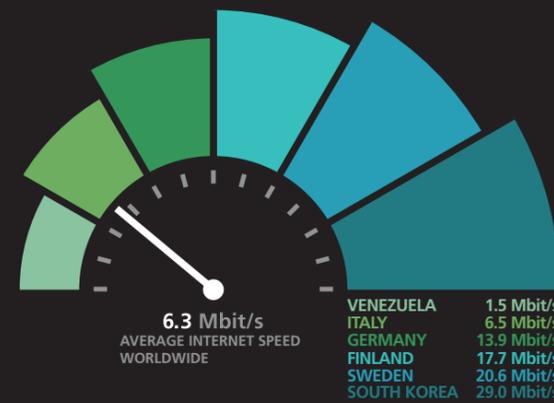
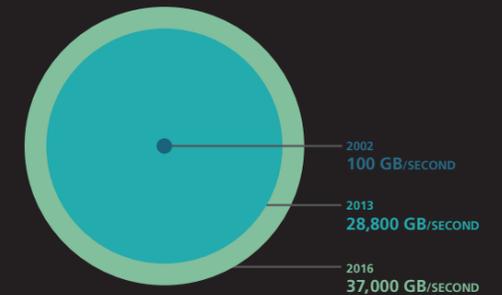
90%

of the data existing today worldwide was created in the last **2 years**.

When days become seconds

Today it hardly seems credible, but just 25 years ago daily web traffic amounted to no more than 100 gigabytes, which is about the maximum storage of a single Blu-Ray disc. Back then, that was a lot of data. Now, though, we generate unimaginable quantities of data each

and every second. Thanks to connectivity and rapid availability, digital traffic has reached a whole new level. These days, values are given per second – with current traffic standing at a staggering 37,000 gigabytes per second, far far more than a Blu-Ray can handle.



Vrroooam!

Every day, huge quantities of data are sent over the internet, supported by fast internet connections. To see just how fast the internet has become, we need only look back at its beginnings: in 1997, the speed of the average internet connection was 56 kilobits. Now the global average is 6.3 megabits per second. Compared to this global average, the speed of internet connections in Germany – 13.9 megabits per second – is

good but still offers room for improvement. The fastest internet speeds in the world are in South Korea, at 29 megabits per second. In the future, we can expect connection speeds to increase still further with the help of technologies such as fiber optic cabling, and it will surely not be long before we see connection speeds of several gigabits per second.

3D printing is booming – and it's no longer just about making plastic action figures. Industry is also reaping serious benefits from the new technology, which is also commonly known as **additive manufacturing**. This alternative moniker often refers to a rather different process, however, which is based around two main ingredients: a laser, and a **fine metal powder** that has the peculiar effect of seeming to be neither liquid nor solid!

A qualified chemist, Joachim Behm spent 23 years working for a powder manufacturer in charge of laboratory facilities and quality management. Just under a year ago, he decided to move to TRUMPF, where he is now responsible for metal powder, overseeing each and every step up to and including powder processing in TruPrint machines. He forms part of what is known as the materials team, a group of experts who focus on locating and acquiring the right kinds of powder. Their work involves numerous lab tests to determine each powder's grain size, grain-size distribution, and flowability. Behm and his colleagues also run test build jobs to analyze the various metal powders, because it's imperative that they fulfill their required function even in shapes that were almost unimaginable before now. In fact, the way in which 3D printing allows us to manufacture objects of almost any geometry and complexity is one of its biggest strengths – ultimately we are limited more by our imaginations than the technology itself.



Making everything out of nothing

Additive manufacturing (AM) means making a completely new part from scratch, using a laser to build up metal powder layer by layer to form the required shape. The data comes straight from 3D CAD software, and the model can be whatever shape you choose. "This process of gradually adding new layers to the top of the powder bed is also referred to as laser metal fusion, or LMF," says Behm. "It's a useful alternative to more conventional methods, providing solutions for multiple industries including tool and die making, automotive, dental and medical devices, and even the aerospace sector." More than ten years have passed since TRUMPF developed its first machine based on this technology. "It's fair to say that we were pioneers in this field." It soon became clear that TRUMPF was ahead of its time, however. Demand was still too low, leading the company to temporarily halt development in 2005. In 2014, the decision was taken to revive LMF technology in the form of an innovative department in its own right, which has been growing steadily ever since. "After so many years working at one company, I was very excited by the idea of helping to shape a new project from scratch in a different kind of working environment," says the powder specialist.



.....
 “ We’re actively
 creating **the future**
 of the **3D printer.** ”

**THE RIGHT
 POWDER
 FOR ANY
 OCCASION**

05
 FUTURE

.....
“ Laser metal fusion
 has made it easy
 for us to do things that
 we previously thought
 were impossible. ”

As well as working on a new machine, which will be celebrating its launch in November, and numerous other development topics, the AM department also focuses on powder sales and marketing. Selecting from a wide variety of powder containers stacked on storage shelves and in cupboards, the members of the materials team test the contents of each container using the facilities in TRUMPF's in-house powder laboratory. To ensure they analyze each powder's full range of properties, the team even prints test parts, cuts them up and examines them under the microscope, checking aspects such as porosity and mass. Once all the tests have been run, machine experts define suitable parameters for each powder. These give an indication of how to coax the optimum behavior from each powder by adjusting machine settings such as laser output and process speed.

The importance of flow

TRUMPF launched its first standard powders on September 1, selling them to customers in a wide range of industries. Combined with the right parameters and a suitable TruPrint machine, these powders can be used to create the parts of the future. Behm sees this technology as a huge step forward: “Laser metal fusion has made it easy for us to do things that we previously thought were impossible. Whole new ways of thinking are emerging – and that's exactly the kind of openness we need.”



PHOTOS: Niels Schubert

In principle, Behm says, the possibilities offered by the alloys you can produce from the 50-plus naturally occurring metals on the periodic table are virtually endless. The most important materials for 3D printing are titanium and titanium-aluminum alloys. That's because they offer a combination of high strength and low weight, which is highly advantageous for the aerospace industry. In the realm of medical devices, dental bridges are often made from cobalt-chrome alloys, while power plants and turbines make use of nickel alloys, since these resist corrosion up to a temperature of 600 degrees. Other commonly used metals include stainless steel, tool steel, and sometimes even gold. Behm also reveals that he has a personal favorite in the powder kingdom: Inconel 718. “Because it flows so well!”

3D printing is transferring into production

In the past, 3D printing of metal parts was primarily used in rapid prototyping because it took only a few days to translate an idea into a finished part. But now the focus is firmly on full-scale production. The method is particularly suitable for short-run batches because additive manufacturing needs no specific tools. Instead, the same machine can print anything at all using different programs. That makes this technology particularly lucrative. What's more, AM allows users to construct highly complex parts with whatever internal channels or hollow spaces they choose. No extra costs are involved because the material is applied only where it is actually needed. “The more hollow spaces you have, the cheaper it gets, because you use less powder,” says Behm.

The material team's goal for the months and years ahead is to launch many more metal powders that are perfectly adapted to LMF processes on TRUMPF machines. There is certainly no shortage of passion and enthusiasm, and working with powder is clearly more than just a job to Behm: “It really is an amazing feeling to see the machine create something totally new from powders that we have studied and scrutinized in such detail!”



Innovations, technologies & future trends.



Automatic thread creation

With the **thread technology package**, the TruLaser Tube 7000 can now automatically create threads in tubes using a numerically controlled spindle and a tool changer near the laser cutting head. The new option enables friction drilling and chipless thread forming in thin wall thicknesses, as well as thread cutting in thicker wall thicknesses, rendering additional process steps on other machines unnecessary. The thread technology package thus minimizes costly part handling and makes the production process even **faster and more reliable**.



The new TruLaser Weld 5000 laser welding cell

The new **TruLaser Weld 5000** makes it easier than ever to get started with laser welding. The new FusionLine laser welding technology provides start-up assistance, making it possible to compensate for inaccuracies in components during the welding process and even to close **gaps of up to 1 mm** in width. This new method is based on a perfectly coordinated combination of laser, beam guidance, optics and a welding wire supply. The machine also has a movable nozzle for shielding gas control, which speeds up the welding process and reduces the expense of

programming and clamping technology – and it's easier to operate, too. For instance, the status monitor shows the operator the key figures from the current production run and a live image of the machine interior. For the exterior, TRUMPF opted for the characteristic cube design, including the status lights that already proved a success in the TruLaser Cell. These and other advantages are described here:

► www.trumpf.info/n581cz

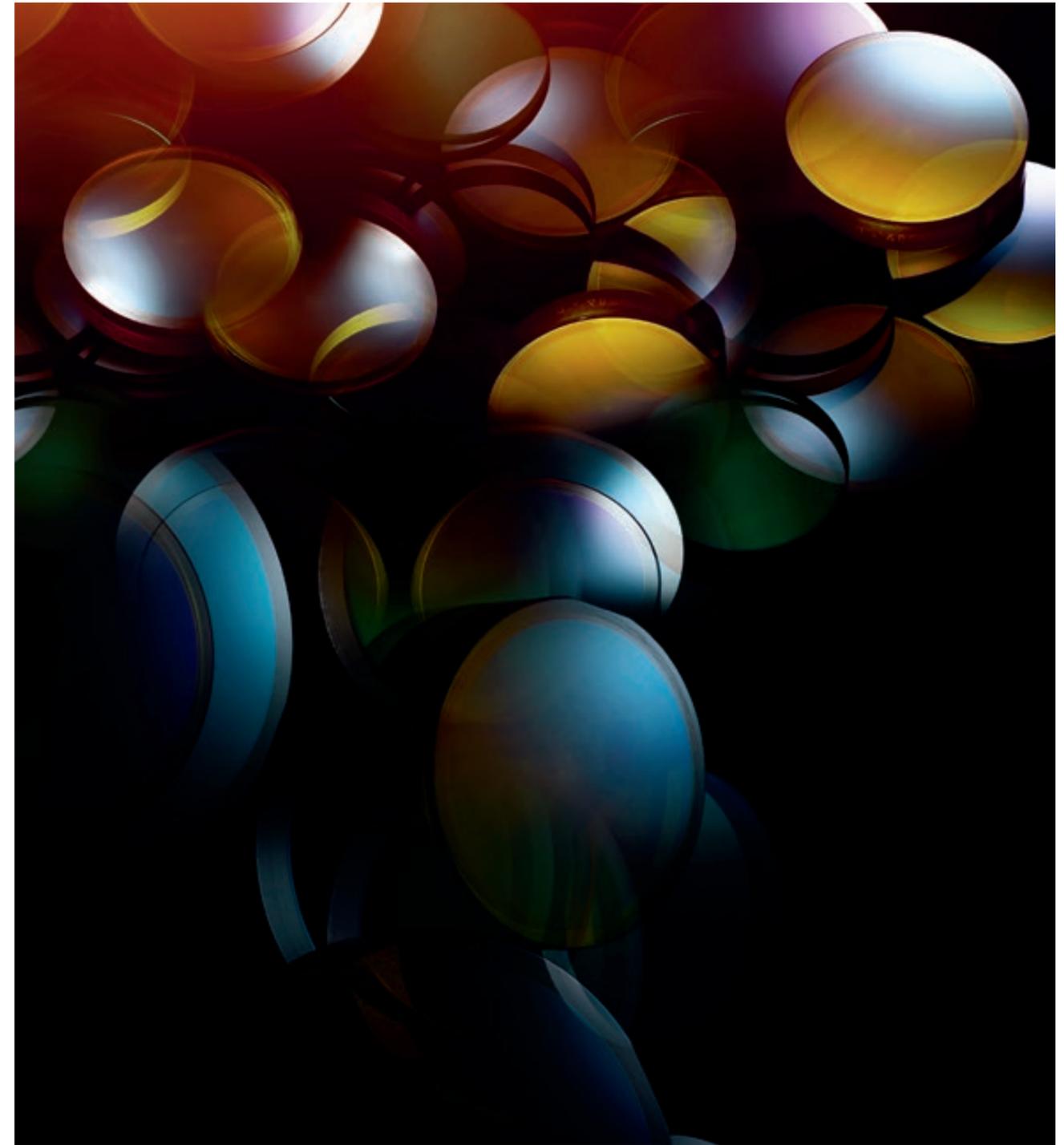


Maximum surface quality

The new, non-imprinting TRUMPF **MultiTool** promises even better surface quality than the previous MultiTool. By holding back inactive punches, it delivers imprint-free punching – even with thin sheets. What's more, the blanking die and the specially coated stripper, designed for the individual punch allocation, offer **flawless results** on both the upper and lower sheet surfaces.

PHOTO: Christian Stoll

pARTgallery



Technology transformed into art. In each issue of TRUe, we will be showcasing selected parts in a whole new light. This time, a **high-pressure ZnSe lens** gets a makeover. Photographer **Christian Stoll** has taken the TRUMPF replacement part out of its familiar environment and given it a whole new context.

OPENNESS

Crackpots and creativity

Open yourself up too much, says my neighbor, and you'll end up embarking on the craziest schemes. That's one of the unshakable tenets he lives by, and he rolls it out at every single one of our backyard barbecues. He believes that a constant stream of new ideas and influences can make people a bit, well, dippy. His favorite example is our neighbor from across the street. We see him tinkering in his garage whenever he has a free moment, and he never tires of coming up with new things. Recently he popped a solar panel on his roof, and now he has an electric three-wheeler parked in front of his garage. It looks a bit like a soapbox car for adults, but was probably a lot more expensive.

I envy his almost childlike curiosity. Being open to things is the key to learning, while the attitude that "what we don't know already can't be worth knowing" is a worrying precursor to mental calcification. However, curiosity also tends to make people fall flat on their face, because not everything new and exciting is necessarily good!

For example, our neighbor from across the way was recently left high and dry by his electric speed machine when they closed the local ring road and its battery couldn't cope with the unexpectedly long detour. He arrived home on foot, soaked in sweat and thoroughly resigned to the gloating of his neighbors. But however much we make fun of him, he insists that he hasn't failed – he simply tried something out that didn't quite work.

That's his version of a quote from Benjamin Franklin, the remarkable innovator who we remember not only for the American Declaration of Independence, but also for inventions including the lightning rod, bifocals, and the flexible urinary catheter. Yet he is also known for the Franklin stove, a novel and supposedly more efficient fireplace that, instead of producing the extra heat he hoped for, actually racked up significant financial losses.

Failure goes hand in hand with openness, and it seems to hit particularly hard just when we are most confident about what we're doing. In his book *Stumbling on Happiness*, Harvard psychologist Daniel Gilbert explains the principal reason why life never goes the way we expect it to: "We tend to imagine the future as being like the present with an unexpected twist. That's why the future as we imagine it invariably looks like a slightly distorted version of today."

As a rule, the future does not conform to our expectations: we simply don't know what lies in store for us. In terms of the accuracy of our future decisions, we are like sharpshooters firing at fast-moving targets with a gun that is stuck in one position, constantly astonished by how rarely we hit the mark.

These insights give rise to two very different conclusions. Either you entrench yourself in the stubborn idea that "everything used to be so much better", or you keep an open mind to embrace all the exciting, new, superfluous, off-the-wall and fascinating things that we will encounter tomorrow, but that we can't even imagine right now.

Sometimes that takes a healthy dose of courage. But it's almost always rewarded with new discoveries.

COURAGE



TRUe #01

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