

**The energy revolution will only succeed with the right finish**

Perfection for wind turbines: Berthiez turning and grinding machines from Starrag S.A.S. in Saint-Étienne (France)

**"We play in the champions' league every day"**

Porsche Werkzeugbau GmbH produces with two large Starrag HSC machining centres Droop+Rein FOGS

**Off-the-shelf medical instruments**

Tschida Medical Solutions' entry into high-precision manufacturing with Bumotec s191



**Starrag  
Aerospace  
Competence  
Center**

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08. – 11.03.2022  
**SIMODEC**  
La Roche-sur-Foron  
(France)

17. – 21.03.2022  
**T.Gold**  
Vicenza (Italy)

04. – 08.04.2022  
**MACH**  
Birmingham (UK)

05. – 08.04.2022  
**SIAMS**  
Moutier  
(Switzerland)

11. – 15.04.2022  
**CCMT**  
Shanghai (China)

17. – 20.05.2022  
**Global Industrie**  
Paris (France)

14. – 16.06.2022  
**OMTEC**  
Chicago (USA)

14. – 17.06.2022  
**EPHJ**  
Geneva  
(Switzerland)

15. – 16.06.2022  
**GTMA**  
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18. – 22.07.2022  
**Airshow**  
**Farnborough** (UK)

12. – 17.09.2022  
**IMTS**  
Chicago (USA)

13. – 17.09.2022  
**AMB**  
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27. – 30.09.2022  
**MICRONORA**  
Besançon (France)

04. – 07.10.2022  
**MSV**  
Brno (Czech)

12. – 15.10.2022  
**BIMU**  
Milano (Italy)

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Dr Christian Walti  
CEO of Starrag Group

### Dear reader,

Is it the same for you? At the moment, I am enjoying every journey, whether I'm travelling for work or pleasure, because no matter how perfect online events are, it cannot replace the in-person experience. Therefore, I am now inviting you on a tour of the Starrag world (the stops on our journey can be found in the current issue of our customer magazine, your personal tour guide).

We will begin at the site in Rorschacherberg, Switzerland, where you will find out about our most significant investment in the future: Marcel Capeder, Team Leader at the expanded Starrag Training Center, who explains how we are overcoming the shortage of skilled workers with a restructured and revised training programme. We see the centre as a school of life that enables its students to think and work in a solution-oriented, entrepreneurial and responsible manner as part of a team.

The aim is to help them develop into specialists that work holistically. We will encounter typical examples of this further south in Vuadens, where a solution-oriented team have developed the top-of-the-range Bumotec s191 model into the equally versatile Bumotec 191<sup>neo</sup> mill/turn centre, which is designed to surmount the challenges of digital transformation.

However, Starrag now has something particularly special to offer to our most talented students at our school of life: a workstation in the newly founded "Aerospace Competence Center", which is located at the Rorschacherberg site and now incorporates the group's expertise on producing the turbines and structural components of aircrafts.

At Starrag S.A.S. in Saint-Étienne, France, a completely different type of teamwork was required to assemble a disassembled Berthiez grinding machine in distant China and commission it by the deadline. Due to the COVID-19 travel ban, Starrag China took over the task – with special remote support from the French grinding experts.

Grinding quality is also a priority for Porsche Werkzeugbau in Germany's Erzgebirge region: The Porsche subsidiary swears by its new Droop+Rein machine duo, which is used to manufacture pressing tools for moulding skin parts of vehicle bodies extremely quickly, reliably and with class-A surface quality.

In contrast, for Enrico Danz in the German region of South Thuringia, everything depends on precision: The production manager of the Stahlwille die forge ordered a high-precision Starrag Heckert H55; the use of this machining centre in a forge, will without doubt astound a number of production experts. You will discover why, after you learn about the Gyro Gearloose of the die forging sector and the large pliers that were manufactured on the Heckert with "tangible" success.

His products will only interest you in an emergency: Surgical mechanic Peter Tschida from the district of Tuttlingen, Germany, manufactures medical instruments on a Bumotec s191 high-precision mill/turn centre. Read the exciting story of an inventor who, together with his sons Florian and Maximilian, first had to learn the high tech of high-precision machining.

I hope that this brief tour has made you curious about the world of Starrag and inspired you to read the Star issue 01-2022.

Happy reading!

Christian Walti



# Investing in the future

## **Starrag doubles its training capacity at the Rorschacherberg site**

Starrag AG is expanding the training centre at its headquarters in Rorschacherberg, Switzerland with double the space, additional trainers and broader training expertise. The goal is to offer optimised vocational training for our own trainees as well as for learners from all over the region. In this way, Starrag is addressing current developments in the labour market – especially the shortage of skilled workers.

Marcel Capeder, Team Leader at the Starrag Training Center, emphasises: "With our optimised training programme, we primarily want to inspire young people to explore technical careers and pass on the highly technical skills that our company is known for." He has no doubt that this programme will succeed, because it is built upon a strong foundation. Starrag AG – the largest employer in the municipality of Rorschacherberg (canton of St. Gallen) – is a major manufacturing company in the surrounding region. Even if not everyone is familiar with the company thus far, watching the chips fly on our machines and seeing the finished high-precision parts usually gets the young people interested in our training programme.

Starrag AG currently has 25 trainees. Most of them are being trained as poly-mechanics and design engineers, but we also offer training for computer scientists, logistics specialists, automation specialists and business people. "This is a considerable offering given that around 200

workers are employed at the headquarters in total", says Sasa Colic, Head of Group Human Resources at Starrag. Sasa Colic and other managers at the Starrag Group consider the training programme to be very important, stating "our most valuable asset is competent,

**"By reorganising  
the programme,  
we are creating the  
required structure  
for the vocational  
training reform that is  
currently in progress  
and will take effect  
in two years."**

**Marcel Capeder**  
Team Leader at the  
Starrag Training Center

motivated employees. By providing the right basic training, we are securing the future of the next generation and therefore the future of our company".

### **Green light for investment**

Due to the growing shortage of skilled workers in the labour market which has been prevalent for a number of years now, the plans to expand the training centre at the Rorschacherberg site quickly received the necessary support from the Executive Board. And Marcel Capeder adds another good reason for the expansion: "By reorganising the programme, we are creating the required structure for the vocational training reform that is currently in progress and will take effect in two years". Since he himself is working as part of various committees to tackle the reform of the eight basic technical vocational training courses of the MEM industry (mechanical, electrical and metal industry), he knows exactly what matters: "A core element is modularising job descriptions, which are also reflected in the training."

For Starrag, the expanded training centre not only creates optimised training conditions for its own employees. It is also intended to support other companies in the region with vocational training – in addition to external training centres Swissmechanic in St. Gallen and LIBS in Heerbrugg. Therefore, Starrag is building a broad portfolio that includes basic courses and inter-company courses as well as supplementary and refresher courses. "Following our expansion and with two additional vocational trainers who joined our team, we now have the expertise in the areas of planning, manufacturing, assembly and the joined technology house."

The new training centre is extended over two floors, with the additional space accommodating welding and automation workplaces as well as manual work stations.



As an example, there are flexible designed training walls that can be used to provide trainings on the logic of PLC controllers using pneumatic installations. Existing CNC as well as conventional machinery are being extended as well.

### **Training can be fun — with projects that inspire**

“A critical factor for successful training is not just our equipment. It is utmost important that we inspire enthusiasm for the profession”, says Training Manager Capeder. “To do this, we need to consider how young age people start their education nowadays. They are much more familiar with using tablets and mobile phones than screwdrivers and files”.

For the future, it is crucial to convey digitalisation and mechanics as one entity, even if they are worlds apart. “The best way to achieve this is through project

work”, explains Marcel Capeder. He mentions the development and production of a robotic arm and control system as recent examples. Another stand-out project involved a turning roller for fishing, which is characterised by its light-weight design and extremely smooth operation. “The trainees gained experience with the 3D printer, which will form a key part of the curriculum in the future”, explains Marcel Capeder. “As a rule, we try to find project work that has some practical value and can be sold in small quantities. This practical aspect means the trainees learn that quality and a fair price really matter when it comes to market-oriented products”.

### **From the company foundation to the present day**

One of the most popular projects is overhauling old machinery – preferably machines used by the company throughout its

over-100-year history. Starrag AG started as a machine construction company founded in 1897 by Henri Levy. At the time, the company achieved exceptional success making machines for embroidery factories. These included an automatic threading machine as well as a bobbin winder. The small coils for shuttle embroidery machines on which the thread had to be wound for processing are called bobbins.

Marcel Capeder is delighted by the enthusiasm of the trainees who take on different tasks to retrofit these original mechanical machines that are over 100 years old. These include foremost understanding the mechanical processes and identifying defects. This is followed by repair work, producing or procuring some parts, assembling and finally fine tuning the respective machine. “So far, we have been able to overhaul every old machine so that it functions again as it originally used to”, Capeder says.



**“At Starrag, we make sure that ‘soft’ skills are also taught. We share values such as trust, fairness, proud and respect.”**

**Sasa Colic**  
Head of Group  
Human Resources



**“In particular, our polymechanics and design engineers have completed their training with the best grades compared with other cantons several times in the last few years.”**

**Marcel Capeder**

Team Leader at the  
Starrag Training Center



Marcel Capeder, Team Leader at the Starrag Training Center (left) and Sasa Colic, Head Group HR (right)

Starrag also offers projects such as the creation of a jet engine. Current topics are explored in the specialist departments, when trainees complete the second part of their four-year training period and are confronted directly with the tasks of the future of a professional life.

### Success throughout the canton

The success of Starrag AG's training programme is proven by the good and consistent achieved results in the final tests of the trainees. “In particular, our polymechanics and design engineers have completed their training with the best grades compared with other cantons several times in the last few years”, says Marcel Capeder, who points out another success factor: “The final

grade is one thing. The other thing, which is more important in my opinion, is transferring the skills learned to the professional world. The fact that we are doing this extremely well can be seen in our current workforce, around one-third of whom come from our own training programme”.

One of the Starrag training champions is Roman Forter, whose final design work – the optimised five-axis programming of a blisk segment – was considered the best in the canton. He impressed not only the examiners but also the specialists at Starrag to such an extent that he was able to oversee various training courses and projects in China and India. Following his professional studies at the university of applied sciences, he now works as a technologist in Rorschacherberg:

“The training programme at Starrag was perfect for me. The programme allowed me to experience what high-tech can really mean – in theory and practice. That motivated me to do my best – with the result that I now have a job that inspires me every day.”

### School for life

Head of Group Human Resources Sasa Colic is convinced of another fact besides professional training: “At Starrag, we make sure that ‘soft’ skills are also taught. We share values such as trust, fairness, proud and respect. Therefore, the mindset of the trainees is important to us. We want to enable them to think and act in a solution-oriented, entrepreneurial and responsible way as part of a team.”

**Bumotec 191<sup>neo</sup>**  
a new edition of  
the top-of-the-range  
s191 model



#### Highly flexible:

The Bumotec 191<sup>neo</sup> is not just a single machining solution, but is basically twelve different machines in one platform. This diverse range is the only way to meet the specific requirements of typical users in the fields of medical technology, micromechanics and the luxury goods industry in an economical and technologically optimal way.



To the film of the  
Bumotec 191<sup>neo</sup>

# Multitasking – digital and ergonomic

The “Swiss army knife” of machining: This is the title given to Starrag’s Bumotec s191 mill/turn centre thanks to its versatility. Three small letters now denote further development of this top model from the Swiss manufacturer: The Bumotec 191<sup>neo</sup> is just as versatile as its predecessor. But it is now even easier to operate, mainly thanks to the new Human Machine Interface (HMI).

#### Concentrated expertise packed into an ergonomic design

“How can we improve upon an extremely reliable, powerful and modular centre, when it already offers the perfect solution for dealing with the various challenges encountered when machining precise, small parts with a high degree of added value?” This was the question the team at Starrag, composed of experts from production, process engineering, quality, application, service engineering and construction, asked themselves.

The answer is clear as soon as you look at the Bumotec 191<sup>neo</sup>: The new model combines concentrated expertise in an

ergonomic housing. The large glass surfaces and optimally positioned access doors mean that the model offers a great view of the different areas of the machine and improved access for operators. The light strip allows users to immediately identify the operating status of the machine at a glance. The operator can easily switch between the screens using their finger.

You can track the progress of ongoing machining processes, configure the programming and monitor production – all in real time. All in all, the mill/turn centre is intuitive and user-friendly, allowing operators to quickly become familiar with the machine. This is a

significant advantage with the lack of highly skilled workers on the job market.

#### Precision machining with 12 different faces

Starrag offers the machining centre in versions with a vice “P,” multipurpose pickup vice “PRM,” back-working spindle “R,” and with combined vice and back-working spindle “RP” and with a bar capacity of 42 mm, 50 mm or 65 mm. But the Bumotec 191<sup>neo</sup> is not just a machining solution – it offers twelve different machines in a single platform. According to Starrag, this diverse range is the only way to meet the specific requirements of typical users in the fields of medical



The tool change time is reduced by around 15%, meaning tough demands relating to the cycle time are met and unproductive downtimes are reduced.



Example of an application from medical technology for implants



To the virtual showroom  
Starrag Vudens

technology, micromechanics and the luxury goods industry in an economical and technologically optimal way.

### Unproductive downtimes are significantly reduced

Even without user intervention, the Bumotec 191<sup>neo</sup> operates in a stable, reliable and productive manner. The tool change time is reduced by around 15%, meaning tough demands relating to the cycle time are met and unproductive downtimes are reduced. Other advantages of the new model include the increased torque of the Starrag milling spindle and the pick-up unit, which operates 12% faster than before.

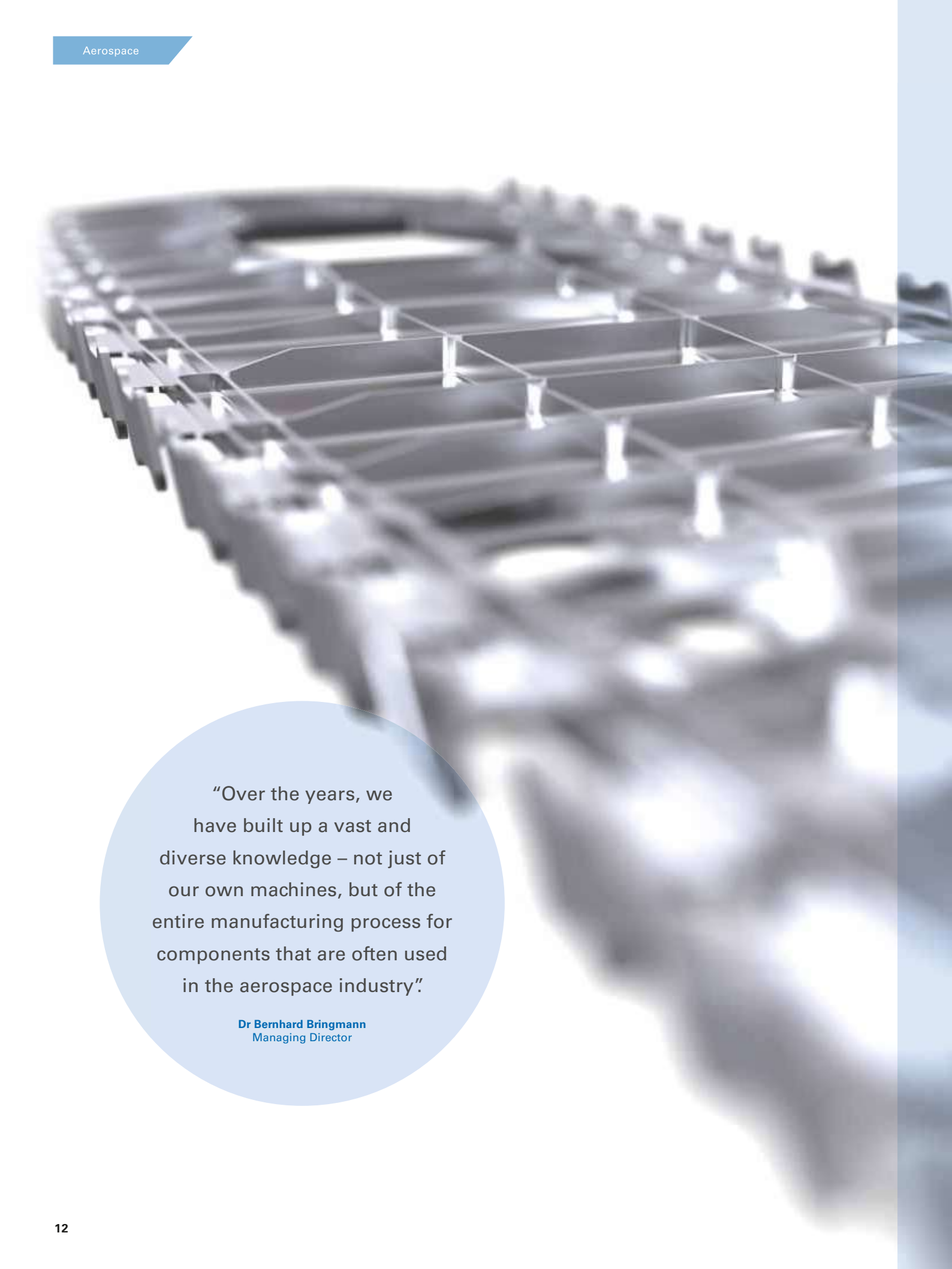
The Bumotec tool magazine offers over 90 tool slots as standard and has tool breakage sensor which works in parallel, for when problems arise. In conjunction with a Bumotec palletiser or an automatic cell robot, continuous production can be performed around the clock, which may only stop preventive maintenance.

According to Starrag, the modular design means that a wide range of customer requirements can be met: A variety of peripheral devices are available, including temperature-controlled high-pressure systems, swarf conveyors and bar feeders. Users can machine a range of complex and demanding workpieces in a single clamping, because the Bumotec 191<sup>neo</sup>

not only turns, mills, grinds and polishes, but it can also perform less frequently used machining processes such as hobbing, skiving and diamond cutting.

### A machining centre with built-in remote control

The new model offers the proven reliability and production stability of the Bumotec s191: It is designed to meet the challenges of digital transformation, as it can be used in conjunction with the latest production technology. ▀



“Over the years, we have built up a vast and diverse knowledge – not just of our own machines, but of the entire manufacturing process for components that are often used in the aerospace industry”.

**Dr Bernhard Bringmann**  
Managing Director



## Aerospace manufacturing expertise – all in one place

The Starrag site in Rorschacherberg in Switzerland has long been synonymous with highly productive, long-lasting machining solutions in the aircraft industry. This is what made this site the perfect choice for the Starrag Aerospace Competence Center – an initiative to combine the expertise already available within the group in terms of manufacturing turbines and structural components.

The aerospace industry has been one of Starrag's core markets ever since the company began to build machine tools in the early 20<sup>th</sup> century – and this is still the case today. Dr Bernhard Bringmann, Managing Director at the Rorschacherberg site and Head of the High Performance Systems business unit, explains: "Over the years, we have built up a vast and diverse knowledge – not just of our own machines, but of the entire manufacturing process for components that are often used in the aerospace industry".

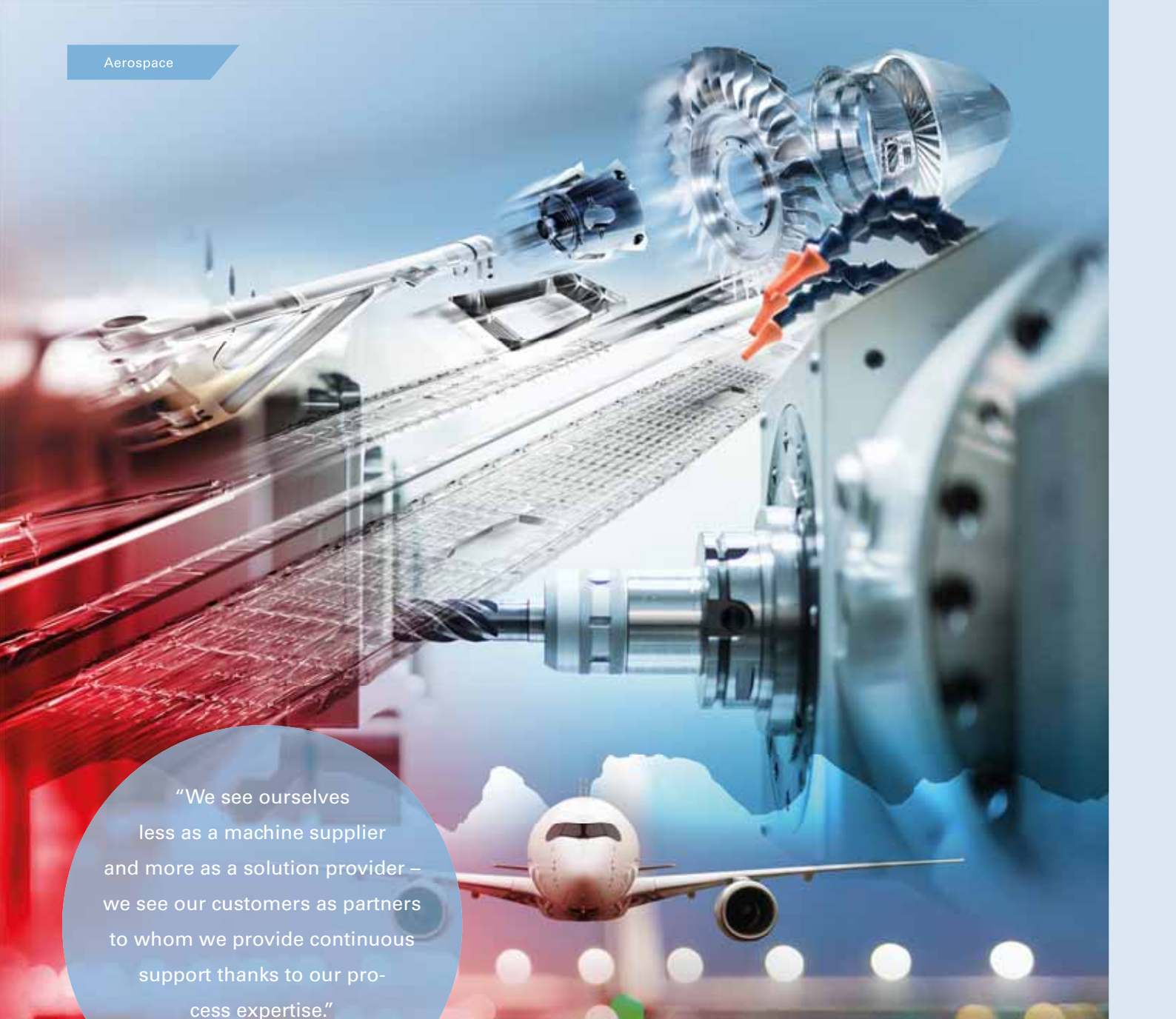
The best way to experience this expertise first-hand is at the Center of Production Excellence (CPE) at the application centre in Rorschacherberg. This approx. 2,000 m<sup>2</sup> hall is equipped with

state-of-the-art NB, LX and STC five-axis machining centres, which can be used to create a broad variety of flow surfaces and complex structural components. Starrag technologists test and optimise new, sophisticated machine processes at the site, usually in response to customer orders and under production conditions – and all while continuing to gather valuable experience.

### **A unique application package**

"Just as the 'Aerospace Competence Center' was given its official name, in CPE we were commissioning an Ecospeed machine featuring pallet of four metres in length to allow us to reproduce our expertise in structural components on

this scale," says Dr Bringmann enthusiastically. The plans go even further: To achieve the best possible synergy effect, future development and production of the Ecospeed series will be relocated from Mönchengladbach to Rorschacherberg. Dr Bringmann provided the following explanation for this decision: "By moving our Ecospeed facilities, we can offer the aerospace industry a huge range of applications from a single source – in a way that very few other companies around the world can". This includes manufacturing solutions for blades, vanes, blisks, impellers, casings, gearboxes and housings for turbines. The range also covers aluminium and titanium structural components of various sizes, plus landing gear components.



"We see ourselves less as a machine supplier and more as a solution provider – we see our customers as partners to whom we provide continuous support thanks to our process expertise."

**Dr Bernhard Bringmann**  
Managing Director

### **Complete manufacturing solutions from a single source**

It's not just the scope of the Starrag range that makes the difference: "We see ourselves less as a machine supplier and more as a solution provider – we see our customers as partners to whom we provide continuous support thanks to our process expertise," says Dr Bringmann.

This support starts as soon as Starrag receives an inquiry. "In an ideal world, a customer would come to us asking for

a manufacturing solution with the component, material and required quantity already in mind," explains Dr Bringmann. "If that happens, we can use all of our expertise to find a solution for manufacturing the parts with maximum production reliability and at the lowest possible unit cost."

Starrag process expertise does not just include manufacturing high-end machines – the company is also perfectly positioned in terms of auxiliary components for machining: for example, it can produce solid

carbide milling tools specifically designed for a customer's workpiece, which provide the customer with process advantages. The same applies to bespoke clamping technology and fixtures. Even custom CAD/CAM software is developed in Rorschacherberg, including post-processor programming. Alongside all of these activities, Starrag also looks after any required measuring cycles and simulations, right through in order to complete automation and digitalisation solutions. Any process elements that Starrag cannot cover itself are passed onto



“We are not just machine manufacturers. First and foremost, we develop processes. Our high-end machine tools are part of these along with numerous other components.”

**Dr Bernhard Bringmann**  
Managing Director



selected specialist partners who can provide optimal products for the process – these products range from coolants and tool systems to additional software.

#### **Processes are optimised, tested, implemented and supported**

To round off its scope of services, Starrag also ensures that all of the components work well together. This is where the CPE in Rorschacherberg comes into play again, as it will continue to be at the hearts of the Aerospace Competence Center in

the future. It is at CPE that customer applications are tested and optimised under actual production conditions. “This means we can create a truly effective, reliable production process and optimised, process-secure, realistic unit costs”, states Dr Bringmann. “But our commitment does not end here: Of course, we also provide support in terms of implementing the solutions on site – no matter where that site is in the world – and continue to help our customers even when the process is up and running.” ▀

# The energy revolution will only succeed with the right finish

Climate change can only be stopped if CO<sub>2</sub> emissions decrease to net zero. On the way to achieving this target, an important role is being played by new, powerful wind turbines with stronger, quieter and more compact drives that can be operated with or without a gearbox. Their efficiency depends on all of the important drive elements having the right finish – for years now, this has been a speciality of the Berthiez machines from Starrag.







Berthiez RVU 4700/450 with a 4,500 mm table diameter. On the new RVU grinding machines, it is possible to grind bearings of any size from 1,000 to 6,000 mm in diameter with micrometre precision.

It is a highly challenging task: According to the Global Wind Report 2021, the annual report by the Global Wind Energy Council (GWEC), over the next decade, wind turbines must be installed three times faster than previously to achieve the target of net zero. However, the global wind energy sector is already working to address the problem by investing heavily in new turbines. Yet, while increasing the pace at which the wind energy infrastructure is expanded, quality cannot be disregarded. In all areas of the value creation chain, there is demand for suppliers who really know their business.

However, the construction of new, more efficient wind turbines is possible only in cooperation with the drive sector. Because with or without a gearbox, the

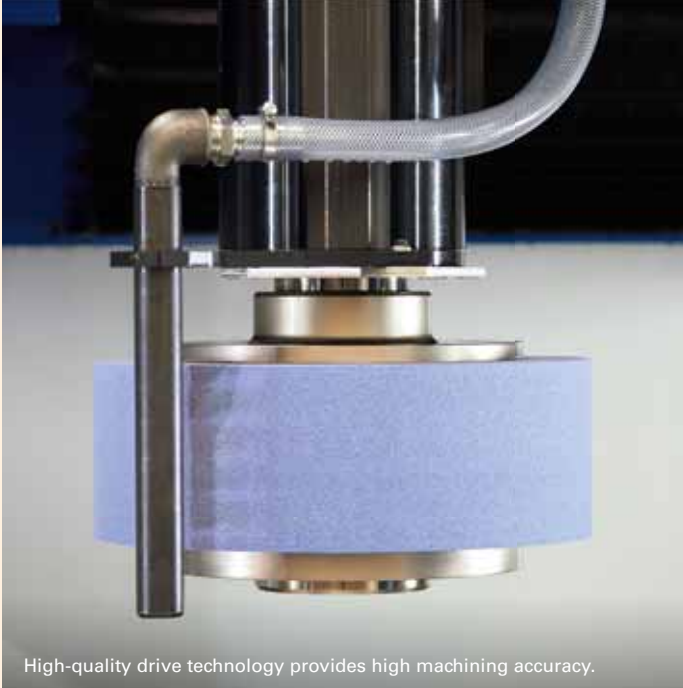
conversion of wind – a very volatile energy source – into electricity depends on drive elements that must be manufactured with high precision, such as bearings, gears and other components of the gearboxes. Starrag S.A.S. from Saint-Étienne, France, has established a very positive reputation with its large vertical Berthiez lathes and grinding machines, both in relation to this application and throughout the entire energy sector.

#### Grinding – A matter of common sense

In particular, grinding plays an important role in the manufacturing of drive elements. “Grinding is primarily a matter of common sense,” explains Jean-Luc Baechlé, Plant Manager of Starrag S.A.S. “Our grinding experts are able, thanks

to many years of expertise, to reliably predict how a dimension or a shape can be achieved with micrometre precision.” The France-based specialist is sure that with Berthiez RVU vertical grinding machines, not only is this task possible, but also the high-precision grinding in the  $\mu\text{m}$  range on these machines will even have an extremely high level of repeating accuracy at all times. The grinding technology from Saint-Étienne with table sizes of 800 mm to 6,000 mm is also designed for large wind turbine components. 2,000 workpieces weighing up to 16,000 kg with a maximum height of 1,000 mm can be machined.

When building machines for very discerning drive manufacturers in the wind energy sector, it is essential to



High-quality drive technology provides high machining accuracy.

”

2,000 workpieces weighing up to 16,000 kg with a maximum height of 1,000 mm can be machined.



A hydrostatic table bearing and a torque motor drive ensure the vibration-damped and backlash-free rotation of the table.

use high-quality drive technology yourself. Saint-Étienne has no concerns in this aspect: The machines of the French Starrag plant have tables with hydrostatic bearings and these tables are equipped with torque motors that, in combination with the highly rigid grey cast-iron construction, provide high machining accuracy and vibration-damped and backlash-free rotation. This set is completed by a support and an electrospindle holder turret equipped with an hydraulic balancing system, large ball screws, constant balancing of the grinding wheels and precise component temperature control.

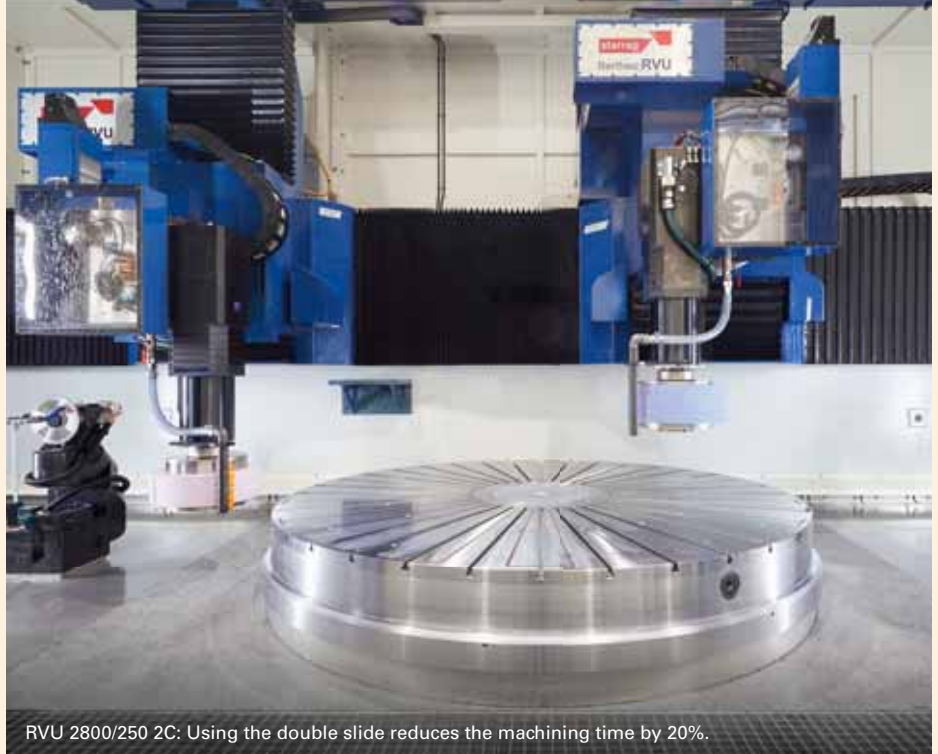
#### **Ergonomic help: HMI Berthigrind user interface**

A very important aspect of grinding is ease of operation. The magic word is HMI: These three letters stand for Human Machine Interface, which describes a user interface that makes it easier for the specialist staff to operate the machine control system. This is a crucial task, according to Sales Engineer, Sylvain Lhoste: “Because the grinding of components is very complex, we support operators with the user interface Berthigrind.” There is a wide variety of possible applications for the

grinding technology from Saint-Étienne. “For all wind turbines we supply machines for grinding the bearing to position the entire wind turbine (nacelle) and the rotor blades. They help the turbine to convert wind energy into electricity in a highly efficient manner”, explains the Plant Manager. “For wind turbines with gearboxes between the main rotating shaft and the generator, our machines are also suitable for machining the high-precision bearings of the rotor shaft as well as the bearings, gears and other components for the generator gearbox. In very large wind turbines that do not have a



The global wind energy sector is picking up speed.



RVU 2800/250 2C: Using the double slide reduces the machining time by 20%.

Grinding is primarily a matter of common sense.

gearbox, our machines grind the largest bearing that is necessary for these turbines." Starrag's grinding technology is popular: For example, it has proven itself worldwide when it comes to manufacturing a wide range of tapered roller bearings, spherical roller bearings and cylindrical roller bearings with a diameter of between 1,000 and 6,000 mm.

#### Using a double slide: 20% less machining time

A speciality is the machining of bearings for wind turbines. If, for example, users working with the RVU 2800/250 vertical grinding machine use two grinding discs or lathe tools at the same time thanks to



When it comes to wind energy, there is demand for technology suppliers who really know their business.

the double slide, they can reduce machining times by around 20%. The extension with the second slide also increases the machine capacity tenfold. "This very efficient plant is an example of close cooperation with our customers," says Plant Manager Baechlé. On the new vertical RVU grinding machines, customers are able to grind bearings of any size from 1,000 to 6,000 mm in diameter with micrometre precision.

#### Doubled warranty period reduces expensive maintenance

"The idea behind it comes from one of the world's leading bearing manufacturers, which wanted to double its bearings' warranty to 24 months for its customers." Thanks to new, optimised machine technology, the group can now manufacture drive technology that is different from the competition in one very important aspect.

The doubled warranty period allows the wind turbine operators longer intervals between instances of expensive and very time-consuming maintenance work. This is a very important factor that is popular with many customers, not just the owners of difficult-to-access offshore platforms. However, it is not the technology alone that turns very discerning users into loyal customers. This is where the Starrag philosophy “Engineering precisely what you value” comes into play. This means customers always receive precisely the technology and service that

they really need – no more, but also no less. Baechlé: “We try every possible option to develop solutions that meet the customers’ needs precisely”

#### **Despite the COVID-19 travel ban: On time commissioning in China**

In this case, what the customer needed was to have a vertical grinding machine quickly and reliably assembled and commissioned in China – in the middle of the COVID-19 crisis. As experts from Saint-Étienne were not allowed to travel to

the Far East, technicians from Starrag China took over the difficult task of assembling and commissioning the machine, which had been delivered in a disassembled state, with support from the remote Berthiez specialists. Baechlé: “Assembly and commissioning were accomplished through close cooperation between France and China, to the full satisfaction of the customer and within the prescribed timeframe. This successful experience in very tumultuous circumstances established trust and has led to many new orders.” ■



High-precision grinding in the  $\mu\text{m}$  range.



“Our machines grind even the largest bearings.”  
Jean-Luc Baechlé, Plant Manager at Starrag S.A.S.

”

The doubled warranty period allows the wind turbine operators longer intervals between instances of expensive and very time-consuming maintenance work.

“With this kind of milling technology and its solution-driven integration into the overall process, we are able to compete at the highest level and play in the champions’ league of large-tool-engineering plants.” Lutz Kramer, Head of Tool and Mould Making



“We play  
in the  
champions’  
league  
every day”

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In recent years, Porsche Werkzeugbau GmbH in Schwarzenberg, Germany, has taken its mechanical machining to the highest technical level. Two large Starrag HSC machining centres Droop+Rein FOGS play a major part in this. These are used to finish pressing tools for moulding skin parts of vehicle bodies with the utmost precision and produce surfaces with grinding quality.

A premium car manufacturer should have a premium tool-engineering plant. To ensure that the Porsche Werkzeugbau GmbH Schwarzenberg plant fulfils all of the preconditions for this, 40 million euro were invested over the last five years to develop the tool-engineering plant to the highest possible level following the transition from KUKA. Among other things, the Schwarzenberg-based company used this money to set up two new production halls, purchase a new 25,000-kN servo press for production-related tool tryout and invest in retrofitting and in new chip removal machine tools – including two Starrag HSC centres of the Droop+Rein FOGS 35 68 N40C type. In addition to this, mechanical production was completely overhauled and the production processes were restructured.

All of these measures were based on a solid foundation: Beforehand, the whole tool-engineering team analysed the entire

process chain, from development and design to procurement, production and tryout of the tools, right through to the transfer to the operator pressing plant – including a fitness test for the pool of machines. An important detail that came to light was the realisation that when it came to mechanical machining, there was potential for improvement in the finishing of the tools, particularly in terms of accuracy, speed and surface quality.

#### Lightweight construction results in tougher requirements

Marco Franz, Head of Mechanical Production, points out some important reasons for this: “For some years now we have been experiencing a shift towards lightweight construction and, as the Porsche competence centre for forming technology in the moulding skin area, we were commissioned to develop the tools required for the conversion to an aluminium body.



During forming, aluminium sheets respond much more sensitively than steel, which created big challenges for us when it came to tool engineering. Our existing machines were not able to meet some of the requirements”. Two new high-speed machining centres for finishing the pressing moulds should fulfil these new requirements regarding surface quality, accuracy and speed.

“We are now faster and more precise and achieve – depending on the component and the geometry – outstanding surface accuracy”.  
Marco Franz, Head of Mechanical Production



**“Starrag were actually able to implement more than 90% of our wish list.”**

Marco Franz, Head of Mechanical Production



According to Marco Franz, they should also help to make the process more efficient and economical, as well as greatly improving quality. The list of requirements contains fundamental preconditions such as process stability, availability and ease of maintenance,

as well as characteristics that cannot be compromised, such as temperature stability. In addition, future-oriented specifications for the performance data of the spindles were defined. Lutz Kramer explains: “When you buy this kind of machine, you expect to use it for the next 10 to 20 years. During this time, several generations of new milling tools are developed that are more efficient and allow higher speeds. We must take all of this into account as early as the tendering process”

With their list of requirements, the Porsche Werkzeugbau decision-makers set a high bar – and came to realise that not many manufacturers would be able to meet the requested standards. “During the technical discussions that we held with many different providers, we were soon able to tell who was able and willing to overcome the challenges.

Some machine providers withdrew at an early stage, others were later unable to offer any acceptable solutions”, says Head of Tool and Mould Making, Kramer.

#### **Premium machine tools from Starrag**

Ultimately, the decision-makers opted for two Starrag Droop+Rein FOGS 35 68 N40C high-speed machining centres. These five-axis machine tools are designed for finishing, have an overhead gantry and offer traverse paths of 6,800 × 3,500 × 1,500 mm along the X-, Y- and Z-axes. The equipment includes a tool magazine with a total of 100 places that can be filled with HSK32, HSK63 and SK50 retainers, as well as an eccentric fork head with a 40-kW milling spindle and a high torque of 700 Nm, and three different motor milling spindles with speeds of 18,000, 40,000 and 65,000 rpm. In addition, for one of the two machines, Marco Franz

ordered a special 6,000-rpm angular head that can be used for machining areas that are difficult to access. "With this range of spindles, the requirements of the coming years are covered," Lutz Kramer is certain.

#### **More than a machine – Engineering precisely what you value**

There were other reasons for choosing the Starrag machines, in addition to the technical data, as Head of Tool and Mould Making Kramer explains: "We didn't just want to buy a machine, we wanted a solution for our tool manufacturing process. That is one of the main reasons why

Starrag seemed to us to be the right partner. With the Droop+Rein specialists, we had the impression right from the start that they were listening to us, wanted to understand us and the thinking behind our processes, and wanted to use their expertise to help us"

Once the machines were installed, the two companies began fine-tuning the workflow together, taking into account the characteristics of CAM, the control system and the machine. This was necessary because achieving the best surface quality requires a high level of accuracy on the path, even at the highest feed

speeds. For this, it was important to illuminate the interfaces between CAM and NC and to work with experts from the control system manufacturer to optimally adjust their functionalities in line with the process requirements.

This interdisciplinary approach and the combination of sophisticated drive optimisation in conjunction with the proven machine technology of the FOGS series was extremely successful: The result was not only a class-A surface but also a very high level of accuracy – at the highest path speeds of up to 16 m/min on the free-form surface. The processes



Lutz Kramer: "When you buy this kind of machine, you expect to use it for the next 10 to 20 years."



**"With this kind of milling technology and its solution-driven integration into the overall process, we are able to compete at the highest level and play in the champions' league of large-tool-engineering plants"**

Lutz Kramer, Head of Tool and Mould Making



With this range of spindles, the requirements of the coming years are covered.



have been running stable ever since. Lutz Kramer is delighted: "It took a long time to achieve stable processes, especially when it came to the forming tools for aluminium parts, because there are many factors influencing this. But Starrag assisted us until we were sure we had reached our goal". Marco Franz adds: "I wouldn't have believed it at the start. But Starrag was actually able to implement more than 90% of our wish list. So it was definitely a good decision to invest in the new Droop+Rein FOGS machines. We are now faster and more precise and achieve – depending on the component and the geometry – outstanding surface accuracy".

**"With the Droop+Rein FOGS machines, we have attained the desired improvement in quality and were also able to reduce the manual bench work by roughly 20% in the follow-up process."**

Lutz Kramer, Head of Tool and Mould Making

The head of tool and mould making confirms: "We are proud of what we have achieved with Starrag. With the Droop+Rein FOGS machines, we have attained the desired improvement in quality and were also able to reduce

the manual bench work of the toolmakers by roughly 20% in the follow-up process. These are strengths that make us one of the top teams in the champions' league of large-tool-engineering plants" ■

Once the machines were installed, the two companies began fine-tuning the workflow together, taking into account the characteristics of CAM, the control system and the machine.

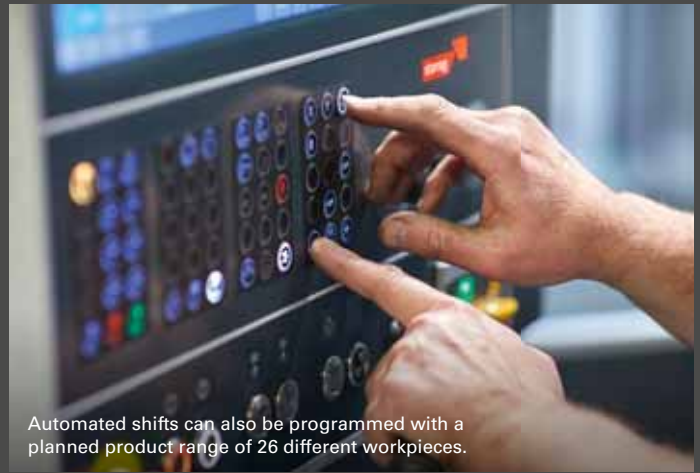


# Tangible success

The Stahlwille  
die forge  
manufactures  
tools at the  
Starrag  
Heckert H55  
machining  
centre



The Stahlwille die forge benefits from the precision and repeating accuracy of the Heckert H55 machining centre



Automated shifts can also be programmed with a planned product range of 26 different workpieces.



The typical die forge is characterised by tool diversity.

**Stahlberg, Erzwiese and "Finstertal" mine:** In the district of Schmalkalden-Meiningen, Germany, many place names point to the high volume of ore in the area. Due to mineral resources of iron, silver and copper, many tool workshops, ironworks and forges have been built on the edge of the Thuringian Forest since the Middle Ages. Among them were artisan pioneers, such as tool manufacturer SWM-Gesenkbau, who was part of the industrialisation in the early twentieth century and is still going strong today.

A castle ruin, a hammer and pliers: The coat of arms of Steinbach-Hallenberg clearly points to the town's specialties. According to the town's website, "the long tradition of the local smithery is still being perpetuated with great enthusiasm, exemplified by the impressive metal working museum and the only corkscrew workshop in the world".

Just as impressive is the 60-year-old SWM tool factory, which has been a part of the Wuppertal-based STAHLWILLE Group – one of Germany's leading tool manufacturers – since 1996. Since then, the die forge in South Thuringia has supplied the entire group with forged parts for the production of high-quality

screwdrivers and gripping tools as well as for the manufacture of intelligent torque technology. Die forging is one of SWM's particular strengths, as the tools have always been made in-house in Steinbach-Hallenberg. Combined with decades of experience, the integrated CAD-CAM chain ensures efficiency and quality. This is especially evident when the tools are fed into one of the partially automated production lines.

At the centre of the newest, cutting-edge SWM production line is the new Starrag Heckert H55 machining centre. Those involved in the manufacturing industry are probably surprised to hear that a die forge uses a high-precision compact machining

centre. But the reason is obvious if you know both the engineer who devised this production line and his ideas.

#### **Enrico Danz: The Gyro Gearloose of the die forging sector**

The human factor, which is particularly important in tool making, plays a key role in this area: Enrico Danz explains how the success of a company stands and falls with its employees. Production Manager Danz started as a car mechanic and completed a mechanical engineering degree at night school while working at SWM. The mechanical engineer now specialises in tool technology, yet this genius has not gone to his head. Danz is certainly not a



The fixtures hold different variants, thereby offering flexible design options.



New workpieces are placed onto the machine one after the other.



The Gyro Gearloose of the die forging sector: SWM Production Manager Enrico Danz

boss who spins his theories and makes decisions from behind his desk. He knows every workpiece inside out; there is no movement that Danz has not already done many times himself. "To identify potential for improvement, I have to visit the site myself. There's no other way," says Danz.

One day, the pragmatist realised that the production of large pliers showed potential for optimisation. For him, the typical approach of increasing the degree of automation with robots and complex, standardised clamping devices was not enough. In his opinion, metal cutting was the weak point – clamping and milling the pliers' heads took too long. Moreover, the spindles had a limited capacity. Danz explains further: "In addition, the product variety was severely limited and retooling was very time-consuming. So it was clear that we had to rethink the production line.

**"The Heckert is a workhorse. It has allowed us to open up countless new possibilities, with more being discovered all the time."**

Our goal was to significantly shorten the production process and keep the set-up time as short as possible"

The greatest challenge was the building structure at the mechanical production site. According to Danz, the production hall is "a GDR building from the 1960s, where the width of the stud frames and the load capacity of the floors set the pace". The only solution was to bring in

production technology from Chemnitz. After all, the Heckert compact series is characterised by one feature in particular: it offers maximum productivity with minimal space requirements.

#### **The "assistant" from Schmalkalden**

Anyone who is familiar with the world of Disney comics knows that even a technical genius like Gyro Gearloose doesn't work alone. And while Gearloose gets his help from a lightbulb with legs, Danz looks to Jan Hilpert of Schmalkalden. The Managing Director of automation specialist ROBOTICS was, as usual, one of the first to hear about Danz's latest plan. "When he presented me with his idea for the new production line, I immediately understood the challenge," he recalls. "How can we achieve an automated shift with a planned product range of 26 different workpieces and an average processing time of 30 seconds?"

**“The Heckert holds up so well with an incredibly stiff and optimally damped spindle that I can now really maximise the performance capacity of my HSS profile cutters.”**

Danz adds: “While Jan was thinking about automation, I was designing the fixture on which at least four different workpieces can be clamped.”

Why does SWM not involve fixture design specialists in the project? Danz was quick to dismiss this: “All the fixture manufacturers I found had little experience with forged parts and their tolerances.” “In our case in particular, there were fluctuating manufacturing tolerances due to the shrinkage rates during die forging. Basically, this was not their area of expertise. That’s why it was probably the wisest decision to use our own expertise and planning capacity.”

#### **High-precision machinery in the forge – Using a sledgehammer to crack a nut?**

The topic of manufacturing tolerances is fascinating. What use is a high-precision machining centre like the Heckert H55 to a company whose usual tolerances are a few tenths of a millimetre? “In typical applications, accuracy may be

the decisive factor, but for us it came down to the stability, space requirements and amazing flexibility of the Heckert centre,” says Danz. “At the moment, we are still working on getting the planned products onto the machine, one by one, but new ones are constantly being added. We are now also receiving parts from sister companies that have to be machined on the reverse side and finally joined together. We have also been impressed by the precision and repeating accuracy of our new machine.”

The die forge requires very rugged and versatile fixtures, which can weigh half a tonne on their own. “With a maximum loading weight of 800 kg, the Heckert can easily cope with this,” says Danz happily. “The Heckert holds up so well with an incredibly stiff and optimally damped spindle that I can now really maximise the performance capacity of my HSS profile cutters. At present, we have increased cutting speeds by around 40% in conjunction with the fixture developed in-house compared to previous production runs. In addition, start-up

strategies can be programmed and can identify further potential for optimisation. With the H55, completely new tool concepts can be created for machining that were not possible before.”

#### **Rapid changeover facilitates automation**

The machining centre not only scores in terms of stability, but in terms of flexibility too. “For me, the loading mass is also ideal in terms of flexibility, because it gives me more design options for the fixture,” says Danz, adding another example of flexibility gains: “I used to have some parts mechanically machined manually in half a shift. Today, thanks to the Heckert, I can changeover so quickly that I can actually automate the process and deploy the employee elsewhere. The changeover takes just over half an hour, by which time the next part is already running. In pallet sequencing mode, it is easy to quickly have two, three or four parts.”

When asked what he particularly likes about the Heckert, “everything” is his first response. But he eventually adds: “The Heckert is a workhorse. It has allowed us to open up countless new possibilities, with more being discovered all the time. This makes me smile every single time. With this knowledge, I can now start to rethink completely different areas of our portfolio, which makes the future even more exciting. Incidentally, this is based on investing in a second Heckert H55 which is identical in design.” ▀



HSS profile cutters operate at three times the cutting speed.



The SWM die forge in South Thuringia supplies the entire Stahlwille Group with forged parts.

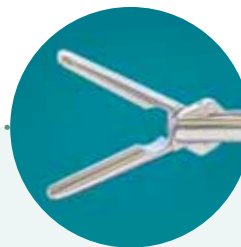
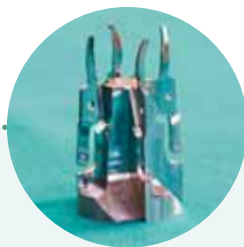
# Off-the-shelf medical instruments



Tschida Medical Solutions' entry  
into high-precision manufacturing  
with Bumotec s191



“We can mill up to nine components in the turret at the same time.”



**TOOTH BY TOOTH:** The Tschida team is proud of the atraumatic DeBakey forceps, a double-articulated instrument with two jaws and special teeth for picking up and holding very sensitive blood vessels safely.

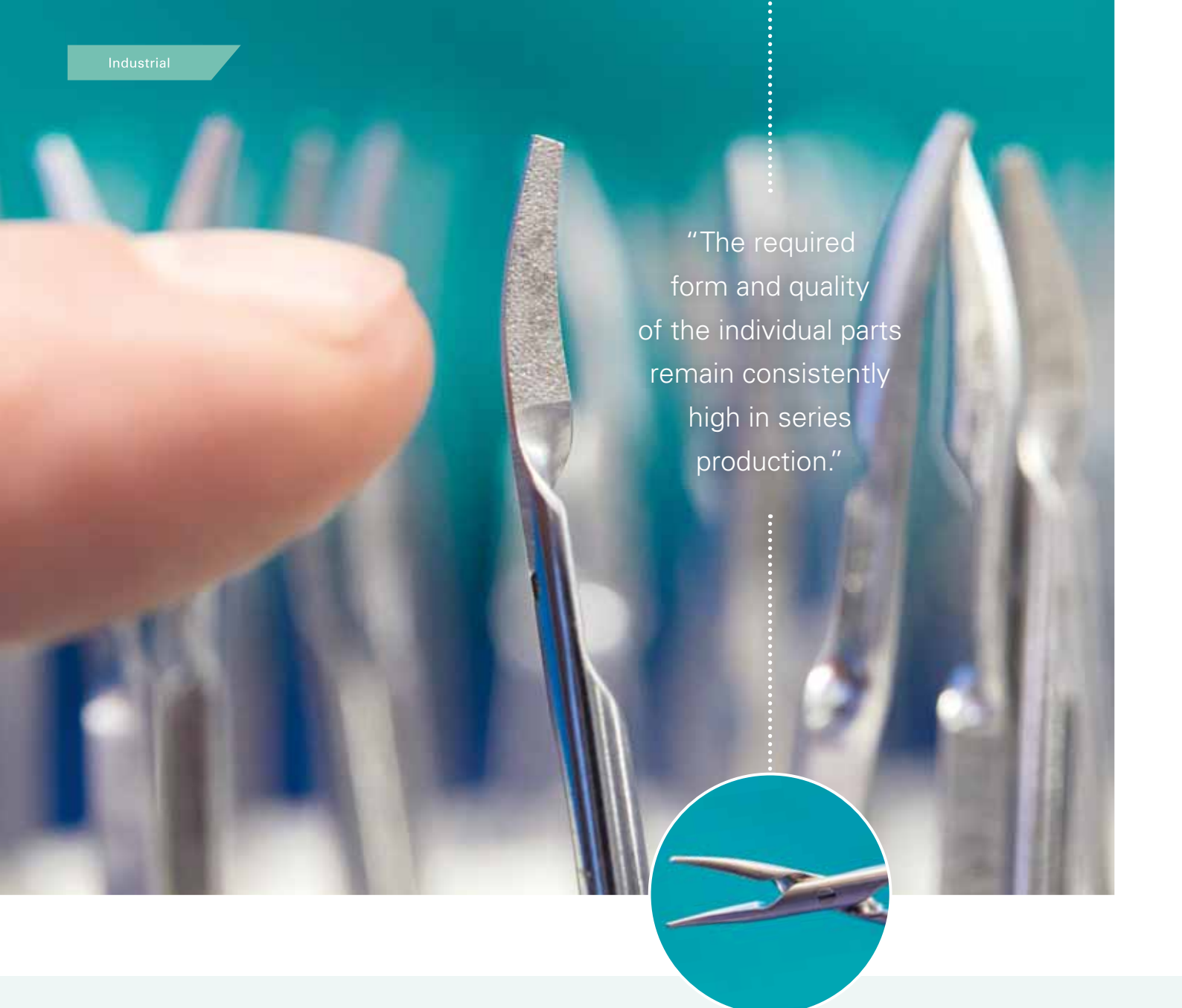
The world's most impressive “Swiss army knife” weighs more than four tonnes and can turn, mill, grind, bore, broach, saw, skive and even needle-etch with backlash-free precision to the micrometre: This was reason enough for surgical mechanic Peter Tschida from the district of Tuttlingen to order the Starrag Bumotec s191 mill/turn centre – the “Swiss army knife” of machining.

Five years ago, Peter and Ivonne Tschida, owners and founders of Tschida Medical Solutions (TMS) in Fridingen (near Tuttlingen), made a very courageous decision. The family-owned company, located in what is often referred to as the “Medical Valley” in the Swabian region of Germany, decided that it wanted to go beyond inventing, developing and designing medical instruments made of stainless steel using 3D CAD, it also wanted to manufacture them itself using the Bumotec s191

high-precision mill/turn centre from Starrag. This took a great deal of courage, as Peter and his sons Florian and Maximilian were total laymen in the fields of CNC machining and CAM programming.

#### High precision with many extras

After around a year of training, with newly acquired knowledge, the Bumotec s191 and its many extras quickly opened a door into the world of CNC machining.



"The required form and quality of the individual parts remain consistently high in series production."

The linear-driven mill/turn centre can load and machine bar parts with a maximum diameter of 50 mm, and the multi-grip device on the opposite station holds and supports complex parts very reliably, ensuring that very tight tolerances can be maintained even with six-sided machining. It also reduces unproductive set-up times: "We can mill up to nine components in the turret at the same time. This means we can avoid eight tool changes compared to individual production," explains Tschida with a practical example.

Manufacturing costs in Fridingen are high, as instruments such as forceps, scissors

and needle holders are produced from high-alloy stainless steel bar parts (X20Cr13, Diameter 25 mm), which Tschida Medical Solutions then combines into complex micro-spring, micro-bayonet and tube shaft instruments. Tschida's team manufactures these components in series production 24 hours a day – even through the night during fully automated, unmanned shifts. Precise temperature management ensures safe and reliable repeating accuracy with precision to two micrometres on all five axes, while the stable and low-vibration machine bed offers near-net-shape finishing on the surfaces. But Tschida is especially proud

of one thing: "The boldest fact about this machine is that all of the know-how remains in-house. We will continue to work through the puzzle under the radar until the innovation is fully developed."

#### Success story: DeBakey forceps

So-called atraumatic DeBakey forceps, a double-articulated instrument with two jaw parts, were selected for manufacturing as a trial. This instrument is given special teething for picking up and holding very sensitive blood vessels safely. These tiny (less than 0.4 mm wide) cross teeth are milled using special tooling; they have



**EDUCATIONAL:** For one year, Peter Tschida and his sons Florian (pictured) and Maximilian learned how to produce medical instruments with the 7-axis s191 Bumotec machining centre to  $\mu\text{m}$  precision.



**MEDICAL VALLEY:** The district of Tuttlingen (pictured: the town of Fridingen) is responsible for around half of the world's sales of surgical instruments.



**PETER TSCHIDA:** "The boldest thing about this machine is that all of the know-how remains in-house. We will continue to work through the puzzle under the radar until the innovation is fully developed."

a very small radius and interlocking, backlash-free longitudinal teeth on opposite jaws. In order to reduce the amount of work required, the s191 finishes the inner sides of the jaws so well that they do not need to be polished at the end of the process.

The case study was successful and Tschida will soon be able to supply its distributors with these DeBaKey forceps,

which stand out from the competition thanks to their high-quality toothing. "It's not uncommon for the jaw parts to decay," explains the surgical mechanic. "It only takes a few teeth to be missing or incorrectly positioned for the forceps to injure vessels."

Despite the significantly higher manufacturing costs, the case study showed that the s191 produces these parts

very efficiently (four parts in a turret). The DeBaKey forceps are testament to what the s191 is capable of. Tschida: "The required form and quality of the individual parts remain consistently high in series production. The case study also shows us how to reduce the time required to refine the parts. In addition, the final assembly times are reduced, as the parts fit together and the desired function is achieved more quickly." ▀

starrag

bumotec

Bumotec 191<sup>neo</sup>

Multitasking – dynamic and ergonomic



Cost per part  
optimised

while adopting "Lean Manufacturing" principles

