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Starrag
Magazine
02-2026

star





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**Star – The Starrag
Division Magazine**

Publisher:

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Picture credits:

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Starrag 2026

© Ralf Baumgarten: p. 1–4, 6–9,
12–23, 32–43

© Tornos AG: p. 44–47

Design: Gastdesign.de

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Star – Starrag's magazine – is published
twice a year in German, English,
Chinese and French. Despite careful
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Since 2012, Azurea Unipessoal Lda has established itself as a benchmark in the field of microtechnology and watchmaking

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UNSTOPPABLE

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COUNTS.



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Martin Buyle
CEO, Starrag Division

Dear Readers,

The demands placed on modern manufacturing solutions could hardly be more diverse. Maximum precision and productivity are in demand, but at the same time also flexibility, cost-effectiveness, and the most efficient possible use of resources. It is therefore crucial to develop the technically appropriate solution for each task.

Two new products featured in this issue already demonstrate how different these solutions can be. The Bumotec 171 enables complete machining on just 32 sq ft (3 m²) for the medical technology, watchmaking and luxury goods industries, as well as micromechanics. The Heckert X90 operates on a completely different scale: it machines workpieces weighing up to 4,409 lb. (2,000 kg) and measuring up to 63 in. (1,600 mm) in diameter.

The dimensions become even larger when it comes to XXL machining. For example, Starrag solutions manufacture wind power components measuring 29.5 ft (9 m) with an accuracy of ± 0.004 in. (± 0.1 mm), or sheaves for cable cars with precision in the micrometer range. Size and precision are not mutually exclusive.

The example of SAMSON shows that productivity today extends far beyond the individual machine tool. With the relocation from Frankfurt to Offenbach, the valve and process technology specialist is updating around 40% of its machine fleet. Starrag is integrating two Heckert machining centers there with automation and a control system. The result: virtually no setup costs and around 30% more capacity.

We also rely on our own technologies within our company. TTL has been developing software and adaptive machining processes in Haddenham, UK, and has been part of the Starrag Group for more than 15 years. As a development and testing platform, TTL is receiving its sixth machining center, a Heckert X50, from its parent company.

Technical and economic solutions do not always have to start with a new machine. NEUMAN & ESSER opted to retrofit a 26-year-old Dörries vertical turning lathe. New drives, electrical systems, and control technology make the existing mechanical components fit for many more years of service. Another example is two 52.5-ft-long (16-m-long) Droop+Rein FOGS gantry milling machines belonging to a US manufacturer of aerospace and defense components, which Starrag also modernized.

The breadth of our engineering capabilities today was also evident at the Aerospace & Turbine Technology Days in Rorschacherberg. Around 250 guests, including 170 customers from 24 countries, came together in June to learn about solutions for the aerospace and energy industries – from automated precision machining of the smallest components to manufacturing solutions for large aircraft structures and engine components.

For me, these examples clearly demonstrate what modern mechanical engineering stands for today: engineering that does not start with the technology, but with the tangible added value for our customers. At the heart of this are solutions that consistently combine precision, productivity, and cost-effectiveness.

Martin Buyle
CEO, Starrag Division



New Bumotec 171 machining center: the essentials of high precision, with- out compromise

With the commercial launch of the new 171 machining center, Bumotec takes another step forward in its innovation strategy by offering a solution that addresses manufacturers' real-world needs: more performance, more productivity, and greater profitability, with less complexity, lower resource consumption, and a smaller footprint.



Compact, precise, intelligent, and resource-efficient, the Bumotec 171 machining center embodies a new generation of production solutions: more value, more productivity, and greater simplicity for manufacturers of demanding, high-value-added products.

A new standard of efficiency for precision machining

Designed according to the “MORE with LESS” concept, the Bumotec 171 combines the advanced technologies that have built the brand’s reputation with a pragmatic approach focused on creating value for the user. Its objective is clear: to deliver world-class machining technology with outstanding precision, repeatability, and reliability while remaining competitive in terms of investment.

A compact machine that frees up valuable production space

In today’s manufacturing environments, every square foot matters. This is why the development of the Bumotec 171 was driven by an ambitious requirement to reduce its footprint to just 32.3 sq ft (3 m²). With an optimized weight of less than 7,275 lb. (3,300 kg), the machine achieves an exceptional balance between compactness, stability, and rigidity. Its design is based on a cast-iron structure

that ensures excellent vibration absorption and sustained accuracy over time. The result is a machine capable of delivering high-level industrial performance while occupying minimal floor space, enabling manufacturers to increase production capacity without expanding their facilities.

Maximum availability for continuous production

The Bumotec 171 was designed with one key priority: minimizing downtime. Its carefully engineered ergonomics, wide access doors, and excellent visibility simplify daily setup, inspection, and maintenance operations. The Windows-based HMI, powered by the FANUC Series 30, Model 31i-B5 Plus / 15”, simplifies programming, parameter management, and production data traceability. The machine also records all operations performed, ensuring accurate monitoring of settings and performance.

On the automation side, the Bumotec 171 incorporates intelligent tool monitoring functions capable of detecting tool wear or breakage and automatically replacing the affected tool with a backup tool stored in the magazine, without interrupting production. Preventive and predictive maintenance programs further contribute to high machine availability. Thanks to these optimizations, production changeovers and setup operations can be completed in less than 20 minutes, depending on the application.

The right balance between simplicity and performance

Manufacturers are often faced with a difficult choice between highly equipped, expensive machines and more basic solutions that may limit performance. The Bumotec 171 was developed specifically to provide the perfect balance between these two extremes.

In its simultaneous 5-axis configuration, it can machine bar stock up to 1.3 in. (32 mm) in diameter and can be equipped with an optional secondary operation unit featuring two vises to further expand its application range.

As a direct successor to the expertise developed with the renowned Bumotec 191 machining centers, recognized worldwide for their precision and repeatability, the new Bumotec 171 delivers a high level of performance in an exceptionally compact format. Additional highlights include a main spindle reaching 8,000 rpm, a machining spindle capable of 40,000 rpm, an optimized work area for chip evacuation, simplified access to key machine components, and easier cleaning for operators.

An all-in-one solution to reduce setups

One of the major advantages of the Bumotec 171 lies in its ability to perform complete machining from bar stock to finished part on a single machine.

Machining all six faces in one setup reduces intermediate handling, improves surface quality, and eliminates the need for additional equipment. This approach shortens production cycles, minimizes the risk of errors, and lowers manufacturing costs. Users can save machining recipes directly within the HMI, store tooling for multiple part families, and benefit from a tool magazine offering up to 60 tool positions, including backup tools. The automated jaw-changing system

on both vises further simplifies batch changeovers and enhances production flexibility.

Reducing energy consumption without compromising performance

Sustainability was also a major focus during the development of the Bumotec 171. Thanks to a new generation of linear motors, optimized Fanuc drives, and reduced moving masses, the machine delivers outstanding energy efficiency.

Equipped with an integrated energy-saving function, the machine automatically optimizes power consumption according to its operating mode. Depending on application conditions, this technology can generate energy savings of up to 7%

The Bumotec 171 was designed with one key priority: minimizing downtime





Designed to meet the challenges of precision, miniaturization, and performance, it serves the medical technology, watchmaking and luxury goods, micromechanics, and broader high-precision manufacturing sectors.

per part produced while maintaining full production performance. The reduction of compressed air requirements to 72.5 psi (5 bar) and the elimination of air/oil lubrication on the 30,000 rpm version further contribute to improved environmental efficiency.

High value-added applications for advanced industries

In response to the growing demands of the world's most advanced industries, the Bumotec 171 offers a leading industrial and technological solution. Designed to meet the challenges of precision, miniaturization, and performance, it serves the medical technology, watchmaking and luxury goods, micromechanics, and broader high-precision manufacturing sectors. Its capability to produce complex parts enables the machining of sophisticated geometries with extremely tight tolerances across a wide range of materials, including steel, stainless steel, titanium, advanced high-performance alloys, non-ferrous metals, and precious metals such as gold and platinum.

Medical technology

This versatility opens the door to numerous high-value industrial applications. In the medical sector, the Bumotec 171 supports the production of orthopedic

7% energy savings per part produced

implants, surgical instrument components, minimally invasive devices, bone fixation systems, as well as components for diagnostic and analytical equipment.

Watchmaking and jewelry

In the watchmaking and luxury industries, it enables the manufacture of highly complex movement components, technical watch cases, precision jewelry parts, and miniaturized mechanisms incorporating noble and innovative materials.

Precision micromechanics

The capabilities of the Bumotec 171 also extend to micromechanics and advanced technology sectors, supporting the production of components for high-performance connectors, sensors, optical equipment, precision measure-



ment devices, and subassemblies for aerospace, space, and defense applications. Its ability to machine demanding materials such as titanium and advanced-performance alloys enables manufacturers to meet the strictest requirements for mechanical strength, dimensional stability, and lightweight performance.

By combining technological excellence, material expertise, industrial flexibility, and economic competitiveness, the Bumotec 171 provides a sustainable response to the current and future challenges of advanced manufacturing industries. It supports the most demanding manufacturers in developing increasingly innovative, high-performance, and miniaturized products while ensuring the highest standards of quality, traceability, and reliability. ▀

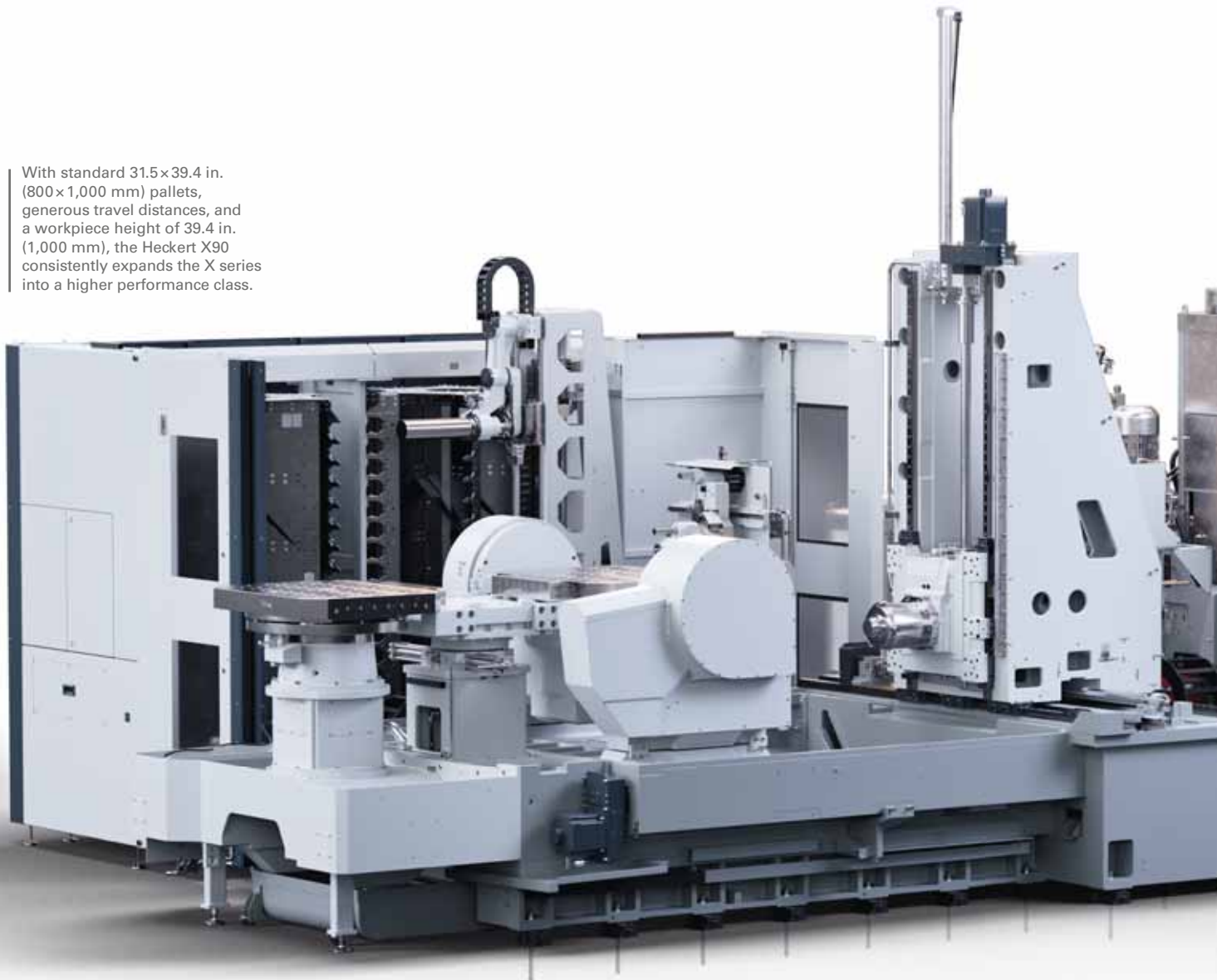
Heckert X90

5 axes

A new dimension

Until now, anyone wanting to machine workpieces of this size in five axes had to resort to significantly larger machine concepts.

With standard 31.5×39.4 in. (800×1,000 mm) pallets, generous travel distances, and a workpiece height of 39.4 in. (1,000 mm), the Heckert X90 consistently expands the X series into a higher performance class.



With the Heckert X90, Starrag pushes this boundary further. For the first time, a compact horizontal machining center from the Heckert X series can machine workpieces weighing up to 4,409 lb. (2,000 kg) and measuring up to 63 in. (1,600 mm) in diameter.

A new performance class

With standard 31.5 × 39.4 in. (800 × 1,000 mm) pallets, generous travel distances, and a workpiece height of 39.4 in. (1,000 mm), the Heckert X90 extends the X series into a higher performance class. For the first time, the proven machine concept of this series is also available for workpieces of this size, combining this new scale with the proven dynamics and precision of a compact horizontal machining center.

Process stability as standard

Large chip volumes place high demands on chip evacuation. The kinematics of the Heckert X90 actively support this process: by tilting the workpiece, chips can be

directed out of the working area. Hot chips leave the working area quickly, significantly reducing heat buildup, chip accumulation, and the risk of subsequent issues. The result is stable processes and longer tool life.

Complete machining with Heckert DNA

Like all machines in the X series, the Heckert X90 features an integrated tilting rotary table, short force paths, and a rigid machine structure. This enables the cost-effective complete machining of complex workpieces in as few set-ups as possible. Large tool magazines, short non-productive times, and a wide range of automation options make the Heckert X90 a high-performance solution for demanding manufacturing tasks. ▀

Footprint

350.4 in. × 81.1 in.
(8,900 mm × 4,600 mm)

Travel distances

X: 68.9 in. (1,750 mm)
Y: 51.2 in. (1,300 mm)
[optional 55.1 in. (1,400 mm)]
Z: 55.1 in. (1,400 mm)
[optional 70.9 in. (1,800 mm)]

Interference circle diameter

63 in. (1,600 mm)

Workpiece height

39.4 in. (1,000 mm)

Maximum load capacity

4,409 lb. (2,000 kg)

Potential savings compared to a large machining center

- Investment costs
- Transportation costs
- Foundation
- Floor space
- Machining process



Like all machines in the X series, the Heckert X90 features an integrated tilting rotary table, short force paths, and a rigid machine structure.

A photograph of industrial machinery, possibly a conveyor system or a large machine with rollers. The image is partially obscured by a large, semi-transparent red rectangular overlay in the lower right quadrant. The text "When a retrofit is the better investment" is written in white, sans-serif font within this red area. The background shows metallic surfaces, bolts, and a white rectangular component.

When a retrofit
is the better
investment



It turned out that giving the existing machine a second life, rather than replacing it, was the better solution. Through a comprehensive retrofit, Starrag made a tried-and-tested vertical lathe ready for the future – and turned NEUMAN & ESSER into a committed retrofit user.



Ultimately,
confidence in
Starrag's retrofit
expertise was the
deciding factor.

"The required capacity was available, and the machine's mechanical components were still in perfectly solid condition," recalls Simon Prell, Head of Machining at the NEUMAN & ESSER machine shop in Übach-Palenberg near Aachen, Germany (NEA GROUP).

Retrofit instead of buying new

In fact, the replacement of the 26-year-old Dörries CONTUMAT VCE 2000/180 had already been planned and budgeted for. But the conditions were far from ideal. Replacing it would have required extensive foundation work and a production shutdown of at least six months. In close collaboration with Starrag, the decision was made to carry out a comprehensive retrofit. Ultimately, confidence in Starrag's

retrofit expertise was the deciding factor. The company manufactures compressors for applications including technical gases and the hydrogen industry. It also manufactures machinery and equipment for mechanical process engineering. Mechanical manufacturing primarily produces large, custom-made components for one-off items and small production runs. Consequently, the requirements for precision, reliability, and availability of machine tools are correspondingly high.

Starrag technology: proven in complete machining

For many years, the machine shop has relied on Starrag machine tools for its mechanical manufacturing operations.

They have proven themselves in the complete machining of complex machine components – such as the complete machining of crankshaft housings weighing several metric tons for piston compressors on a Droop+Rein T series gantry machining center, which has been in continuous three-shift operation since 2011.

The Dörries CONTUMAT VCE 2000/180 has proven itself to be just as reliable – and has been doing so for more than a quarter of a century. This compact single-column vertical lathe machines

large rotationally symmetric workpieces such as cylinders, cylinder liners, and pistons, as well as complex replacement and repair parts. The range extends from solid cylinders to thin-walled cylinder liners with strict requirements for wall thickness accuracy. In addition, there are pistons with diameters of up to 51.2 in. (1.3 m). Whether it's new machinery, spare parts manufacturing, or repairs – tolerances in the hundredths-of-a-millimeter range are required for both inner and outer diameters. Its high precision, robustness, and – above all – its exceptional long-term accuracy made the machine the ideal candidate for a retrofit.

It's no coincidence: The vertical lathe had proven its worth in daily use for decades. Its solid cast components form a robust

machine base that can handle both high cutting forces and machining operations in the hundredths-of-a-millimeter range. This combination of precision and durability has proven its worth, especially in the demanding spare parts and repair business.

Focus on support and control

The retrofit focused on the two assemblies where the machine's age was becoming increasingly apparent – the tool carrier unit of the vertical lathe (support) and the control system. The support system at the Starrag plant in Mönchengladbach, Germany, was completely overhauled and updated to the latest state of the art, and, among other things, equipped with a new Z-axis drive. At the same time, the machine was equipped

with a completely new electrical system featuring SINUMERIK ONE, new drives, measuring systems, a switchgear, and a control panel.

In collaboration with the maintenance department, the modernization measures were designed early on to ensure cost-effectiveness and minimal downtime. "Support and control – those were the two areas where we saw our main challenges," says Simon Prell. "The fact that we focused specifically on these areas has resulted in the machine now being in like-new condition again."

The focus was not on replacing an older control system. In collaboration with Starrag, the vertical lathe was equipped with a control system that closely mirrors



"It's incredibly easy for operators to switch to a different machine and start using it right away."

Simon Prell, Head of Machining,
NEUMAN & ESSER





A retrofit may be the more cost-effective and, at the same time, high-performance solution.

that of the newer machine tools in the plant. As a result, operators today can switch between machines with virtually no adjustment period. "Job rotation has become possible," says Simon Prell. "It's incredibly easy for operators to switch to a different machine and start using it right away." He rates the implementation as "absolutely satisfactory." By 2027, the company plans to convert all of its machine tools to a standardized Siemens control concept.

Get up and running immediately thanks to a quick restart

The success of the retrofit became apparent immediately after commissioning.

Despite the completely new control system, the machine shop had the vertical lathe back in full production as early as the following week. After a brief on-site training session, the operators were able to get to work effectively straight away. Simon Prell says, "We were productive right away. That was actually the biggest benefit for me." The unavoidable downtime was limited to just twelve weeks. For Simon Prell, another key to success was the close collaboration between the Starrag retrofit specialists and the company's own maintenance team. "It's always very important to us that there's good cooperation between our maintenance team and the service representative," he emphasizes. The key factors here are the available expertise and "clear communication on an equal footing."

The real test didn't begin until after the system went live – during day-to-day production operations. However, spectacular increases in productivity were not the goal of the retrofit either. Even before the modernization, the vertical lathe was operating at a high level. "We were never at a low level.

But we've really stepped it up a notch," Simon Prell sums up. He sees improvements mainly in productivity, machine availability, ease of use, and machining quality. However, he says that it is difficult to provide specific figures. "You have to be realistic about that. We're looking at an improvement in the single-digit percentage range." He adds that, as a typical custom manufacturer with small batch sizes, it is difficult to quantify such effects precisely anyway. For NEUMAN & ESSER, the consistently high quality of the workpieces is more important than the actual processing time.

Satisfied employees increase productivity

This reliability really pays off, especially in the spare parts and repair business. Unlike in mass production, no two orders are alike. "I've got great confidence in the machine and its reliability," says Simon Prell, describing his confidence in the modernized vertical lathe. "It impresses with its solid and sturdy construction." His team, too, still really enjoys working

on the machine. The key factors are the machine's ease of access, spacious work surfaces, and high level of user-friendliness. For the department head, the successful retrofit therefore has significance that extends far beyond this single project. While modernization was rarely

considered in the past, it is now an integral part of the company's investment strategy. "It will remain a path forward in the future – and always an option," says Simon Prell. This approach is particularly effective for tried-and-tested machines, as it helps maintain productivity, make

optimal use of existing infrastructure, and significantly reduce downtime compared to a new installation. Following his positive experiences with grinding and now also with vertical turning, he intends to continue down this path.

Sometimes a retrofit is all it takes

Starrag is an important partner on this journey. Following the successful retrofit of the Dörries vertical lathe, the next modernization project is already on the horizon – a Scharmann boring mill. For the head of production, this is a logical step. If the mechanical components are in good working order, a new machine isn't necessarily required. In such cases, a retrofit may be the more cost-effective and, at the same time, high-performance solution. ▀

"We were productive right away. That was actually the biggest benefit for me."

Simon Prell, Head of Machining,
NEUMAN & ESSER





When modernization delivers the best business case

Two 52.5 ft (16 m) Starrag 5-axis gantry machining centers from the Droop+Rein product range, each with more than 15 years of continuous aerospace production, have been modernized to deliver another two decades of highly productive machining. By preserving a highly validated manufacturing process while introducing the latest control, drive, and monitoring technologies, Starrag helped a world-leading aerospace manufacturer extend the value of its existing assets with minimal disruption to production.

The phased modernization program was carried out by Starrag for a leading aerospace manufacturer producing critical components. While one machine remained in production, the other was stripped back and rebuilt. Once the first machine was proven, the process was reversed, and both Droop+Rein FOGS machines were handed back on time and on budget. For this customer, the economics strongly favored modernization because the machine structures remained mechanically sound and fully integrated into a highly optimized production cell.

The project was completed cost-effectively, while also avoiding the significantly longer lead times associated with commissioning a new large-scale machine tool. "The machine was only down seven months, compared with buying a new machine, which would take around two years. That represents significant cost savings," says Starrag USA Service Manager Stephen Barclay. What the customer received was not simply more of the same. Both machines returned with entirely new electrical infrastructure, the latest-generation Siemens CNC, the latest drives and

motors, volumetric compensation across the full working envelope, and sensor-level data capture supporting predictive maintenance. The modernization improved reliability, performance, functionality, and visibility while preserving the manufacturing process on which the customer depended. The Droop+Rein FOGS overhead gantry 5-axis machines were originally installed in 2004 and 2011, respectively. "To give you a perspective, they're approximately 52.5 ft (16 m) long, 19.7 ft (6 m) across, and 8.2 ft (2.5 m) tall, and they're designed to machine very large

aircraft and fuselage components with very, very high precision,” says Stephen Barclay, who oversaw the program and coordinated it with Starrag’s engineering teams in Germany. At this scale, precision is expressed volumetrically rather than linearly. “The target is to position the tip of the cutting tool, which is moving in a 5-axis environment, within a 55-micron sphere anywhere in the working envelope,” explains Stephen Barclay. Both machines have maintained that precision, or better, through more than 15 years of continuous 24/7 production.

Evaluating replacement versus modernization

The two machines operate in a 34 °F (1 °C) temperature-controlled room as part of an integrated pallet-based cell incorporating a

dedicated CMM, wash and dry stations, and load/unload stations, with 45.9 ft (14 m) pallets shuttled between work zones. At this level of aerospace manufacturing, a stable, serialized environment is essential. “What typically wears out on these machines are cables, electrical components, and, in this case, the machine’s control system, which was simply no longer supported,” says Stephen Barclay. “It’s like computers. Even though the computer is working perfectly well, it reaches end of life and isn’t supported anymore. When the customer still needs the equipment, it can make excellent business sense to modernize. I would use the word ‘re-lifting,’ simply because of the investment in the foundation and large structural components.” Starrag evaluates each project individually.

In situations where customers require increased capacity, larger working envelopes, new machining capabilities, or substantial productivity gains, a new machine may offer the strongest long-term business case. In this instance, however, the existing machine structures remained exceptionally capable, and the customer’s highest priority was preserving a proven aerospace manufacturing process. Modernization therefore provided the optimal route to achieving those objectives. The conversation began in 2018, long before any purchase order, and both modernization and replacement options were carefully evaluated. The customer’s engineers traveled to Europe to witness the acceptance of a new FOGS machine at another user’s facility. “I think this was a decisive point, and everyone was comfortable proceeding with the retrofit rather than installing new,” says Stephen Barclay.

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“To give you a perspective, they’re approximately 52.5 ft (16 m) long, 19.7 ft (6 m) across, and 8.2 ft (2.5 m) tall, and they’re designed to machine very large aircraft and fuselage components with very, very high precision.”

Stephen Barclay, Starrag Service Manager, USA

Protecting the process

The most demanding requirement was continuity, not speed or accuracy. “The customer wanted to minimize disruption and internal requalification effort,” says Stephen Barclay. “Any significant change



“The entire electrical cabinet was assembled, pre-tested, and ready to go.”

Stephen Barclay
Starrag Service Manager, USA

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to the production platform would have required extensive process validation, programming, and qualification work. A key requirement was that the machine had to run all existing code, use all existing tooling, and integrate seamlessly into the established production environment. By maintaining the proven machine architecture while upgrading the technology platform, we were able to preserve validated manufacturing processes and minimize operational disruption.”

In aerospace, that is not merely a convenience. It is a compliance requirement. “Aircraft parts are like medical parts. You can’t just randomly decide to build them differently. Every component is serialized. The manufacturing process is proven and carefully controlled,” Stephen Barclay says.

That principle shaped the technical scope. A completely new electrical cabinet was installed, along with all cables, sensors, and drive modules. Drive motors were replaced with the latest-generation Siemens units, physically smaller, equal in power, and significantly more energy efficient, across two 52.5 ft (16 m) machines operating around the clock.

The CNC was upgraded to the latest Siemens platform, resolving the obsolescence issue that triggered the project



while introducing the latest Sinumerik motion-control packages, including MDynamics and Engineered Motion Control. Spindles and other major mechanical components were deliberately left unchanged. “It was their decision not to replace the spindles with a different design,” Stephen Barclay explains. “They preferred to exchange them for refurbished and repaired versions. This ensured that the critical mechanical components remained in good condition, while avoiding changes that could have affected their process.” One upgrade

went beyond the original project scope. Both machines moved from Starrag’s standard Kinematic Management System (KMS) to Starrag’s upgraded Volumetric Compensation System (VCS), which corrects geometric deviations throughout the machine’s working volume from within the CNC rather than relying solely on mechanical accuracy. The benefits include improved tool-tip positioning during fully interpolated 5-axis movement and enhanced surface quality, exceeding the equal-to-or-better performance standard Starrag was contracted to achieve.

Compressing seven months of downtime

Downtime governed every aspect of the project. With one machine out of service, the manufacturer increased inventory levels of key components and absorbed the lost capacity internally rather than transferring work elsewhere. That left no margin for schedule overruns. "If the machine was down longer than we agreed, this would have had a serious impact on their ability to meet production requirements," says Stephen Barclay.

The solution was to move as much work as possible off-site, with more than 18 months of procurement and preparation completed before work began on the first machine. "Subassemblies were all pre-manufactured and packaged at our facilities in Germany. The entire electrical cabinet was assembled, pre-tested, and ready to go," says Stephen Barclay. The cable tracks carrying signal wiring, hydraulic lines, and pneumatic hoses

along the full 52.5 ft (16 m) axis length were built and tested at the factory. "Our role was to remove the old and install the new." Supporting the effort was more than 20 years of retained engineering data.

"The FOGS machines are all customized to fit the customer's facility. We retain the original build specifications, so we can access them even 20 years later. This information was critical to supporting the retrofit," says Stephen Barclay.

Progress was tracked against a schedule containing hundreds of subtasks through joint biweekly review meetings, and a 12-week proving period between the two

machines was completed successfully. Starrag also embedded application support engineers alongside operators during the transition to the new HMI.

From reactive to predictive

The most significant functional gain from the modernization was not accuracy, but visibility. "The new control simplifies data collection from the machine for the customer. We're talking about every switch and sensor. One sensor can now collect temperature and pressure-vacuum information together. These sensors will even tell you the gas pressure in the refrigeration units, which they didn't do before.

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"The new control simplifies data collection from the machine for the customer."

Stephen Barclay, Starrag Service Manager, USA



Modernization with visible impact: the retrofit brings the machine up to date, both technically and visually.

The customer can acquire more data points than ever before, creating much greater visibility into trends and potential failure points, something that simply wasn't possible more than 20 years ago." That capability feeds a dedicated in-house analytics function. "It's all about identifying trends that improve equipment uptime and overall production performance within the factory. It allows you to capture data that wasn't visible before and use it to improve productivity while reducing the risk of unplanned stoppages," Stephen Barclay says. The cell also retains Starrag's Self-Qualification System (SQS), which runs every three months. The machine parks its milling

spindle, picks up a laser spindle, and measures its own volumetric accuracy across the entire travel range using permanently mounted optical mirrors, generating a health report on the machine's primary axes.

Proven before and after

Nothing was left to assumption. A complete machine measurement and a customer-selected test component were evaluated before work began and then repeated after completion of the project. "Everything was equal to or greater than the original values. That was the agreement. We guaranteed that every feature

and every performance parameter would be as accurate and productive as before, or better," confirms Stephen Barclay.

As a manufacturer serving the defense industry, the customer also conducted cybersecurity reviews in parallel. Software versions, build dates, and supporting infrastructure were verified well in advance to ensure compliance with the customer's cybersecurity requirements. This project demonstrates Starrag's ability to support customers across the entire equipment lifecycle. Whether the right solution is a new machine, a strategic modernization program, or a combination of both, Starrag works with customers

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"We guaranteed that every feature and every performance parameter would be as accurate and productive as before, or better."

Stephen Barclay, Starrag Service Manager, USA





"The field team Starrag applied to our project is absolutely superb and has been key to our collective success."

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to identify the approach that delivers the strongest operational and economic outcome for their specific production requirements.

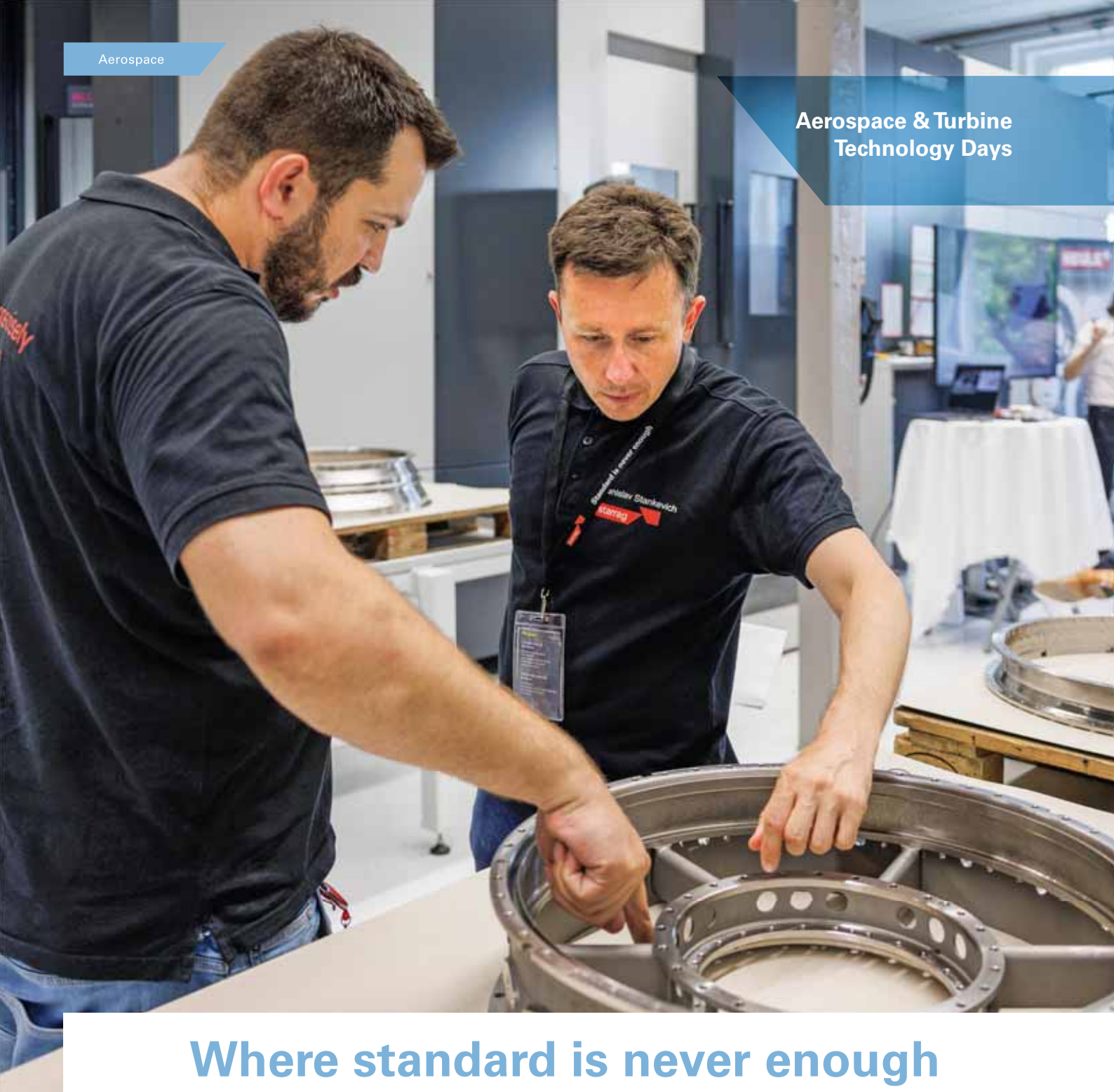
The manufacturer's critical systems lead described Starrag's execution as "back-to-back home runs." The customer's internal systems lead and Facilities Principal Engineer for the project said: "There are times in our lives when the phrase 'When you see something, say something' is overwhelmingly applicable. The excellence I've witnessed in the Starrag team during the FOGS retrofit projects is very much worth noting because it's rare to

see in today's challenging business environments. But seeing is believing. From new material containerization and staging to on-site work execution, and the engineering and packaging that took place in Germany prior to deployment, it all showed that Starrag diligently adheres to the 'Proper Planning Prevents Poor Performance' paradigm. It was on full display throughout this project.

I've seen the two projects unfold flawlessly because of your team's organizational excellence. Frankly, the field team Starrag applied to our project is absolutely superb and has been key to our



collective success." He added: "The Starrag team has been top-shelf throughout the retrofit work carried out here in Texas. Frankly, the project execution has been the best I've seen in my 49 years in industry. You've all knocked it out of the park with back-to-back home runs." ▀



Where standard is never enough

Efficient production for the aerospace and energy industries

Rising production rates, skilled labor shortages, and increasingly complex components are continuously transforming manufacturing in the aerospace and energy industries. How can these challenges be addressed? Planners, manufacturing managers, and production specialists found the answers at the Aerospace & Turbine Technology Days held in June 2026 at Starrag headquarters. The focus was not on standard machines, but on integrated manufacturing processes, digital tools, and automation concepts.

Temperatures above 86 °F (30 °C) in the height of summer initially had participants at the 26th Starrag Aerospace & Turbine Technology Days breaking a sweat. But the host, Starrag, was well prepared: The large event tent was air-conditioned, and a steady supply of bottled water and other refreshments was available throughout the halls of the Aerospace and Turbine Competence Center, where the displayed systems and machines generated additional heat.

Martin Buyle welcomed around 250 guests. "A new record," said the CEO of the Starrag Group. Among them were nearly 170 customers from 24 countries, as well as prospective customers and representatives of partner companies who had accepted the exclusive invitation. All major aircraft manufacturers, OEMs, tier-one suppliers, and power plant turbine manufacturers were represented. "Customers from the Americas,

Asia, and Europe traveled to Rorschacherberg, Switzerland, to take part in our industry event," added Martin Buyle's fellow Executive Board member, Alexander Attenberger, who is responsible for Starrag's sales operations.

Growth is creating production bottlenecks

The aerospace industry is currently in a growth phase, and experts agree that it will continue to expand in the coming years. However, precisely because the order books of major aircraft and

engine manufacturers are full, their production managers and suppliers are coming under increasing pressure. Production rates must increase, lead times must be reduced, and the shortage of qualified skilled workers also calls for new manufacturing concepts.

"This is exactly where we come in," says CEO Martin Buyle. "We do not offer our customers standard machines, but precisely the manufacturing solutions they need now. Here at our headquarters in Rorschacherberg, which is fully specialized in the production of complex components for the aerospace industry as well as gas and steam turbines, we inform the global industry community about the latest developments and create opportunities for in-depth discussions," emphasizes Martin Buyle.

Automation and digitalization take center stage

The event was particularly valuable for planners, manufacturing managers, and production specialists, who are often faced with the challenge of transitioning from largely craft-based, one-off production to serial manufacturing. Accordingly, automation and digitalization were central themes throughout the entire event. The importance of digitalization and automation was highlighted right at the beginning by Andreas Haimer, President of the HAIMER Group and a member of the Supervisory Board of Wintool AG, in his keynote presentation: "These are no

A new record, nearly 170 customers from 24 countries and 250 guests



"We do not offer our customers standard machines, but precisely the manufacturing solutions they need now."

Martin Buyle, CEO Starrag



longer options today, but a necessity – especially for companies that want to continue manufacturing economically in Europe or other high-wage countries in the future. The goal must be to standardize, digitalize, and gradually automate manufacturing processes.”

His particular focus is on the shop floor: “CAM systems and NC programs operate digitally – but tool management hardly does. This is exactly the gap we are closing with our ‘Tool Room of the Future’ concept.” By this, Andreas Haimer refers to an end-to-end process that covers everything from toolholder selection, storage, assembly, and tool provisioning through to the machine. At the same time, the analog processes are digitally replicated – from creating the digital twin and transferring the data back to the CAM system, to inventory management, tool preparation, and ultimately production. The benefits: simplified simulation,

**“Artificial intelligence
will be the defining
technology of the
coming decade.”**

Prof. Dr. Oliver Gassmann
HSG St. Gallen, Technology
Management

reduced setup times, and improved process reliability. Since such a ‘Tool Room of the Future’ is already a reality at Starrag, participants were able to see the presented solution firsthand on site.

The second guest speaker went one step further. Dr. Oliver Gassmann devoted his presentation to AI applications in industry. “Artificial intelligence will be the defining technology of the coming decade,” says

the Professor of Technology Management at HSG St. Gallen. He believes AI has enormous potential for all manufacturing companies. However, he also cautions: “To realize these benefits, we must rethink our workflows and processes. It is not enough to simply buy the latest AI tools. It is essential to train employees so that they can truly use the systems and unlock their full potential.”

13 stations – 13 highlights

From theory back to practice. Starrag had set up 13 stations, which participants visited in small groups. “Our focus is not on product presentations – we are committed to showcasing practical solutions that deliver real added value for our customers,” emphasizes Alexander Fitz, Starrag Sales Manager Aerospace & Turbines. “We planned and implemented these solutions together with trusted, specialized technology partners – Blum,

Fanuc, Haimer, Heule, Hexagon, Liebherr, Schunk, Siemens, and Vericut." Each station highlighted a specific application or technology that is particularly relevant to Starrag customers. This showcases the broad range of specialized expertise available within the Group. The machine portfolio ranges from compact machining centers such as the Bumotec 191^{neo} turn-mill center, which demonstrated the fully automated, ultra-precise machining of fuel injection nozzles without operator intervention, to the massive Droop+Rein FOGS series machining centers, which are used to manufacture components such as landing gears. Structural components made of aluminum and titanium, casings, turbine blades, and blisks are the key workpieces for which Starrag

machines are ideally suited. The topic of "Automation of Large Machine Tools" attracted considerable interest. This is because it places special demands on the conveyor technology, pallets, clamping systems, and measurement technology used. A special project is currently being implemented by Starrag in the USA together with Liebherr Automation Systems: a flexible manufacturing system for the overhaul of engine components. It comprises eleven Starrag machines. These include Berthiez machines VT 20 and RVU 1350 for vertical turning and grinding, as well as five-axis Heckert X90 MT machining centers and large Starrag STC 1250 MT machining centers. A highlight is the 64 pallets supplied by Starrag, which are used on all four machine types.

The final word goes to a participant: "The Starrag Technology Days are an excellent opportunity to learn about new developments and take away inspiration for our own production. What I find particularly impressive is the consistent integration of complete manufacturing processes – from machining and downstream processes through to automation. I am taking numerous ideas back to our company that will help us improve our processes and ultimately deliver an even better product to our customers. A big thank you to the excellent organization of the event, which not only made the hot temperatures bearable but also always allowed time for interesting discussions with colleagues from other countries." ▀



The topic of "Automation of Large Machine Tools" attracted considerable interest.



TTL invests in Heckert X50 for high-value aero engine work

For a company that has built its reputation entirely on software, ordering a Heckert X50 5-axis machining center might seem like a change of direction. For TTL, the Buckinghamshire specialist in adaptive machining and digital manufacturing, it is the logical next step for a business whose customers now trust it with projects where components can reach six-figure values per part.

Founded in 1987 and based near Aylesbury, TTL has spent almost 40 years solving the problems that sit between a CAD model and a finished part. It develops customized CAD/CAM/CNC solutions built around Siemens technology, specializing in adaptive machining, digital twins and in-process control for aero engines, defense, nuclear, medical and precision manufacturers worldwide, with around 85% of its customer base outside the UK. TTL has been owned by Starrag for more than 15 years but operates as a standalone business unit with its own structure and IT systems. "TTL is an independent business unit which deals solely with software, and our solutions are all around Siemens NX and dealing with adaptive machining,"

says Simon Rogers, Vice President at TTL. In December, the company will take delivery of a Heckert X50 5-axis horizontal mill/turn machining center – the sixth machine at the Haddenham facility, and the first TTL has bought from its parent group.

The reason for the investment

"Jet engine components, repairing HPC blades, repairing blisks – that is something we're deeply embedded in, so we needed to invest in the best technology available, and the choice was a machine from Starrag. The Heckert X50 mill/turn capable machine is going to be at our facility later this year. It wasn't purchased because we're part of Starrag, it was

acquired on its technical attributes and the fact that a lot of our global customer base has invested in Starrag technology."

The driver is the changing value of the components that TTL's customers ask it to process. Automating the repair of a single blade is one business case; an integrated bladed rotor is another entirely. "With components being repaired which are single blade, you can imagine it could be a \$500 part, but \$1,500 in cost. Now, with the complex integrated bladed rotor (IBR) or blisk component, those numbers could be 10X and \$50,000 to \$150,000. To automate the repair of those components with our technology and the Heckert X50 is a significant commercial advantage," adds Paul Whistance, Finance Director at TTL.

A major factor in the purchasing decision was a multi-machine adaptive machining requirement for a major US defense program, on which TTL is working alongside Starrag as process and software partner. The US defense program has made a significant long-term investment in the Heckert X50, so purchasing the same machine enables TTL to develop, prove



“To automate the repair of components with our technology and the Heckert X50 is a significant commercial advantage.”

Paul Whistance, Finance Director, TTL

and optimize the customers’ processes at Haddenham rather than at the customer sites worldwide.

The gap in the business

TTL’s five existing machines are small to medium-sized 5-axis platforms, acquired from outside the group to suit lower-value repair work while also operating a range of different CNC control systems. As components have grown in value

and complexity, that installed base has reached its limit. “We’ve historically opted for non-group machines because our customers required a lower-cost, entry-level multi-axis machine,” says Simon Rogers. “A \$500 part repair is a different business case from remanufacturing or manufacturing higher-value components. This is where our need and interest in Starrag machines have sparked. The business case drives us towards the technology, and as our technology becomes capable, we have to move towards more capable machines.”

The machine

The Heckert X50 is a horizontal machining center with a trunnion table, giving short force paths, high structural rigidity

and complete 5-sided machining from a single clamping as well as turning capability. For TTL, that trunnion arrangement is the most important feature on the machine. “It’s a trunnion-type machine, so that gives us the ability to move the components, which is huge for us in terms of dynamic capability,” says Simon Rogers. “The speed at which we can keep the tool tip in contact with a component, such as an aerofoil, is significantly improved. Additionally, the diameters we can reach are nearly twice those of the other platforms we have. This is significant for TTL.” The machine also delivers considerably greater component height, opening up the mid-sized casings TTL previously could not accommodate, including the flanges and ports involved in casing remanufacture.

"The machine has an 18,000 rpm motor spindle, 5-axis milling and turning capability, and the ability to tap into all of those functions, with the added ability to mount an angle head and the security of the hybrid bearings, is what makes this the ideal machine. It has very high precision, incredible resonance control and unparalleled dynamics. That is why we've selected it. We honestly believe this has capabilities that far exceed what other machines can provide."

The machine is supplied with the latest Siemens Sinumerik control, which matters for a business whose entire toolset is built on Siemens technology. TTL can develop and validate a process end to end, from the CAM environment through to the control that will run it on the customer's shop floor.

The benefits

TTL's work typically divides into two streams. One is new part manufacture from castings and forgings where the challenge is best-fit alignment in six degrees of freedom; and the second is MRO, where the component no longer matches the model from which it was produced. "Components in service are obviously not the shape they were when they were manufactured by design, so they're not the same as the CAD model," explains Simon Rogers. "This is where we have to adjust for deviation or shape change caused by stress or heat deformation, using an automatic measurement workflow that can scan and utilize probing data. By measuring, we can then

auto-calculate the new CAD model shape in the software to make new tool paths, new post-processor code, new simulation, and then new G-Code that's going to successfully process that part. The prize is the elimination of hand finishing."

"Very simply, you can machine so far, and then you have to stop; otherwise you're going to scrap the component. So you have to leave some stock, and that means high blends or high stock levels. Then you have to go to a manual hand blending or die grinding process, and that means RSI. It has health and safety challenges, especially with Inconel and titanium polishing and grinding processes. We have some customers that have applied the technology and no

longer need hand finishing processes for their product to get back into service. This is a significant benefit."

The perfect fit

The X50 is the smallest machine in the Heckert X series, which is precisely why it suits TTL – a development and turnkey specialist rather than a subcontractor, with a facility sized accordingly. "TTL has a geographical limit with our building, so we typically use small to medium-sized machines," says Simon Rogers. "For us, the Heckert X50 is a large machine for our facility, and it allows us to handle a medium-sized gas turbine component, as it has a big swing with certain configurations. When it comes to a customer

"We use our skills, our experience, our engineering knowledge to solve problems that others cannot solve."

Simon Rogers, Vice President, TTL

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“Five years ago, more than 90% of our business was outside of Starrag, now it’s 50%.”

Simon Rogers, Vice President, TTL

program, we can align very quickly with an X70 or an X90 for the larger component types.”

That scalability matters as processes proven on the Heckert X50 at Haddenham transfer directly onto larger machines in the same family at customer sites. It will also serve as a test bed for machining hard metals. “It’s a decision not made just by TTL; it’s a decision made by customers,” says Simon Rogers. “We like to follow what the end users choose. They’ve chosen Starrag for reasons based on cutting trials, based on assessments and specifications, and ultimately, I agree with them in this case.”

The bigger picture

The order marks a broader shift in TTL’s relationship with its parent. “Five years ago, more than 90% of our business was outside of Starrag, now it’s 50%,” says Simon Rogers. Many of Starrag’s global target audience in the aerospace, marine, defense, nuclear, medical and luxury goods sectors are standardizing on Siemens NX. This is where TTL’s expertise in applying that technology has become a route back into accounts for Starrag brands across the group. The Heckert X50 machine will also serve as a showcase. Starrag UK will offer open access for demonstrations and customer

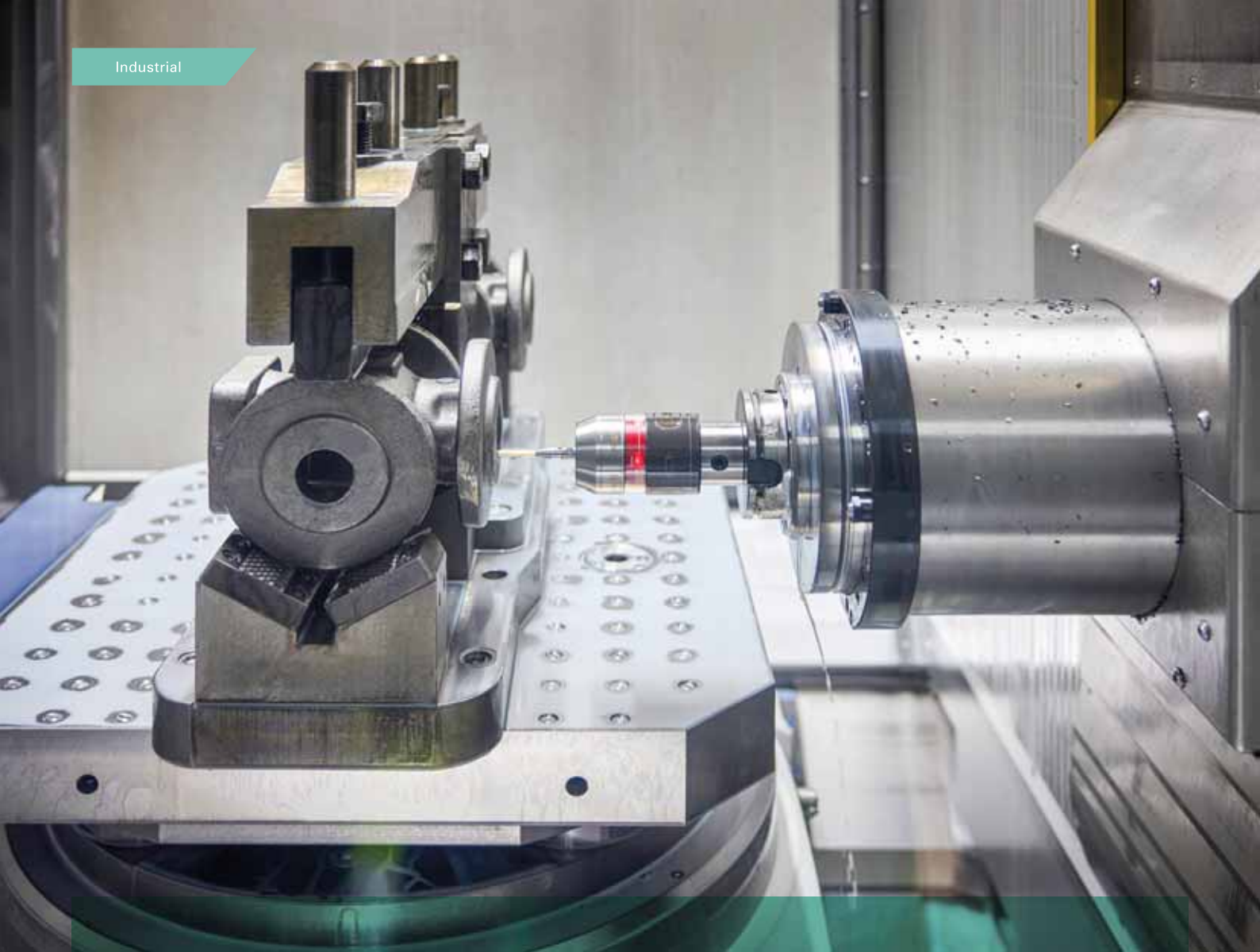
visits, giving prospective buyers the chance to see the Heckert X50 running real aerospace processes rather than sample cuts. “We use our skills, our experience, our engineering knowledge to solve problems that others cannot solve. By having access to these machines locally, we can increase the capability both for us, and for the wider group, taking business to the next level. We now have that capability in-house, and we can be a center of excellence to use this machine at a higher level than anybody else,” concludes Simon Rogers. The Heckert X50 arrives at Haddenham in December, ahead of TTL marking its 40th anniversary in 2027. ▀





No setup times for a batch size of 1

Two linked Heckert H80 machining centers
ensure efficient valve housing machining



What can be done to make single-part and small-batch production at facilities in Germany globally competitive? SAMSON, a manufacturer of specialty valves, chose a solution from Starrag as the general contractor. It consists of two Heckert H80 machining centers, fully automated by an Erowa Load-Master Compact pallet system, which enables the machines to operate autonomously for many hours using up to 69 preconfigured pallets. The system is complemented by a Gebhardt material storage system, which automatically provides the appropriate raw materials for loading based on the production order.



“As part of establishing the new site, we have the opportunity to comprehensively modernize our machine fleet and replace around 40% of it.”

Alexander Eppl
Head of Manufacturing
Technologies, SAMSON

SAMSON AG, a global provider of valve and process technology solutions, is undergoing the largest transformation in its history. The company’s headquarters is being relocated from Frankfurt to Offenbach, including more than 120 machines and systems, as well as nearly 2,000 employees covering the full range of functions, from administration and development to production, sales, and service.

The relocation brings many advantages, as Dr. Alexander Eppl, Head of Manufacturing Technologies, explains: “Over the past 120 years, we have grown significantly here in Frankfurt, and we have now reached structural limits in terms of space and intralogistics. In Offenbach, we can completely reorganize our operations

across approximately 1,506,900 sq ft (140,000 m²) and continue to grow.” Alexander Eppl is responsible for the redesign and relocation of the manufacturing operations: “As part of establishing the new site, we have the opportunity to comprehensively modernize our machine fleet and replace around 40% of it. In doing so, we are laying the foundation for an efficient, future-oriented manufacturing operation that can compete successfully on the global stage.”

Focus on automation

Since the beginning of 2026, the manufacturing operations have been relocating approximately 120 machine tools in phases while maintaining full production capacity. The installation of new equipment

is also well underway, with a strong focus on automation. “Our goal is to increase productivity and address the skilled labor shortage through unmanned shifts,” emphasizes Alexander Eppl. “To achieve this, we need to decouple employees’ working hours from machine operating times and eliminate setup times.”

The challenge is that SAMSON’s portfolio of valve housing components is highly diverse, as the company specializes in control valves for special applications. The workpieces vary in terms of the materials to be machined, as well as their geometries and sizes. Very small batch sizes, including single-unit production, are the norm. “That’s why we need a flexible automation solution with preconfigured pallets,” explains Uwe Berger, who is

“Starrag developed the technically best overall solution for us within an affordable cost framework.”

Alexander Eppl
Head of Manufacturing
Technologies, SAMSON



responsible for operations in the Valve Housing department. “Only in this way can we implement unmanned shifts.”

Specifically, the focus is on the machining of valve housings with nominal diameters of up to 5.9 in. (150 mm). In addition, intermediate pieces, insulating components, and similar parts are to be machined in a fully automated process. This work was previously carried out on four-axis horizontal machining centers. “From a machine technology standpoint, they were entirely adequate,” says Uwe Berger. Initially, he did not want to change that in order to avoid unnecessarily increasing the pro-



gramming effort. “However, we adopted Siemens NX as our new CAM platform to ensure reliable machining through simulation using a digital twin. This is a fundamental prerequisite for automated machining.”

Partner sought with automation experience

Since this type of automation was new territory for SAMSON’s manufacturing operations, those responsible looked for a partner with relevant experience – “ideally a German machine manufacturer, as we place great importance on short distances and the fast, reliable service that comes with them,” says Alexander Eppl. The existing machine fleet includes four-axis machining centers from various

manufacturers that generally meet the requirements. However, additional criteria played a role in the selection process. It was particularly important to Alexander Eppl and the SAMSON decision-makers that the machine manufacturer act as the general contractor: “During the relocation phase, we are not in a position to take on the coordination tasks ourselves. We need a reliable partner who understands our requirements and can implement them.”

Three companies were shortlisted. They submitted proposals for an automation concept consisting of machining centers and a pallet system. “Ultimately, Starrag developed the technically best overall solution for us within an affordable cost framework,” explains Alexander Eppl.

"A major contribution to this came from Guido Steinbrück, the Starrag sales representative responsible for our account. He has known our company for many years and is a very good listener. As a result, he quickly understood what was important to us and presented a proposal that was precisely tailored to our needs."

For the flexible manufacturing system, Guido Steinbrück recommended two four-axis Heckert H80 machining centers from the compact modular series developed at the company's Chemnitz plant: "These are space-saving horizontal machining centers with the characteristic Heckert DNA – precise, powerful, fast, and exceptionally reliable over many years." SAMSON has already been gaining experience with a Heckert H80 in valve housing machining for the past two years. Uwe Berger is very satisfied with it: "The machines fully meet our requirements," Uwe Berger confirms. However, with this latest order, he took the opportunity to incorporate a few special requests. One of the Heckert H80

machining centers is equipped with a facing and pull-down clamping function to produce a sealing edge with micrometer-level precision. "We also chose the larger tool magazine with 265 tool positions so that duplicate tools can be loaded, enabling extended periods of autonomous operation."

Heckert compact machines also available in a 5-axis version

Another factor in favor of Starrag as a partner was that the Heckert compact machines are also available in a five-axis version – a key consideration for SAMSON, as the company is currently developing a modular valve platform. The housings

incorporate numerous features, increasing machining complexity and making five-axis machining an attractive option.

"We also intend to manufacture these components in a single setup using automated machining in the future. That is why, when planning our new manufacturing system, we have already reserved a third machine position for a 5-axis machining center."

In this context, Uwe Berger expresses another wish: "In our system, we want to have standardized machine pallets – for the two four-axis machining centers and the future five-axis machining center." No problem for Starrag. This is because Heckert compact machines are designed from the outset for standardized machine pallets.

"The Heckert H80 machining centers fully meet our requirements."

Uwe Berger
Senior Foreman Body
Manufactory, SAMSON



An automation concept that delivers results

Even more important than the proven machines for Alexander Eppe is the automation concept developed by Guido Steinbrück and his team. The Starrag representative gave the SAMSON decision-makers a choice between proposals that he had developed together with three leading pallet system manufacturers.

The contract was awarded to the Swiss supplier Erowa with its LoadMaster Compact 1400. Erowa Sales Manager Alexander Winter explains what makes his system so suitable for this application: "The LoadMaster is a modular, high-performance automation system. With its robust construction and long linear travel axis, it is particularly well suited for supplying multiple machines, which it can connect in a single line with magazines and setup stations."

Compared to the other options, the Erowa LoadMaster resulted in the leanest overall system. Alexander Eppe also highlights a special technical feature of the solution: "We need to be able

to insert the pallets into the rack from both sides and, if necessary, rotate them as well. For this purpose, there is a 360° swiveling function developed by Erowa, which works perfectly."

The LoadMaster system installed at SAMSON provides 69 pallet storage positions. These are equipped with high-precision machine pallets from Starrag – one of the machine manufacturer's core competencies. "At our request, these were fitted with a hole pattern that allows us to mount our fixtures," explains Uwe Berger. "These remain permanently on the pallet, meaning that the setup process for the raw material requires hardly any effort."

High-bay warehouse for raw materials and finished parts

Speaking of raw materials: Guido Steinbrück's proposal to automatically supply the four Erowa loading stations with

blanks stored on Euro pallets was very well received. This is provided by a storage system from Gebhardt, which also accommodates the finished parts and stores them until further processing or completion of the production batch.

Control system manages the entire manufacturing process

To control the orders and all processes – including the precise provision of the required raw materials – a powerful control system is required. "We already use PROCAM's EMS software in other areas of the company," explains Alexander Eppe. "So we also preferred to use this for our flexible manufacturing system. Communication between EMS and the Starrag machines and the Erowa pallet system was not a problem."

Today, PROCAM EMS assumes overall control. This includes, among other

"With its large tool magazine, which holds 265 tools, sister tools can also be loaded."

Uwe Berger
Senior Foreman Body
Manufactory, SAMSON





things, the optimized planning of orders and determining the sequence in which they are processed on which machine. EMS also takes into account constraints such as the remaining tool life, allowing the machines to operate autonomously for as long as possible. In addition, EMS supplies the machines with the respective NC programs.

"The major challenge in digitalization is ensuring a functioning data exchange between different systems," emphasizes Alexander Eppl. "The communication between the control system and ERP system, the tool management system, the CAM and CAQ systems, as well as the CNC – for fully automated operation, this has to work 100% perfectly. These are, of course, tasks that largely fall within our area of responsibility.

But Starrag and Erowa have also been very open and cooperative in this regard." Since May, the flexible manufacturing system has been in operation at the SAMSON plant in Offenbach. Alexander Eppl praises the achievement: "What Starrag accomplished as the general contractor for the new flexible manufacturing system was outstanding. The schedule, execution, and costs have all remained completely on track."

And Uwe Berger is confident that the targets set will be achieved: "At the moment, we are only utilizing the system to around 80% capacity. But we can already see that the setup cost share, which accounted for around 15 to 20% of the total costs for our small batch sizes, is being reduced to almost zero. In addition, this automation will allow us to gain around 30% more capacity compared to two standalone machines." ▀

"What Starrag accomplished as the general contractor for the new flexible manufacturing system was outstanding."

Alexander Eppl
Head of Manufacturing
Technologies, SAMSON

The true magnitude of XXL

What sets modern heavy machinery manufacturing apart



A duo of giants in action: Using two machine tools weighing about 959 US tons (870 metric tons) each, a supplier to the wind power industry machines rotor housings and brake discs up to 29.5 ft (9 m) in size with a precision of ± 0.004 in. (± 0.1 mm).

“XXL” doesn’t refer to the dimensions of a single machine, but rather to the variety of tasks it can handle.

The media loves rankings – the world's largest cruise ships, the fastest sports cars or the tallest skyscrapers. These days, even when it comes to smartphones or coffee makers, hardly any product is introduced without being ranked on a list somewhere.

Even the trade press is following this trend. A few weeks ago, a well-known mechanical engineering magazine published an overview of the world’s largest milling machines. The Droop+Rein FOGS HD from Starrag was also included in the rankings – in an outstanding second place. But size isn’t just measured in feet, tons, or horsepower – in reality, there’s much more to it than that. At Starrag, “XXL” doesn’t refer to the dimensions of a single machine, but rather to the variety of tasks it can handle.

From a turbine blade specialist to an XXL system provider

The real breakthrough into the world of large components began in 1956. With machines for machining turbine blades, Starrag entered the fields of energy technology and aerospace, where the highest precision and ever-larger workpieces go hand in hand.



Ultimately, the targeted expansion of the corporate group paved the way for today’s range. Specialists such as Dörries, Droop+Rein, and Berthiez systematically expanded the range. Starrag consolidated these capabilities into the Large Parts Machining Systems (LPMS) business unit, which combines milling, turning, and grinding for large workpieces.

Landing gears ensure safe landings

In the aviation industry, Starrag demonstrates its XXL expertise not only with massive workpieces but also with critical safety components, where reliability and precision play a key role in manufacturing them. These include landing gear components, which are the parts of a commercial aircraft that are subjected to the greatest stress. They must safely support the entire aircraft weight during every landing while withstanding extreme shock loads, lateral forces, and changes in direction. The requirements for materials, geometry, and manufacturing quality are correspondingly high. New landing gears are made of high-strength titanium or steel alloys; in the future, they may

Size isn’t just measured in feet, tons, or horsepower – in reality, there’s much more to it than that.

also be made of stainless steels that are difficult to machine. Typical examples include blanks with a machining ratio of over 80% and machining strategies in the micrometer range. Machining involves up to 40 steps and includes complex external contours, multiple holes with tight tolerances, and subsequent heat treatments. The geometry of the components poses a particular challenge. As soon as machining features extend beyond the cylindrical base body, turning alone is no longer sufficient. In that case, Droop+Rein FOGS machining centers handle the entire machining process in a single setup. The high rigidity of the machines makes it possible to manufacture even safety-critical landing gear housings cost-effectively and with the highest precision. Starrag’s solutions are proving popular.



It's not the size of a machine that matters, but how precisely it delivers the value the customer actually needs.

Aerospace suppliers around the world are already using approximately 60 Droop+Rein machining centers specifically for the production of aircraft landing gear. They are a prime example of how "XXL" is not just a matter of feet or tons but also of precision, process reliability, and the ability to reliably machine highly complex components.

When machines themselves are XXL

In the wind power industry, too, the interplay of size, precision, and productivity is key. Not only are the workpieces enormous here – the machine tools are, too. As part of a manufacturing network, a Droop+Rein large-scale machining center and a Dörries vertical lathe both machine rotor housings and brake discs for 14- to 15-megawatt-class offshore wind turbines.

Both machines weigh about 959 US tons (870 metric tons), which is roughly equivalent to the weight of 140 fully grown bull elephants. The components already have diameters of around 29.5 ft (9 m) and are manufactured with a precision of ± 0.004 in. (± 0.1 mm). The Dörries vertical lathe used is even designed for workpieces with a swing diameter of up to 49.2 ft (15 m). This means that manufacturing capacity is already in place that is ready for the next generation of even more powerful offshore wind turbines.

Precision down to the last micrometer

However, the machining of large workpieces does not end with milling or turning. It is only during the final finishing process that they achieve their final precision. For this purpose, vertical rotary grinding machines from Dörries and vertical grinding machines from Berthiez are used. For example, Berthiez machines process main bearings with workpiece

diameters of up to 185 in. (4,700 mm) by combining turning and grinding in a single setup. This reduces the processing time from three to four days to just four to five hours. Dörries machines, on the other hand, were specifically redesigned for machining the larger roller bearing rings of the future. Among other features, they include an enlarged gantry with expansion options for collet chucks up to 276 in. (7,000 mm) in diameter, a completely redesigned turning/drilling support, and an integrated HSK-100A drilling spindle. This means they are prepared to machine even larger roller bearing rings in the future.

Step by step to the summit

Modern aerial tramways and gondola lifts demonstrate that XXL is also in demand in the cable car industry. A well-known company in the industry uses a 298,000-lb. (135-t) Droop+Rein FOGS D40 with a working area of $787 \times 370 \times 272$ in. ($20,000 \times 9,400 \times 6,900$ mm) to manufacture drive

and idler pulleys. It processes segments up to 42.7 ft (13 m) long for the pulleys of large cable cars. A spectacular example is the two 29.5-foot-wide (nine-meter-wide) pulleys at a modern valley station. Despite their size, the segments must be machined in a single setup with an accuracy of only 0.0008 to 0.0010 in. (20 to 25 μ m). The key factor here is the machine's high rigidity. It ensures that even workpieces of this size are machined with the highest precision – a fundamental requirement for the safe and reliable operation of modern cable cars.

Sometimes the workpiece requires a new machine

Sometimes the requirements are so specific that existing machine designs reach their limits. This applies, for example, in tool and mold making, where users must rough-machine heavy press tools with high cutting performance and then finish them to achieve the highest surface quality and dimensional accuracy. To address this challenge, the Droop+Rein FOGS HD – a new high-gantry concept – was developed, combining the advantages of a traditional portal machine with the dynamics of a gantry machine.

With travel ranges of 591 $\times$ 197 $\times$ 79 in. (15,000 $\times$ 5,000 $\times$ 2,000 mm), a torque of up to 5,532 lb-ft (7,500 Nm), and separate work areas, multiple workpieces can be machined in parallel and set up simultaneously. The machine performs finishing operations about 20 to 30% faster than conventional portal machines and is suitable for both heavy-duty roughing and high-precision finishing. With volumetric measurement, climate control, and a volumetric compensation system, this machine design achieves accuracies of 0.0006 to 0.0008 in. (15 to 20 μ m). This is also evident in the tool and mold

making industry: XXL doesn't just mean large dimensions, but above all the ability to handle a wide variety of manufacturing tasks with maximum precision and productivity. The following example in particular makes it clear – for Starrag, "XXL" doesn't necessarily mean a larger machine, but rather, above all, a solution tailored to the specific task at hand. Paraphrasing the Starrag slogan, one could therefore say: "Engineering XXL – precisely what you value." Or, in other words – it's not the size of a machine that matters, but how precisely it delivers the value the customer actually needs. ▀

XXL-sized grinding:
At a Dörries machine,
employees are testing
the new grinding support
system for high-precision
machining of large
roller bearings.



The Dörries vertical lathe used is even designed for workpieces with a swing diameter of up to 49.2 ft (15 m).



Step by step to the summit: Starrag technology from Bielefeld has proven its worth in the production of segments up to 42.7 ft (13 m) in size.

Azurea Unipessoal Lda: **Swiss expertise meets Portuguese industrial innovation**

Since 2012, Azurea Unipessoal Lda has established itself as a benchmark in the field of microtechnology and watchmaking. Under the leadership of Vincent Skrzypczak, the Portuguese entity has undergone remarkable expansion, distinguishing itself by its ability to meet complex technical challenges while maintaining exceptional quality.



In the space of 10 years, Azurea Unipessoal Lda has multiplied its production by 18—growth supported by strategic investments in technology and skills.



With a modern working environment and state-of-the-art production tools, Azurea Unipessoal Lda specializes in the manufacture of assembled components for watch movements.

Technical challenges are met through close collaboration with Tornos, a key partner in machine selection and skills transfer.

With over 50 computer numerical control (CNC) machines, including 30 Tornos automatic lathes, Azurea Unipessoal Lda demonstrates how innovation and tradition can coexist harmoniously.

A strategic location and unique know-how

Created to meet the growing demand from the Azurea Group's Swiss companies, the Portuguese subsidiary was set up

in Maia, near Porto, an industrial hub renowned for its skilled workforce. "Duplicating our Swiss know-how in Portugal was a major challenge, but we were able to train and support our teams to achieve our objectives," explained Vincent Skrzypczak, CEO of Azurea Unipessoal Lda. With a modern working environment and state-of-the-art production tools, Azurea Unipessoal Lda specializes in the manufacture of assembled components for watch movements. Technical challenges are met

through close collaboration with Tornos, a key partner in machine selection and skills transfer.

Innovation at the heart of Tornos machines

At Azurea Unipessoal Lda, Tornos machines are the first key phase in production. "With models such as the SwissNano and EvoDECO, they enable us to meet our demanding precision and repeatability requirements.

EvoDECO models, equipped with independent tool systems, enable simultaneous roughing and finishing, thus improving productivity.



Azurea has even adapted certain functions, such as bottom extraction on SwissNano machines, to meet its specific needs, illustrating its innovative spirit and need for verticalization.

The SwissNano, in particular, stands out for its ease of use and accessibility,” explained Vladimir Leitão, an expert on the production team. “They are highly intuitive machines, ideal for producing components down to diameters of less than 0.16 in. (4 mm), with optimum visibility of axis movements.”

EvoDECO models, equipped with independent tool systems, enable simultaneous roughing and finishing, thus improving productivity. In addition, TISIS and TB-DECO software offer powerful tools for synchronizing operations and

simplifying complex programming. Azurea has even adapted certain functions, such as bottom extraction on SwissNano machines, to meet its specific needs, illustrating its innovative spirit and need for verticalization.

A fruitful collaboration with Tornos

The acquisition and integration of Tornos machines, such as the EvoDECO and DECO models, have played a crucial role in Azurea Unipessoal Lda’s growth. “These machines enable us to produce complex components with unrivalled

stability and repeatability. This perfectly meets the precision requirements of the watchmaking industry, where every micron counts,” Skrzypczak explained. The partnership with Tornos is not limited to machines. The Azurea Group invests in the in-house training of its employees to ensure that its know-how continues to thrive. These courses are taught by in-house trade experts or by service providers such as Tornos. Employees therefore benefit from regular technical training and responsive support to optimize the company’s manufacturing processes.

"We worked closely with experts from Tornos Ibérica, particularly during the COVID period, to perfect our skills on TISIS and TB-DECO," Leitão emphasized. This training has enabled the team to take machine operation even further.

An ambitious future

In the space of 10 years, Azurea Unipessoal Lda has multiplied its production by 18 – growth supported by strategic investments in technology and skills. With 43,056 sq ft (4,000 m²) square meters of factory space and expansion

projects underway, the company is positioning itself to integrate new technologies, including single- and multispindle solutions from Tornos. "Our aim is to stay at the forefront of innovation while anticipating market needs," Skrzypczak added.

Shared values and a common vision

Azurea's culture is defined by commitment, ambition and flexibility, values also embodied by Tornos. Combining Swiss precision and Portuguese dynamism, Azurea Unipessoal Lda perfectly illus-

trates the potential of internationalization. With partners like Tornos, the company is ready to meet tomorrow's challenges and continue to innovate for the watch-making industry and beyond. ▀



For further information:
azurea.ch



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"Our aim is to stay at the forefront of innovation while anticipating market needs."

Vincent Skrzypczak, CEO,
Azurea Unipessoal Lda

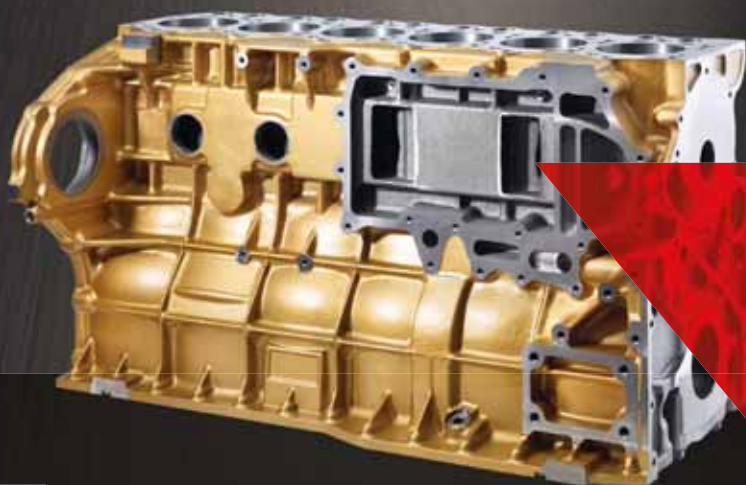
starrag

Engineering precisely what you value

Heckert

Experience leadership

Highly dynamic
engine manufacturing



Successfully
brought into series production:

Complete turnkey solution for the engine
block and cylinder head



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