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star

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A new dimension for the future

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Modernization of large-scale machines pays for itself many times over

A new machine dimension for a valued customer
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Star – The Starrag Division Magazine

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Starrag at trade shows 2024

20.–25.02.2024
Singapore Airshow
Singapur

04.– 08.03.2024
SIMODEC
La Roche-sur-Foron (France)

07. + 08.03.2024
PBExpo, Miami (USA)

25.–28.03.2024
Global Industrie
Paris (France)

08.–12.04.2024
CCMT, Shanghai (China)

09.–11.04.2024
MRO Americas
Chicago (USA)

15.–19.04.2024
MACH
Birmingham (UK)

16.–19.04.2024
SIAMS, Moutier (Switzerland)

03.– 07.06.2024
BIEMH, Bilbao (Spain)

04.–07.06.2024
MACH TOOL
Posen (Poland)

11.–14.06.2024
EPHJ, Geneva (Switzerland)

11.–13.06.2024
OMTEC, Chicago (USA)

18. + 19.06.2024
TecDays STR
Rorschacherberg (Switzerland)

22.–26.07.2024
Airshow
Farnborough (UK)

09.–14.09.2024
IMTS, Chicago (USA)

10.–14.09.2024
AMB, Stuttgart (Germany)

24.–27.09.2024
Micronora, Besançon (France)

08.–11.10.2024
MSV, Brno (Czech Republic)

09.–12.10.2024
BIMU, Milano (Italy)

24.–27.10.2024
CAEE, Tianjin (China)

05. + 06.11.2024
TecDays STC
Chemnitz (Germany)

05.–10.11.2024
CIIE, Shanghai (China)

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Martin Buyle
Division CEO Starrag

Dear reader,

What do the topics of sustainability and refurbishing a machine tool have to do with each other? A great deal, as it turns out, as explained in the interesting article about our retrofit business for large-scale machines at our location in Mönchengladbach, Germany. The examples in that article show in detail the extent to which environmentally damaging CO_2 emissions can be reduced by avoiding production of entire new assemblies.

Alongside economic considerations, the issue of sustainability provides additional incentives for refurbishing a machine.

The company HACO in Denmark manufactures large-scale components for wind turbines and has relied upon Starrag technology for years. Thanks to a solution of the Starrag Droop+Rein product range, this customer has been able to save time and money, as they need fewer machines and undergo reduced setup times. This is a good example of increased productivity.

Finding new ways to generate measurable added value for our customers is one of our main driving forces. One example of how this can be achieved in collaboration with our customers is shown by a solution implemented at Voith Turbo in Garching, Germany. Two five-axis Heckert T45 multifunctional machining centers with rotating function have been put into operation to replace the previous plant that needed nine machines to complete machining tasks.

Applications in the medical sector are always exciting. They are relevant to each and every one of us. The Bumotec product range has already supplied two Type 191^{neo} machining centers to the company Dawnlough Precision in Ireland. They are used to produce parts for medical technology with remarkable results. Thanks to its high level of productivity, the company has been able to pass on cost savings of up to 50% to its customers.

On December 8th 2023, we completed our merger with Tornos Holding AG and became part of a larger machine tool manufacturing group. The first weeks of the new StarragTornos Group AG were marked by intensive work and discussion to find opportunities for collaboration and mutual support. This is of course only the beginning, and a great deal of work will be needed to move from the initial analyses to concrete results. I am very confident that we will identify approaches for our Starrag division that will enable us to achieve greater added value for our customers and enhance our competitive advantages. I will continue to inform you of the progress made here.

You will also find updates concerning the Tornos division in every Star issue.

I hope you find this issue to be an interesting and inspiring read.

Yours,
Martin Buyle

Rethinking streaming: **The Starrag media library**

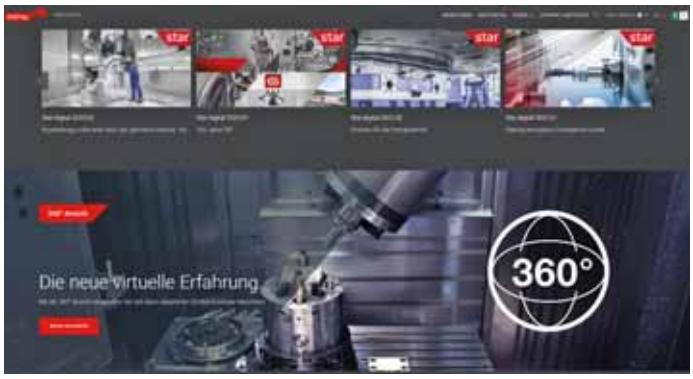
A new dimension for the future

The media libraries of leading streaming services such as Netflix, Amazon Prime or Disney+ provide information and entertainment at the push of a button, any time of the day – in high resolution and with the best 3D sound quality. However, despite all of this comfort and convenience, they mainly simply offer a passive experience. Starrag is proactively taking the next step and breaking new ground in this area.

It started with two simple 2D codes. In 2022, Starrag invited interested parties to a digital world premiere via a QR code and link. After a short registration process, the virtual showroom in Vuadens, Switzerland opened up and the highlight was on full display in glowing red text: The Bumotec 191^{neo}. With another click, the sales engineers were treated to the first exclusive presentation of the new top-of-the-range model. The presentation then transitioned to a 360 degree demonstration, enabling visitors to view the flagship product in detail from all angles.

Digital information bundle

Two years later, this 3D demonstration has become part of the new Starrag media library, which bundles together all of the digital information the company offers: from brochures, videos and TecTalk interviews through to all digital issues of the Star customer magazine. The content is currently available in German and English; Chinese, French, Spanish and Italian versions are also in realisation. Michael Schedler, Head of Marketing at Starrag: "The media library is not just a collection of content, but rather an interactive portal. It guides our customers and interested parties directly to the core of our manufacturing technology." For example, the 360 degree presentations enable users to take control of the camera movement and gain insight into



A glimpse into the future of streaming: The Starrag media library demonstrates how virtual technologies enable proactive experiences.

media.starrag.com

machining processes in a wholly unique way. "Imagine being able to discover every detail of a machine tool for yourself – from the precision of a head change through to the productivity of the manufacturing process. That is exactly what our media library offers," Schedler explains. "As part of our digitisation offensive, we offer a proactive virtual experience that enables our users to guide the camera themselves. They can view the machines from all angles and in particular from the inside."

Virtual and close to customers

Another highlight is the wide variety of presentation formats. "TecTalk video interviews, such as the discussion with Tony Liu about the new Tech Center in Shanghai, demonstrate how we are able to remain close to our customers worldwide," the Head of Marketing adds. "And our user videos show how our machines prove their effectiveness in practice – such as producing planetary gear carriers or blisks."

Visitors can also access a behind-the-scenes look at the Aerospace & Turbine Technology Days 2023 with just another click. Schedler: "As a central part of our medial library, it is even possible for visitors to relive the highlights of our events. Users can save their favourites in a personal section, meaning that they always have quick access to the specific content that they are interested in, and this is always kept fully up-to-date."

Recalculating – That's how sustainable a retrofit is

Modernization enables even older machines to be brought up to a technical level equivalent to current systems. In addition to increased production quality and availability, the issue of sustainability plays an increasingly important role today in deciding to perform a retrofit.

In the past, the issue of sustainability played a less important role in the decision-making process for investments within the manufacturing industry. However, this is changing on a fundamental level, as companies are faced with demands for sustainable production from many sides, from political and governmental organisations as well as customers, users and investors. "Whereas previously the focus was more on economic benefits, nowadays issues such as energy and resource efficiency as well as reduced CO_2 emissions play an increasingly important role for our customers," observes Hans Jeschke, Director Service at Starrag Technology GmbH. This not only applies to new acquisitions, but also increasingly influences the decision to modernize an existing plant instead of replacing it.

Many reasons for modernizing

This question always arises once a machine has been in use for several years. At some point, guides, bearings or spindles wear down, cable chains start to become brittle, or control and drive components are discontinued by their manufacturers. Ultimately, once quality problems start to occur, availability decreases and regular maintenance is no longer sufficient to rectify these problems, an urgent need for action arises.

"For large-scale machines such as our vertical turning lathes, portal milling machines and boring mills in particular, modernizing production facilities is worth it," emphasizes Jeschke. "Customers often save around 50 percent of the costs in comparison to purchasing an equivalent new machine. Additionally, it may be possible to put the machine back into productive operation more quickly – after all, the foundation and frame are already in place." Furthermore, the "ramp-up time" after modernization is very small, as employees are already familiar with the peripherals and performance of the machine.

The service team knows machines inside and out

Starrag Technology boasts an experienced team of experts who are ready to help with retrofitting large-scale machines: a total of more than 100 specialists perform maintenance and repairs on customer machines, provide support for relocating existing machines – whether to a different place in the same hall or to a different continent –, audit plant components, and

100

Starrag Technology has already modernized more than 100 plants.

Modernization of our large-scale machines pays for itself many times over

carry out comprehensive modernization to bring even older machines up to date with the latest technology. The majority of the service team is based in Mönchengladbach, Germany.

Archive for historical machine documentation

This long history has a major benefit: The majority of the personnel currently working in the service department were previously involved with design and manufacturing of the various machine tools that have been brought together under one roof at Starrag. "If a customer contacts us, he can be confident that he will be able to talk directly to a specialist with truly in-depth product expertise," emphasizes Hans Jeschke. And that is not all – thanks to the historical development of the company, the service team also has access to complete documentation for all of the "old" machines – regardless of whether they are machines under the brand names of Dörries, Ecospeed, Scharmann, Schiess or Wotan. There are even still documents available for old Froriep systems. These documents are archived in a dedicated building with a floor space of approximately 7500 square feet (700 square meter)metres. "Even for machines from the 1940s, we are still able to dig out the matching original documents," Jeschke states. "This means that even before we come face to face with an old machine at the customer's facility, we already know which components are installed in it."

Powerful organisation

In order to efficiently implement the wide range of service projects, a complete company structure has been mapped out in Mönchengladbach: starting with purchasing, then design and workshop, through to logistics. Two former production halls are set aside for use by the service technicians. These contain not only machine tools, test benches and assembly stations, but also the spare parts warehouse with approximately 6000 items in stock. This ensures that spare parts and replacement assemblies such as engine spindles and milling heads are always available at short notice – both for current machine generations and for all predecessor models.

A retrofit saves up to 50% of costs in comparison to purchasing a new machine

The halls themselves underwent a "retrofit" in 2021, as they received a new coat of paint, energy-efficient LED lighting and new sanitary rooms, among other improvements.

Starrag Technology operates another service team in Bielefeld to look after the machining centers under the Droop+Rein brand. "For electronic modernization – such as replacing control systems – we have yet another team of specialists in Amt Wachsenburg near Erfurt, Germany," Hans Jeschke adds.

Updating old machines

"Our services contribute a substantial proportion of the turnover of the Starrag Group," Jeschke continues. Modernization of old plants itself represents a stable source of business, because large-scale machines can easily continue to perform their work reliable over multiple decades – if they receive an update from time to time. "Retrofitting is generally advisable after 15 to 20 years at the latest," states Jeschke. This can take place multiple times over the lifespan of a machine. By replacing old control and drive components, even a machine from the 1980s can be brought up to a technical level comparable to that of a modern system – and not just in terms of availability, precision and throughput. These old machines can also be upgraded with regard to digitisation, enabling them to meet the requirements of Industry 4.0 and supply data via the Internet of Things (IoT). This can be used for an energy management system, for example, which brings the discussion back around to the topic of sustainability.

Huge reductions in CO_2 emissions are possible

However, retrofit measures also directly improve sustainability, Hans Jeschke adds, returning to the main topic: "Modernization of a large-scale machine results in a substantially better carbon footprint in comparison to investing in a new machine. On the one hand, there is no need to produce significant quantities of cast steel, and on the other hand, the huge quantities of reinforced concrete for the

76.5 – 171 t CO_2

Reduction in CO_2 emissions thanks to retrofitting

Comparison between modernization of an Ecospeed F 2025 and acquiring a new Ecospeed F 2035

> Reduction due to cast steel

- The delivery weight of a new machine is approximately 83.5 t. Instead, modernization requires delivery of just 15 t of material – meaning 68.5 t less, predominantly consisting of cast steel.
- Production of 1 t of cast steel causes, depending on the source and casting process, between 1433 lbs (650 kg) and 4400 lbs (2000 kg) of CO_2 equivalent.[1)]
- Retrofitting reduces emissions by approximately **44.5 to 137 t CO_2 equivalent** just in terms of avoiding production of cast steel.

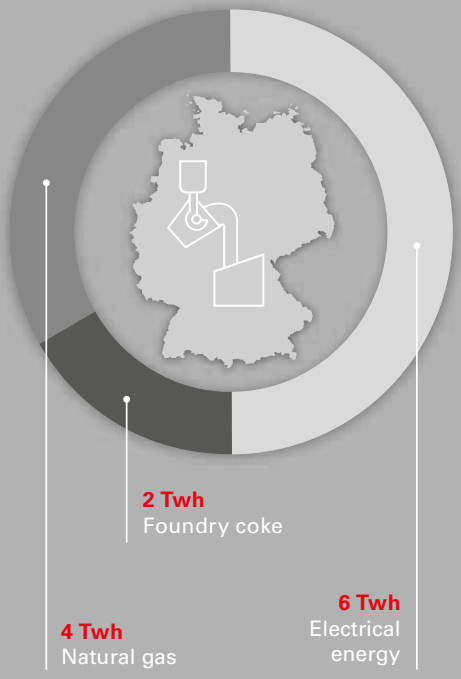
> Reduction due to reinforced concrete

- An Ecospeed foundation has a base area of approx. 807 sqft (75 sqm) and a thickness of 4.3 ft (1.3 m). That corresponds to a volume of approx. 22 000 imperal gallon (100 cubic meter) of reinforced concrete.
- Producing one 220 imperal gallon (one cubic meter) of reinforced concrete causes emissions of approx. 705 to 750lbs (320 to 340 kg) CO_2 equivalent.[2)]
- Reusing the existing foundation therefore saves a further **32 to 34 t CO_2 equivalent.**

Objectives of a retrofit

- Improved availability, precision and throughput
- Implementation of up-to-date health and safety requirements
- Increased energy efficiency and sustainability

Energy consumption
of the casting industry
in Germany[3)]



[1)] Sources: Bundesverband der Deutschen Gießerei-Industrie (BDG) / Abdelshafy, A., Franzen, D., Mohaupt, A. et al. A Feasibility Study to Minimize the Carbon Footprint of Cast Iron Production While Maintaining the Technical Requirements. J. Sustain. Metall. 9, 249–265 (2023)

[2)] Source: www.ibau.de

[3)] Source: dena – »Energieeffizienzpotenziale in der Giesserei-Industrie«

foundation do not need to be poured." As an example, Jeschke calculated the savings from a current customer project: a large aviation group commissioned Starrag Technology to carry out modernization of its Ecospeed F 2025. The fact that there is no need to produce new cast steel for the framework alone means that the retrofit of this machine has avoided emissions of between approx. 44.5 and 137 tons of CO_2 – depending on the proportion of scrap and melting process used. A further 32 to 34 tons of CO_2 emissions were avoided by reusing the existing reinforced concrete foundation. This is in addition to the emissions that would be produced by transportation.

Modernization pays for itself many times over

However, avoiding the emissions that would be produced by acquiring a new machine is not the only way in which a retrofit helps promote sustainability, as Hans Jeschke emphasizes: "For us, sustainability also encompasses the health and safety of the people who work on the machine." For example, it is possible to create an enclosure around the machine and put into place an extraction system to significantly reduce exposure to cooling lubricant aerosols. At the same time, new control systems and safety functions provide further substantial improvements in safety when operating the machine. Hans Jeschke adds: "All in all, modernization of our large-scale machines always pays for itself many times over – in terms of higher cost-effectiveness, greater sustainability and health, and a better competitive position – because sustainable action is increasingly becoming a hallmark feature of the manufacturing industry as well."

A new machine dimension for a valued customer

Lords of the rings: HACO CEO Henning Albrechtsen and Starrag Senior Consultant Sales/Renewables Hubert Erz inside the iron blank from partner SM Industries.

Mobile gateway: With the new Droop+Rein portal milling machine, the gantry axis moves across the eleven metre-wide rotary table. The total weight of the machine is 870 tons.

> "This saves users time and money, as they need fewer machines and undergo reduced setup times."
>
> **Fabian Schwarz**, Head of Project Management of the Business Unit Large Parts Machining Systems (LPMS)

Henning Albrechtsen, owner of the Danish family-owned company HACO A/S, had been looking forward to the "Christmas present" of a Droop+Rein portal milling machine from Starrag for a long time, and he was not disappointed, as it arrived in good time at the end of November 2023 and was put into operation after the holidays. The special features of this 870-ton colossus include its XXL size and its unusually large basement section across two storeys.

Sights set on XXL: The gantry axis of the portal milling machine moves over a distance of 46 ft (14 m).

The Starrag team in Denmark (from left to right): Anatol Harms, Daniel Berg, Karsten Niehues, Robert Jazvec, Oleg Schall and Darko Jovic.

On screen: Starrag employee Darko Jovic operating the Siemens control panel during commissioning.

"Never before have we built such an extensive tunnel system for a production plant; it is reminiscent of ancient catacombs and even I have never seen something like this anywhere else," explains Hubert Erz, Senior Consultant Sales/Renewables at Starrag. "However, this expensive and elaborate investment for our core customer facilitates service access and day-to-day collaboration using this new machine." Laying the foundation involved processing 850 cubic metres of concrete and 100 tons of steel: thanks to its generous dimensions across two stories, it provides operators with easy access to drive elements and other components of the Droop+Rein portal machine. In any case, the basement section immediately garnered a positive response from the production team. Henning Albrechtsen states: "The foundation forms the base for the machine tool, and its stability and design help determine the level of precision that can be achieved with the machine. In addition, the tunnel system within the foundation provides good access to all relevant machine assemblies and thereby ensures optimal ease of servicing. Furthermore, the 'cellar' enables many units to be positioned underneath the upper edge of the hallway, which contributes to a substantial reduction in noise levels." However, the tunnel system is not the only innovative approach that the CEO of HACO – a second-generation family business – has taken. The company already owns five Dörries vertical turning lathes, which have helped it grow to become one of the leading Danish contract manufacturers of gigantic components for the wind power sector and offshore industry.

> "Integration of both processes enables production of complex workpieces with great precision and efficiency."
>
> **Fabian Schwarz**, Head of Project Management of the Business Unit Large Parts Machining Systems (LPMS)

Danish teamwork: XXL rotor housing for the future of wind power

However, even a job shop specialising in XXL components cannot afford downtimes. As such, HACO has already needed to increase the maximum swing diameter of its vertical turning and boring mills several times. Their next major order, from an international leader in the area of wind turbine manufacturing, involves completely new dimensions. This order focuses on the next generation of offshore turbines with rotor diameters that now exceed 660 ft (220 metres), designed for an output of 14 megawatts with their direct drives. HACO and a

Danish partner have been contracted to produce components of correspondingly large size. This involves machining front and stator sheets and brake discs, alongside other primarily welded components and multiple steel rotor housings with weights of between 50 and 90 tons and diameters of almost eleven metres.

In order to approach this XXL future with confidence, Henning Albrechtsen decided to purchase a pair of machines designed to handle these ever-increasing dimensions. The first machine, a gantry portal milling machine with a 74 ft-lbs (100 kW) milling head and 2×82 ft-lbs (111 kW) master-slave main drives, represents the combination of two distinct areas of expertise for Starrag. Erz: "We integrated components from the Dörries product area into a Droop+Rein milling machine, thereby combining turning technology with milling technology." The machine has a clearance of 497 inch (12,600 mm) in between the stands, the gantry axis travels over a distance of 551.2 inch (14,000 mm), and the tool slide allows a maximum stroke of 137.8 inch (3,500 mm).

> "We integrated components from the Dörries product area into a Droop+Rein milling machine, thereby combining turning technology with milling technology."
>
> **Hubert Erz,** Senior Consultant Sales/Renewables

Easy access: The basement across two stories enables easy and ergonomic work on all machine assemblies and supply units.

Complete machining improves productivity

Assembly and commissioning were performed by a Starrag team led by Fabian Schwarz, Head of Project Management of the Business Unit Large Parts Machining Systems (LPMS) with the product areas of Droop+Rein, Dörries and Berthiez. Even though large machines are part of his day-to-day work, this new creation with its hydrostatic bearings and rotary table with a weight of 180 tons and a maximum load capacity of 350 tons is still something quite special. One benefit of the machine is that it combines milling and turning in a single machining centre. "Integration of both processes enables production of complex workpieces with great precision and efficiency," Schwarz explains. "This saves users time and money, as they need fewer machines and undergo reduced setup times."

Stationary portal, moving table

The table of the second machine is movable. The machine delivered at the end of 2023 features a moving portal, whereas this configuration has a stationary portal and a moving table. Erz: "This special design, created primarily for turning processes, has received new support with the new tool holder constructed and constructed by the Bielefeld team for combined milling/turning operations." In terms of dimensions and weight, the 6-axis portal turning machine is number one, and only the master-slave main drive (output: 2 × 36 kW) is somewhat larger. The plant has also gained a larger workpiece swing diameter, which was able to be increased from 13,000 mm to 15,000 mm thanks to the moving table.

Regardless of this, HACO can completely machine all workpieces on both machines, meaning that they can

Half time: View from the bridge of the portal milling machine to the semi-transparent curtain, behind which the second portal turning machine is being built in 2024.

> "As a supplier to the energy sector, with a focus on green energy, HACO intends to contribute to the lowest environmental impact in the manufacturing process."

HACO-Homepage: www.haco.dk

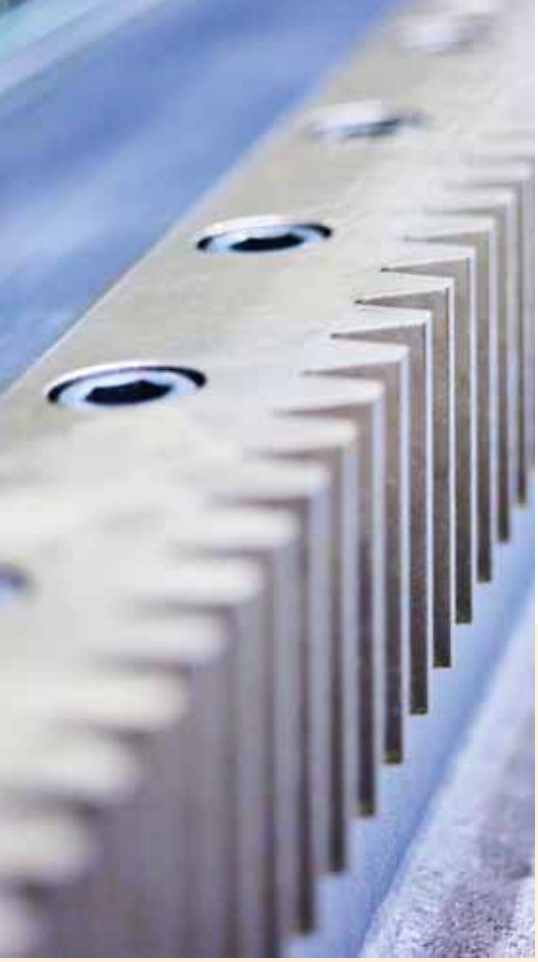
be used as ideal supplements to and replacements for one another. This pair of machines also features highly precise positioning across all axes – the two machines can achieve electronically controlled positioning in the micrometer range even for metre-long travel paths.

However, how does a company that produces components for wind power approach the issue of sustainability? As HACO states on its homepage: "As a supplier to the energy sector, with a focus on green energy, HACO intends to contribute to the lowest environmental impact in the manufacturing process." This approach on the part of the Danish company has been confirmed by TÜV Nord, which has certified its environmental management system according to the strict requirements of EN ISO 14001. As such, new machines are always fitted with a sophisticated enclosure with supplementary extraction unit, which protects employees against noise and aerosols (mixtures of air and very finely dispersed solid and liquid particles).

HACO has now taken a further important step to protect the environment in how it operates its new XXL machine pair: its operation site is the SM Industries A/S industrial estate in Rødekro, which is a company with whom HACO has worked closely for many years. This leading supplier of steel components for wind power applications was a subsidiary of the steel trader Euro-Steel DANMARK A/S until recently, and previously delivered welded blanks via heavy goods transport to the HACO plant in Barrit to undergo mechanical finishing all the way from the town of Rødekro, which lies 62 miles (100 kilometers) to the south. These components, mainly sets consisting of a rotor housing, front sheet, stator sheet and brake disc and weighing multiple tons, were then transported all the way back again from Barrit to the port at Aabenraa on a specially designed fixture.

Internal transport instead of heavy-duty transport

SM has provided its long-standing partner with a hall for the XXL machine pair, which HACO then excavated to a



Tooth by tooth: Precise machining on the micrometer level requires electronic systems as well as solid mechanical drive technology.

Fabian Schwarz (left), Head of Project Management LPMS (in conversation with HACO CEO Henning Albrechtsen): "Integration of the turning and milling processes enables production of complex workpieces with great precision and efficiency. This saves users time and money, as they need fewer machines and undergo fewer setup times."

Tunnel vision: Starrag Senior Consultant Sales/Renewables Hubert Erz and HACO CEO Henning Albrechtsen inspect the new high-tech catacombs beneath the centre of the enormous rotary table.

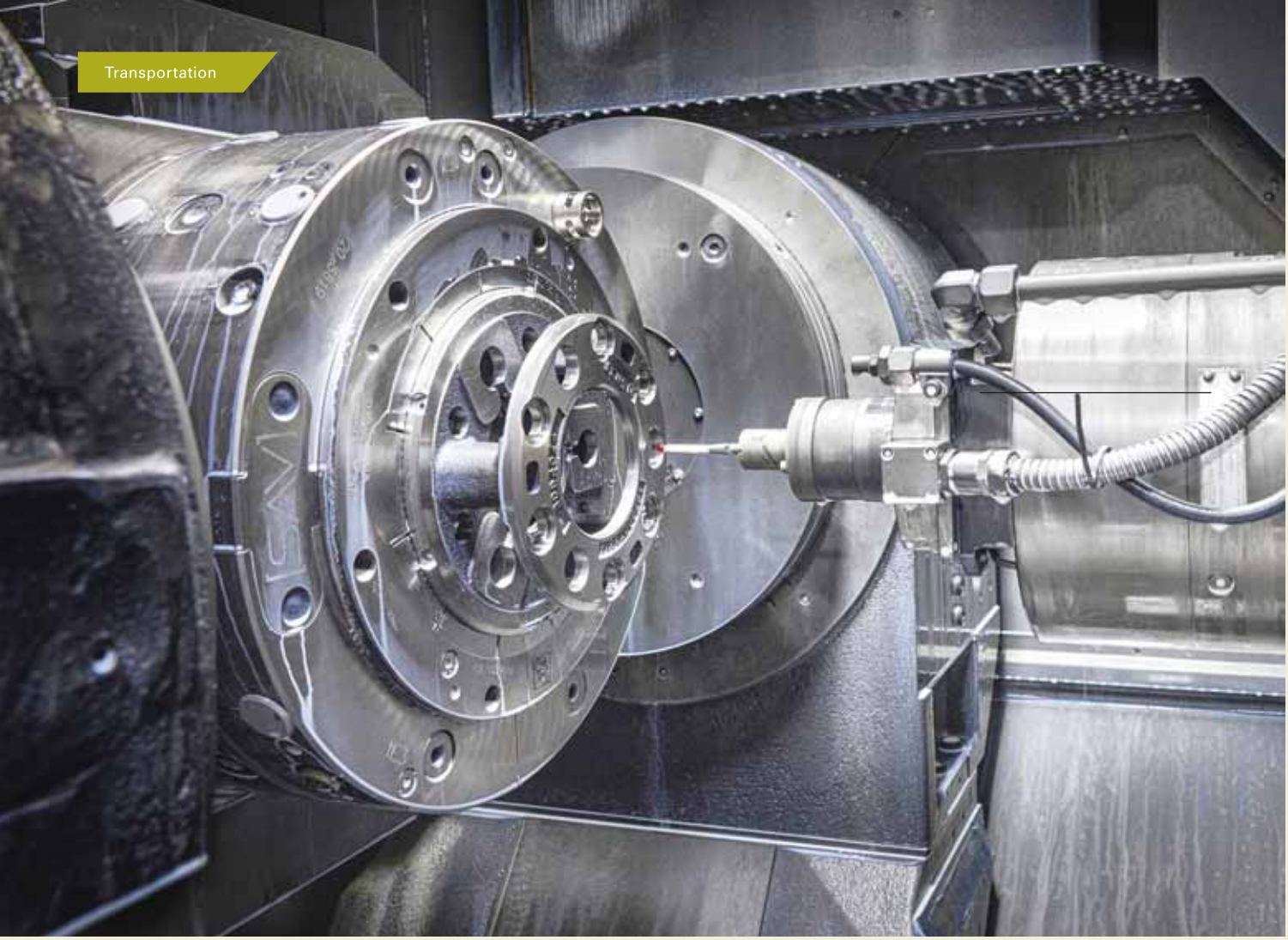
depth of up to 19 ft (six meters) metres for the extensive foundations. This has eliminated the previous need for typical overland heavy-duty transport and replaced it with quick and environmentally friendly internal transport. And the Rødekro location is near to the Baltic Sea ports of Kalvø Havn and Aabenraa, from which the jointly manufactured plant components can be transported for assembly in the customer's coastal plants with much less environmental impact. This is also perfectly in line with HACO CEO Henning Albrechtsen's viewpoint: "There has been close collaboration between the companies HACO and SM for a long time. For this new project with its particular challenges, we worked together to find the most costeffective and sustainable solution. Using an existing production hall meant that there was no need to construct new buildings. And since we are located on the same site – next door to each other, in other words – transport paths between blank manufacturing, heat treatment processes and mechanical processing were reduced to a minimum, which has cut costs substantially. All of these benefits and the proximity to the port 7 miles (11 kilometers) away have contributed to a sustainable solution and are in accordance with the green principles of the wind industry."

His 87-year-old father Johan also responded positively to this result. "When he established HACO, he invested in high-quality machines with automation right from the start. The first vertical milling machine was already equipped with an automatic pallet changer," states Henning Albrechtsen. "This was later followed by a flexible manufacturing system with two linked vertical milling machines. Something like that had never been seen before in our region. As such, we are continuing to follow this innovative and future-oriented approach and developing to meet the challenges of the times. My father has visited the first machine twice so far, and is already looking forward to the arrival of the second." This machine is still in Bielefeld, and will begin its journey to Denmark in the first quarter of 2024.

Planetary gear carrier machining in

Efficiency has a name: Heckert T45

two clamping positions



Voith, based in Garching, Germany, has been manufacturing planetary gear carriers for bus transmissions using a unique, robotic manufacturing plant for more than two years. The core elements of this plant are two Heckert T45 five-axis multifunctional machining centers with turning function. These enable the entire machining process to be carried out in just two clamping positions. The effect is tremendous: in comparison to the previously used conventional manufacturing process which used a total of nine machines, the space required has been reduced to one quarter, machining times have been reduced by 30%, and each component requires only 20% of the previous throughput time.

Imagine that you are riding a public bus through the city: it stops to let passengers on and off, drives off again, accelerates, brakes, stops again – and so on. If you do not notice any juddering movements or switching noises while this is happening, then there is a strong likelihood that the bus is equipped with a Voith DIWA automatic transmission. The "DIWA" is the differential converter (Differenzialwandler in German, hence the name), which enables a smooth start-up across a speed range in which other transmissions would need to shift two or three times.

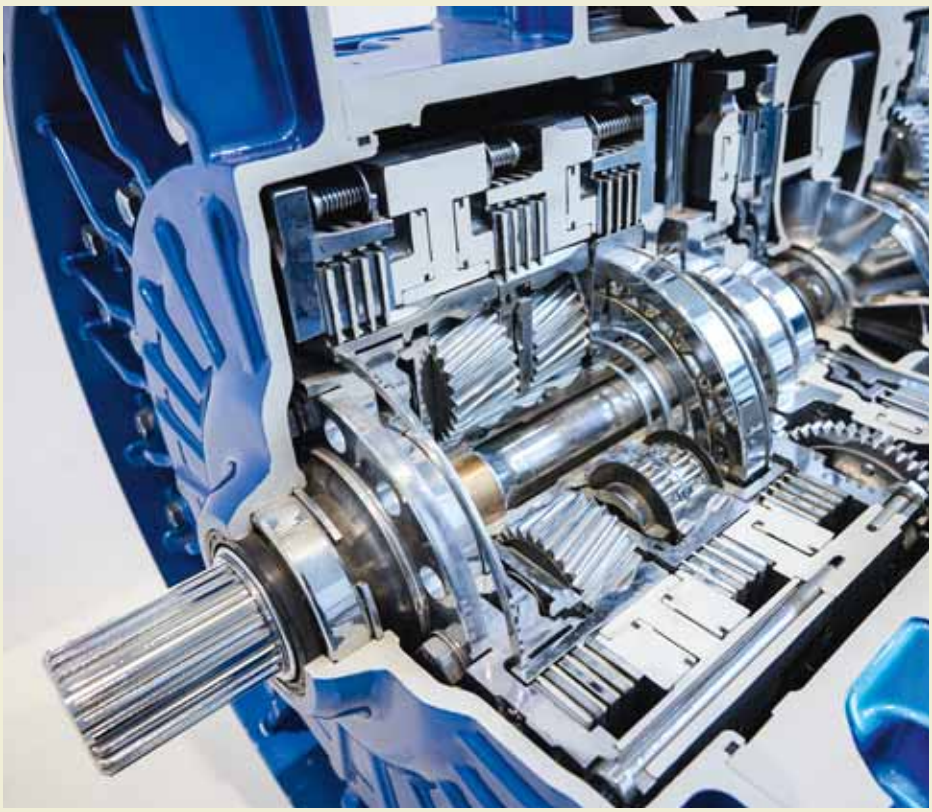
"Thanks to automation of the manufacturing plant, we are able to manage our resources even more effectively in future, and deploy our qualified workers efficiently."

Friedrich Oberländer,
Director Production
Technology at Voith Turbo

More than 160,000 DIWA automatic transmissions are currently in operation worldwide. And there is good reason for this: thanks to their innovative design and extremely high quality, DIWA transmissions have become extremely popular with passengers and drivers, and therefore with bus companies and manufacturers as well. As a result of their reduced fuel consumption, they also ensure more cost-effective operation. However, technical innovations are not the only decisive factor for this success. Reliable delivery, flexibility and a competitive price/performance ratio are just as important. "We are constantly monitoring our production processes to find opportunities for optimization," says Friedrich Oberländer, Director Production Technology at Voith Turbo in the company headquarters in Heidenheim, Germany. "Our focus is on optimizing our level of automation, the technology data in our processes, and how we can intelligently structure those parts of the process that cannot be automated for our employees."

Manufacturing concepts on the test bench

The Garching location, where the Voith transmissions are produced, is also affected by these requirements. "We maintain a high level of vertical integration in order to manage our flexibility and cost-effectiveness," explains Vincent Ross,



> "We are committed to combining maximum automation with optimized manufacturing technology for series products."
>
> Friedrich Oberländer, Director Production Technology at Voith Turbo

Head of Manufacturing at the Garching facility. "To do so, however, we need to constantly scrutinise our processes for any possibilities for optimization."

In 2018, the employees responsible for this optimization process identified that the manufacturing plant for the planetary gear carriers installed in the current DIWA transmissions was in need of improvement. In addition, there was a sequential, multi-stage manufacturing process in place at the time, which was no longer in line with current technical capabilities. "It was essential to streamline the process and use innovative technologies," emphasizes Friedrich Oberländer, who is responsible for these matters across all locations. "We are committed to combining maximum automation with optimized manufacturing technology for series products."

The Heckert T45 – the key to optimized manufacturing

Oberländer came up with an idea for achieving this when he visited the Starrag stand at the AMB 2018 trade fair. When he saw the Heckert T45 five-axis multifunctional machine with turning function, which was brand new at the time, he recognized the potential for planetary gear carrier manufacturing. "With its robust design and above all its quick, powerful rotary table, this machining centre can handle the entire, previously six-stage manufacturing process on a single machine and in just two clamping positions." There followed many discussions with the Starrag mechanical engineers in Chemnitz, as well as with other manufacturers of five-axis machining centres. Vincent Ross, who took part in the decision-making process, reports: "We created a structured analysis with integrated risk analysis before the decision was made to use the Starrag plant." Friedrich Oberländer explains the primary argument: "At the time, Starrag was the only supplier

"For the past 24 months we've been able to calculate an OEE of over 90%."

Vincent Ross, Voith Turbo, Head of Manufacturing at the Garching facility

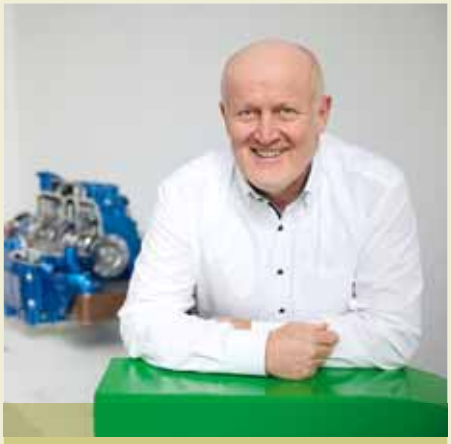
offering a multifunctional milling and turning centre with a 15.8 inch (400 mm) pallet and the speeds and torques that we needed for our application, namely the Heckert T45. Good past experiences also played a role. After all, we have been Starrag customers for a long time now, and we are very satisfied with our Heckert machining centers and the support we have received."

Successful development partnership

Voith and Starrag worked hand-in-hand on the conceptual planning of the manufacturing plant. Vincent Ross explains: "We considered various concepts, including a transfer system without robotics. However, in line with our strategy of designing automation to be as flexible as possible, we decided to use a solution with an articulated robot. This enables us to not only supply and remove components, but also automate reconfiguration of the machines."

Starrag brought an external automation specialist on board for implementation. This three-part team created a production cell consisting of two Heckert T45 machining centers and a robot with a load capacity of up to 1102 lbs (500 kg).

The robot checks the incoming blanks and loads and unloads both machining centres. When it is time to change to a different series – currently, the plant is used to machine three different planetary gear carriers with a total of 20 variants – it mounts the required gippers, swaps and clamping devices into the machines, without machine downtime. The grippers and the fixtures consisting of pallets, support cylinders and power chucks are already provided pre-assembled in the robot cell. The blanks and finished planetary gear holders are transported into and out of the plant, respectively, on two separate conveyor belts.



"Thanks to the minimal costs and effort involved in changeover between variants, we have become significantly more flexible."

Friedrich Oberländer, Director Production Technology at Voith Turbo

Key factors: Employee expertise and commitment

"Together, we were able to install a completely new manufacturing system for planetary gear carriers, with a level of efficiency that continues to impress hugely," says Vincent Ross. The key factors in his point of view: the people involved. "The high level of expertise, specialist knowledge and commitment of the Voith employees and Heckert specialists have made our idea for automated complete machining on a single machine with two clamping positions a reality." Ross acknowledges that the path to achieving this was not without its rough patches. The installed Heckert T45s were the first series models of a newly developed machine that had not previously needed to contend with this kind of continuous operation. As such, the rotary transmission initially suffered premature wear, though this problem was mitigated to everyone's satisfaction by means of a design adjustment. Starrag also made successful improvements to the toothed belt magazine: the material used for the belt turned out to be sensitive to the cooling lubricant used by Voith, and was replaced with a different material following appropriate testing.

Friedrich Oberländer also mentions that there were problems with the retaining force in clamping position OP 20, which were subsequently rectified via a special coating on the collets. "We worked together to look for, find, and above all carefully implement solutions to every problem," Oberländer confirms. "This is what makes partners like Starrag stand out."

> "We worked together to look for, find, and above all carefully implement solutions to every problem."
>
> Friedrich Oberländer, Director Production Technology at Voith Turbo

Output per area unit increased many times over

Vincent Ross agrees with this, and is pleased with the uptime that has now been achieved: "After more than 24 months, we have verified an OEE of over 90%." Using this new plant, his team is able to manufacture planetary gear carriers in five-figure quantities each year, which is roughly equivalent to the previous output. However, the space required is approximately 75% less, and the throughput time has been reduced by around 80%. This is primarily due to the significantly lower set-up and idle times. In addition, net processing times have been decreased by approximately 30%. "The greatest impact with regards to cost-effectiveness is in assignment of employees," adds Friedrich Oberländer. "Thanks to automation of the manufacturing plant, we are able to manage our resources even more effectively in future, and deploy our qualified workers efficiently."

New perspectives

The effects for customers are extremely important. "Thanks to the minimal costs and effort involved in changeover between variants, we have become significantly more flexible. We can respond much quicker to customer requirements," says Friedrich Oberländer. "In addition, this solution has opened up new perspectives for us," Vincent Ross states with conviction. "In our new cell, we can manufacture not only the planetary gear carriers for the DIWA 6 but also the successor product, the DIWA NXT 7-gear mild hybrid transmission, which is perfect in terms of process reliability and costs. Even a changeover to future generations of transmissions or comparable components will not pose a problem."

Time flies

Weiss Watch Company continues to take bold leaps

When Weiss Watch Company founder Cameron Weiss takes a leap, it's a bold one. Weiss will mark its 10th anniversary in June 2023. In the past three years, it has moved the business 2,000 miles across the country from its Los Angeles, California, birthplace to historic quarters in a former vinyl record label printing shop in Nashville, Tennessee. With expert support from Tornos, it has become an accomplished Swiss-type lathe business.

Along the way, Weiss has managed to do the impossible: He has made appreciable progress toward restoring prestige to American watchmaking: He introduced his first dive and automatic watches; significantly reduced the number of watches the company produces while more than doubling their prices in order to ensure highest quality while meeting high demand; trimmed his workforce from five employees to just two – himself and his wife, Whitney; and began machining in-house several watch components that he previously outsourced. The rightsizing was made possible by the company's investments in highly complex and automated manufacturing

"This allows me to just focus on making and assembling watches while the machines are working hard."

equipment; the pared-down output maintains the highest level of watchmaking craftsmanship – including in the hand finishing and assembly stages – that truly distinguishes its handmade products. Ten years into this change-filled journey as a watchmaker and business owner, Weiss is as enthusiastic and willing as ever to take on a challenge.

Capitalizing on Tornos solutions

"Five years ago, I was afraid to touch a Swiss-type machine, but I've always wanted to work with them and make the parts – I just didn't think I could do it," Weiss explained. "Then, out of necessity with us wanting to move the business and realizing I'd have to find new workers – during the COVID-19 pandemic – I realized that being able to work alone would be very valuable. And Swiss-type turning technology today is at a level where I can do that because our volume and product mix are not huge. I saw that I could really capitalize on using really good equipment like the Tornos SwissNano and Swiss DT 26 to make our parts – and that it wouldn't be such a huge undertaking if I could program the machines properly."

That's where Tornos' application expertise made a world of difference. "We don't make high volume parts and we don't make particularly expensive parts. But for me as a watchmaker, coming from the technical side and being able to make the parts in our own workshop and learn all about it, that's the exciting part," Weiss explained. "Time will tell whether this all becomes financially rewarding, but it's been good enough to support the machine purchases – including the Tornos SwissNano in 2018 and a Tornos Swiss DT 26 last summer – so far. It's just me running the machines now to make our parts so I'm focusing heavily on using the best technology possible – like the bar feeder on both of our Tornos Swiss-type machines so that I can just program the machine, turn it on, and it can run unattended through the night.

"TISIS takes some stress off of me because I don't know any alternative to TISIS."

This allows me to just focus on making and assembling watches while the machines are working hard." To make all that happen – right-sizing his workforce, in-sourcing an ever-expanding array of watch components, and optimal use of his own time – Weiss turned to Tornos for the technology and in-depth training to make himself a Swiss-type lathe programmer and operator. While he uses his SwissNano to make, for example, sliding pinions – the component that interacts with the watch's setting wheels of the watch to enable the crown to be turned to move the hands on the watch – he uses his new Swiss DT 26 to produce the watch crown, the small knob that sits on the side of the watch case and allows adjustment of the time displayed.

Priceless Tornos training

Weiss credits Tornos application engineer Piotr Wilk, who is stationed in Poland and a former member of Tornos' legendary "Jump Team" that can be dispatched anywhere in the world to support customers on-site, with getting him up to speed on the SwissNano and the Swiss DT 26.

"Piotr is great, a really good teacher. He taught me the maintenance that needs to be done on the machines, where everything is located, what type of oil to use and where it goes, and what I needed to know about tool inserts for turning, the geometry, the different inserts that you need for different features – even just figuring out what companies to buy those tools from, because watch-making tools are very specific and very few companies make tools that are that small to cut super-specific watch features," said Weiss, who considers that one-to-one tutoring a highvalue investment. "My Tornos training was priceless because it's very difficult to find people to teach you – and if you can't find the right people to teach you, even the best machines are absolutely worthless if you don't know how to run them."

Weiss Watch Company's Tornos SwissNano and Swiss DT 26 (shown here) are equipped with bar feeders, providing founder Cameron Weiss a greater degree of autonomy.

That training has allowed Weiss to enjoy an unprecedented level of autonomy, as has Tornos' TISIS software, which makes part programming a snap. "TISIS takes some stress off of me because I don't know any alternative to TISIS. I have never programmed a Swiss-type machine at the controls, so I don't even know what that would be like," Weiss said. "It's really nice being able to track the 2D tool movements and see how the change in programming affects that."

"It's really nice being able to track the 2D tool movements and see how the change in programming affects that."

What's next for the company that is now solely a family business ? Weiss said it's important to him to maintain a connection with his community of customers, continue to fine-tune his knowledge of machining technologies, and introduce new models of watches "designed and built for everyday adventures."

Bumotec solves medical production puzzle for Dawnlough Precision

Dawnlough Precision is a subcontract manufacturing business that has travelled a relentless journey of growth since it started manufacturing tooling for the aerospace and medical industries back at the start of the millennium. The ascension to success over the last 20 years has arrived through an aggressive growth strategy and investment in high-end machine tools. Part of this high-level investment journey has included the arrival of two Bumotec 191^{neo} turn/mill centers from Starrag.

Initially founded in 1987, the turn of the millennium has seen the Galway manufacturer gain accreditation to ISO: 9001, ISO: 13485 and AS: 9100D, establish a design department and increase its manufacturing facility – firstly to 20,000sq/ft and then to 50,000sq/ft in 2018. Underpinning this growth is a robust business strategy and the adoption of advanced production tools such as FMEA, PPAP and SPC. The robust management of processes and production is a necessity for the Irish manufacturer to succeed in two of Ireland's core manufacturing sectors.

To maintain its growth trajectory, Dawnlough has invested in the most flexible, capable and productive machine tools – and this is why it has recently taken delivery of two Bumotec 191^{neo} machines. The world-class production facility on the West Ireland coast has more than 54 CNC machine tools run by a highly skilled and experienced workforce dedicated to providing premium manufacturing solutions. Recently acquired by the Acrotec Group, the 110-employee business is still run by longstanding Managing Director and previous owner Brian McKeon.

Looking at the path the business is taking, Keith Kennedy, Aerospace Production Manager at Dawnlough says: "We manufacture high precision components for the Aerospace and Robotic Assisted Surgical Industries as well as tooling and production aids for the medical device sector. When I started in 2006, tooling was the main business focus, but as the Aerospace and Medical Device industries have expanded locally this presented many opportunities. Our Aerospace work started with seating components for Rockwell Collins, which led us to 5-axis machining. We then progressed to Flight Critical components for the likes of Spirit Aero Systems and Pratt & Whitney. Similarly, we progressed from manufacturing medical tooling and instruments to producing complete assemblies."

As Europe's largest employer of medical device professionals per capita, Ireland is renowned for its medical industry expertise. As a country with a medical sector that employs more than 42,000 people in more than 450 businesses and exports more than 12.6bn € of medical equipment, Dawnlough is well positioned to serve this continually expanding segment.

Discussing the expansion in the medical industry, Keith continues: "Our core

A fenestrated clamps manufactured on the Bumotec 191neo machines in 'one-hit'. Without the Bumotec machines, Dawnlough would not have been able to produce these parts in 'one-hit' with a price competitive solution for the customer.

> "The big thing about Bumotec was the flexibility. It offered everything we wanted."
>
> **Keith Kennedy**
> Aerospace Production Manager, Dawnlough Precision

business has predominantly focused on Vascular work and from this, we have expanded our offering. We now produce an array of components for our RAS Customers as well as consumable instruments.

The First Bumotec on the Emerald Isle

It is here that the search for a suitable machine led Dawnlough to purchase a Bumotec 191neo FTL-R in June 2022. Discussing the acquisition, Keith recalls: "We had several components we initially targeted for this type of machine."

"We needed a machine with very high levels of accuracy, short cycle times and incredible efficiency because it's a very competitive market. We visited many companies reviewing high accuracy machines, but it's only as you look closer and purchase one of these machines for this type of work – you really see the 'value-add' they bring. We were looking for repeatability, flexibility, high spindle speeds, the ability to machine hard material and 2 to 3µm precision on production runs. We had very specific requirements and we were not sure if it was going to be achievable."

"Some of our initial trial parts were 46HRc and we are using tools from 0.004 inch to 0.02 inch (0.1 to 0.5mm). We needed repeatability of 2 to 3µm, but we needed to hold that overnight. Some of the functions of the Bumotec machine such as the software for monitoring the machine, the cutting load, the contact cutting time and the large 90 tool ATC that enables us to have sister tooling in the machine is incredible."

"It was a huge investment for our business. It was an unknown risk, but the Bumotec ticked all of our boxes and end goals. The big thing about Bumotec was the flexibility. It offered everything we wanted. It's an exceptional machine with accuracy that takes our business to a different level."

As well as machining 46HRc parts, there was also a need for specific RAS parts that were a key driver to the first Bumotec installation, Keith says: "We were machining these parts in batches of 200-off up to six times a year and there are 6 different parts in the family with a projected ramp-up of 200–300% a year. So, we wouldn't have been able to support the customer with our existing method. There was also a fallout due to accuracy, as we couldn't 100% meet the GDT accuracy."

"We needed to put a bar diameter in the machine up to 1.5 inches whilst also running high precision production runs of small instrumentation parts. The Bumotec also had the sub-spindle and a robotic unit which was important, as we need traceability for every part we make. We took demonstration parts and gave Bumotec our end goal. We went to Switzerland in April 2022 and we received the machine in June."

Success Brings Machine Number 2…

Following the remarkable success of the Bumotec 191^{neo} with FTL-R configuration, the Galway company then added a second Bumotec 191^{neo} in March 2023. Supplied with an FTL-PRM configuration, the second Bumotec 191^{neo} was introduced with complete automation and a 20-position pallet station for lights-out production.

Discussing the arrival of the second Bumotec machine, Keith continues: "When it came to the first machine, we had a vision and a target and Bumotec delivered on that. What they offered us with the second machine was a complete turnkey solution for our instrumentation components. We had given them a target of for producing instrument parts from a much harder material. This still required extreme levels of precision and production volume with the flexibility to produce families of parts."

"We needed to machine materials from 46 to 52HRc such as 17-4 and 420 stainless steel as well as titanium. The instrument parts for use in invasive robotic surgery include tools like grippers, cutting instruments and scissors. We have made many instrumentation components as well as parts of the robotic unit that actuates

> "On the purchase of the second machine, we knew exactly what Bumotec could offer, so we worked with them remotely."
>
> **Keith Kennedy**
> Aerospace Production Manager, Dawnlough Precision

The two Bumotec 191^{neo} machines are the centrepiece of the new department at Dawnlough Precision.

> "The Bumotec 191neo is an exceptional machine with accuracy that takes our business to a different level."
>
> **Keith Kennedy**
> Aerospace Production Manager, Dawnlough Precision

The work envelope of the Bumotec 191neo FTL-R with the sub-spindle was the first Bumotec machine to arrive in Ireland in June 2022.

the instruments. We are producing the parts in medium to high volume runs across two different parts in various quantities per month."

Some of the parts had very long cycle times on the 5-axis machines and this needed to be reduced to below 30 minutes with 48HRc material. Not only was the cycle time a challenge, but once again Dawnlough had to attain extreme precision levels in a production environment with the flexibility to produce upwards of 30 different components. Initially machining 20 to 50 parts a month, the schedule was set to rise rapidly to 200 parts per month before reaching production volumes – numbers not possible on a 5-axis machining centre. "It was a learning curve to move from aerospace work to the niche market of medical instrumentation. We didn't have the machine technology to produce the parts to the specifications and production cycles required, but our Managing Director works on the philosophy of 'build it and they will come'."

"On the purchase of the second machine, we knew exactly what Bumotec could offer, so we worked with them remotely. Based on what we had seen previously – we knew they were the best option. What Bumotec offer is exceptional and way beyond anything we had anticipated. With the original Bumotec 191neo FTL-R machine, we had the sub-spindle, but with the next set of parts we needed the Bumotec 191neo FTL-PRM. With this machine, we had the option of the vice, a 9 ft (3 m) bar feed and also a robot loader. We needed the robot loader for traceability. It also expanded the capacity of the machine where we could go from 2inch (50 mm) barfed stock to 3 inch (80 mm) billet loading and unloading from the robot."

"The sub-spindle option we had on the FTL-R wasn't feasible for the parts we needed, whereas the FTL-PRM gave us two vices. Without the vices, we would have needed to undertake secondary machining, which would have been difficult with the required, so to be able to pick up the component in the vice and conduct the second operation in a single cycle was key to finishing the parts – it was another turnkey solution."

> "We have also made considerable savings on tool costs and change-overs in comparison to our machining centers and this is a credit to the 40,000rpm spindle."
>
> **Eddie McHugh,** General Manager, Dawnlough Precision

Keith Kennedy (left) discussing a medical instrumentation part with Senior CNC Engineer, Ronan Faherty.

Contributing to the conversation, Dawnlough's General Manager, Mr Eddie McHugh adds: "We were machining parts on our 5-axis machining centers and we needed to increase output by 400%. We were machining around 400 parts a month on two different products with a cycle time of 45 minutes. This was tying up two machines and one man permanently every month. On second and third shifts with fewer staff, we had concerns about machine tolerance drift, so output was reduced and it also made inspection labour intensive."

Looking at additional savings with the arrival of the Bumotec 191^{neo} FTL-PRM, Eddie adds: "There is a labour saving with one man running two machines around the clock. Additionally, with the pallet loader, the parts are loaded into the machine and back to the pallet loader in a specific order which made huge savings on inspection. We have also made considerable savings on tool costs and changeovers in comparison to our machining centers and this is a credit to the 40,000rpm spindle."

With 54 CNC machine tools from 10 different manufacturers, Dawnlough has one machine alongside the two Bumotec 191^{neo} that is commonly used in the medical industry. Comparing this machine to the Bumotec, Keith continues: "In comparison, the Bumotec has increased capacity, it has a larger tool library, higher spindle speeds, a larger diameter bar capacity and a lot of other features that just offers so much more flexibility. It's not only a better and more flexible option, it's a more robust machine which is what we need – especially as we machine everything from very small medical components to 1.6 inch (42 mm) bar from hard materials."

Referring to the robust build of the Bumotec 191^{neo} compared to the alternate machine in the small part machining department, Keith recalls a story saying: "One night, we were machining 1.6 inch (42 mm) diameter aluminum between centers on the Bumotec 191^{neo} and a tool broke. When trying to pick the part from the sub-spindle, the machine bent the 1.5 inch (40 mm) bar. The next morning, we spoke to the service team, re-set and re-calibrated everything and started running the machine at our 2 to 3 micron tolerances. On the competitor machine, we had a 6mm tool that chipped off a vice and tripped the machine out – the machine was subsequently down for 3 weeks and cost us 15,000 € in service, as the whole machine had to be disassembled and rebuilt. That is when

you know to buy the second Bumotec machine because the stability, rigidity and overall build quality is second to none."

The Future

Looking to the future, Dawnlough has plans for more Bumotec machines and continued expansion, which will certainly continue with the ambition of the Acrotec Group. "The machines are extremely flexible with a large 90-tool capacity. This means we can just change the programmes over, the jaws and collets and it is ready to go in less than 2 hours. For our high-precision business that manufactures mid to high volumes with a high mix of complexity – the Bumotec is the perfect machine for our business."

Service

As a company located on the west coast of Ireland, Dawnlough is well positioned to serve its customers – but its machine tool suppliers have not always served Dawnlough with a level of customer support that a leading manufacturer would expect and deserve. Referring to the service and support from Bumotec, Keith concludes: "The service is exceptional. There is absolutely no comparison to some of our other machine suppliers. Starrag is a brand with a limited footprint in Ireland and I believe our Bumotec was their first machine in Ireland. Despite other brands having a larger footprint in the area, the Bumotec support is second to none. The after-sales support is unbelievable. I don't think there is another machine brand we have at Dawnlough that offers the same after-sales support – and we work with at least 10 brands." Eddie concurs by adding: "The service from Bumotec is probably the best we have had. If you need engineering support they are there straightaway, whether it's engineering support, post-processors, technical queries or anything else. The support has been fantastic."

Dawnlough Senior CNC Engineer Eric Leclos showing how an intricate aluminum medical device part is manufactured in 'one-hit' on the Bumotec 191^{neo} with a cycle time over 70% less than before the Bumotec machines arrived.

"The service from Bumotec is probably the best we have had."

Eddie McHugh, General Manager, Dawnlough Precision

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