COMPLETE

Nr. 01/23

The complete machining magazine

All eyes on:

The digital MILLTURN

For a smart use of production data.

WFL MILLTURN TECHNOLOGIES

Linz changes.

Linz has an eventful past, which has shaped the city distinctly. Not only the first half of the 20th century brought massive changes to Linz's history, the city's development already started in antiquity. Find out everything about the history of Linz in this and the following issues.

Dear valued customers, dear readers,

"We make it work"

The current crises caused by the coronavirus pandemic, disrupted supply chains, inflation, the energy crisis as well as climate change are all posing huge challenges for us. These crises are resulting in shortages of a wide range of resources such as raw materials, energy, components and parts.

Crises always bring opportunities with them too and act as drivers of innovation, as so many changes take place with regard to things like energy policies, sustainability, the Green Deal, digitalisation, etc. Various industries are investing in production capacities and innovative methods for implementing these changes. We at WFL are seizing this opportunity and acting accordingly. **Sustainability** and digitalization are firmly anchored in the company. Starting with the expansion of the PV system and sustainability initiatives within the company, such as electric charging points, thermal renovation, the carbon footprint of our MILLTURN sites and much more – we are tackling these things head on.

Digitalisation is another key area which is always being driven forward. A wide range of different digitalisation solutions can be used to detect faults early on and make it much easier to coordinate processes. All in all, they serve to boost efficiency in production – and we are working actively on this. Further development and implementation of sensor systems in our machinery remains an important topic for continuously improving and automating machine conditions as well as production processes.

Automation is another topic that is keeping us busy. The factory of the future demands mobility and flexibility, and we at WFL and FRAI have made it our task to offer the customer corresponding solutions in this regard. Starting with automation solutions with articulated robots, multi-chains, automated linear and area gantries, as well as mobile robot automation – these are the topics that we're forging ahead with. The future topic of mobile robots in particular is of great interest to us. Mobile robots can move around the space independently, providing absolute flexibility for industry. This type of automation brings many benefits with it – it's something that's increasing in demand among our customers too.

Technology expertise has top priority for us. With the concept of complete machining, we offer our customers a wide variety of production solutions. There are no limits to the areas of application. We would like to highlight in particular our technology solution expertise in "internal machining". Deep hole drilling is one of the special disciplines within this field, particularly as these kinds of machining steps usually require special equipment in terms of both tools and the right MILLTURN.

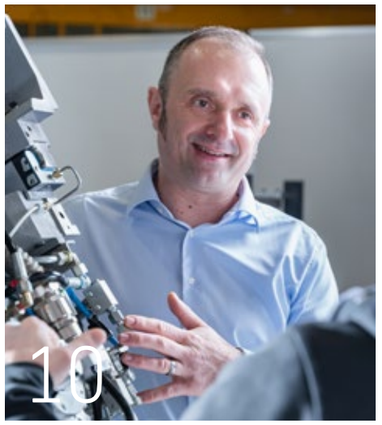
In this edition, we focus in on technology expertise, including the topic of deep hole drilling, the complete machining of components for small power plants, and the complete machining of crankshafts. The exciting customer story with Renk provides insights into the machining of parts for vehicle transmissions. Roughly 60% of all parts to be machined for vehicle transmissions are rotating parts, practically all of which can be produced on MILLTURNs. Last but not least, we'd like to show you some innovations to our internal processes with a user story from our automatic small parts storage supplier.

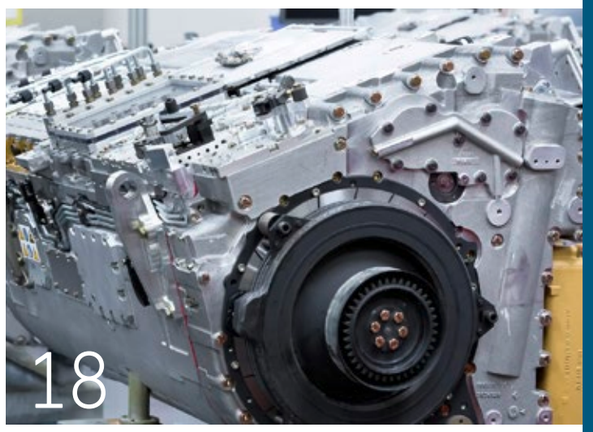
We hope you enjoy reading!

The WFL Management Team

Günther Mayr
Managing Director Sales, Technologies and Services

Norbert Jungreithmayr
CEO



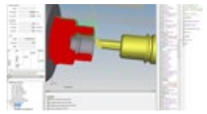


WFL software solutions

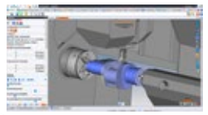
The perfect software solution for any type of machining

Programming and simulation

WFL cycles
The technology cycles of WFL cover a broad range of standard and special technologies for all kinds of applications. These program modules make it possible to carry out efficient programming directly on the machine control or on a PC.



WFL programming solutions (CrashGuard Studio & Millturn PRO)
WFL offers in-house software solutions for the machining process with a MILLTURN. The various software options are perfectly tailored to the requirements for complete machining.



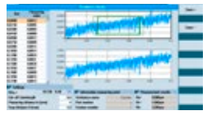
CAD / CAM products
WFL helps customers by providing recommendations of user-friendly programming solutions, making it as easy as possible to get to grips with programming.

Production

CrashGuard
The patented CrashGuard collision prevention system is a real-time software upgrade for the CNC control. With the aid of an internal 3D model in the machine, collisions between machine components in automatic or manual operation are prevented.

iControl
WFL iControl protects your MILLTURN, even during autonomous production throughout the night. It responds if the collision limit or adaptive process limit is exceeded, or if there are significant, rapid changes in force.

Silent Tools+
SilentTools+ boring bars are 'intelligent tools' which, thanks to sensors, provide information on utilisation, temperature, deflection and the surface quality achieved and actively intervene in the machining process in the event of an overload.



Measuring
To reliably manufacture complex workpieces with high quality, processes must be controlled in a 'closed loop'. The measurement method developed by WFL enables maximum manufacturing precision to be achieved with the tightest dimensional and positional tolerances on workpieces.

Tool control and management
Drilling and turning tools can be measured using the tool control cycles. The tool management allows you to continue automatic production of parts in a highly flexible machine for as long as possible without interruption.

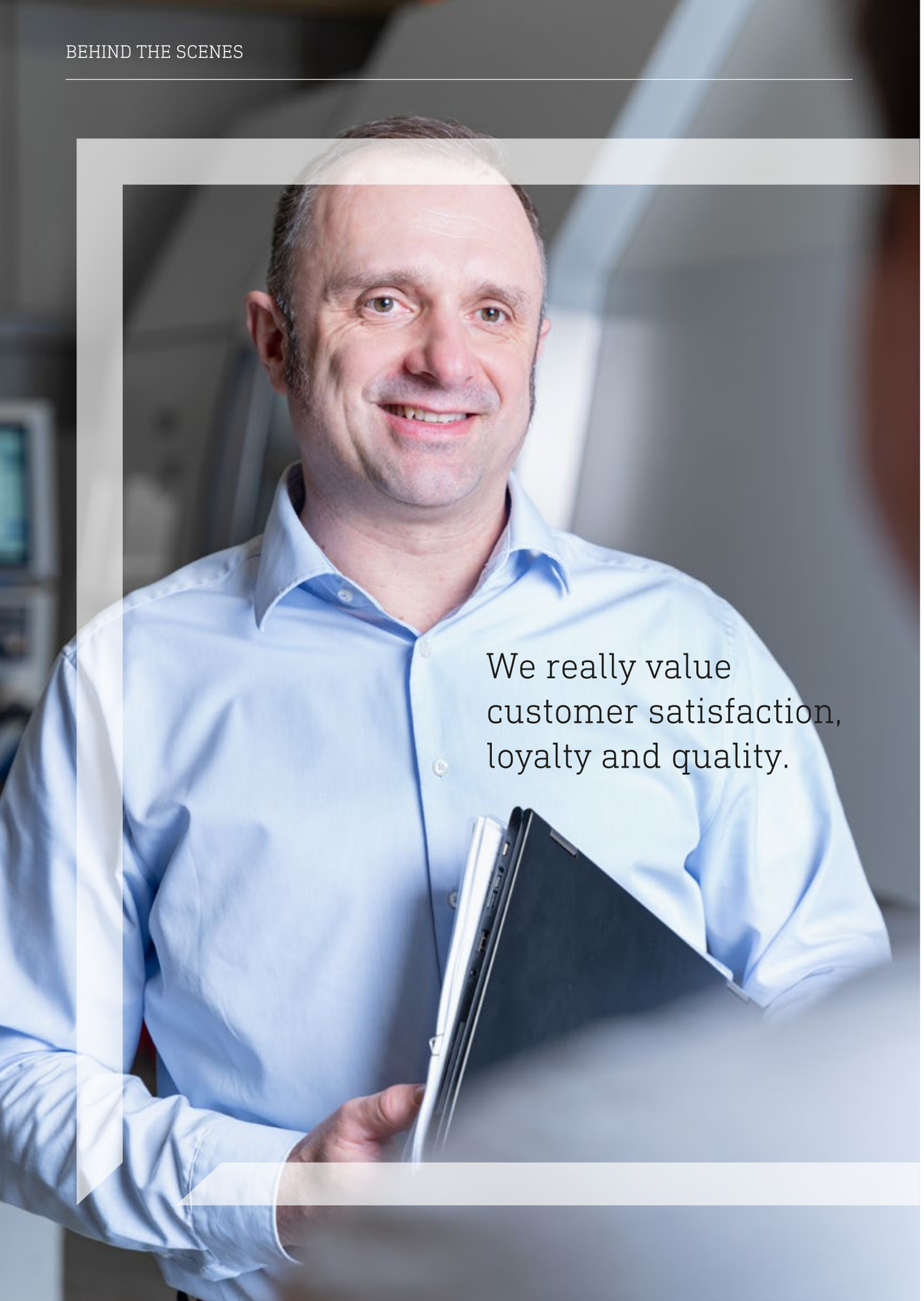
Greenside Technologies
Greenside Technologies enables machines to be put into energy-saving mode (the hydraulics, pneumatics, lighting, drive supply) during the production process when they are not in use.

Digitalisation

myWFL
With the new myWFL operational data acquisition, you get a 24/7 overview and can exploit the optimisation potential of the smart factory. Not only does the new software offer a transparent user interface, but it also improves machine utilisation.

WFL SOFTWARE SOLUTIONS

THE SUITABLE SOFTWARE SOLUTION
FOR EACH AND EVERY MACHINING TASK



Achieving our goals with renewed vigour

Setting sail with service – new management brings breath of fresh air

In sailing, it's important to remain steady and, above all, reliable. Consistently good performance means that no road is too long and no wave or problem too big, even in stormy times. By constantly working on yourself and developing, you'll never stray from the planned course. Teamwork is absolutely essential here, as it brings the high performance required in order to reach your goal.
The WFL Service department has always been a shining beacon in the company. Nevertheless, an experienced team needs fresh impetus and new ideas. Roland Steingress is a new member of the WFL Service family. Long distances, communication and daily contact with customers are essential and the building blocks to successful work. In our latest edition of Complete magazine, we are once again exploring the area of customer service and shedding light on the general processes and future-oriented approach by and with Roland Steingress.

Please, tell us a bit about yourself, Mr Steingress.
My name is Roland Steingress and I come from a small town called Hohenzell in the Innviertel region of Austria. I grew up there and now have a family with two wonderful children and a great wife. In my career, I started out in the automotive sector as an apprentice car mechanic at BMW. After that, I took the examination for my master craftsman's certificate. In 1997, I started my job as Operations Manager at Hütter, where I took on the job of restructuring the company from the ground up. We built a new company building, planned interior work and recruited staff/customers who remained true to the company in the long term. During this very same restructuring process, I entered into discussions with BMW Austria, where, in 2005, I was able to continue my career at the Bavarian car manufacturer. My new role was to manage the After Sales department in western Austria for 27 BMW dealers. I focused specifically on customer satisfaction, loyalty and technical quality in the workshops. This helped me get promoted to Sales Administration, where I managed the Technical Support team, the Warranty department, the process area and the IT service for Austria. 2012 brought with it a consolidation – not just for Austria, but for Central and Eastern Europe too. This was a turning point and an eye-opener for me. New cultures, new languages and, above all, a wide range of different nationalities broadened my perspective. My mindset changed and pushed me to the decision to continue working internationally. This led me to my next job at KTM in 2017, where I led the Customer Service and Product Improvement departments. All of these roles ultimately led me to WFL.

What helped you make the decision to move to WFL, the global technology leader in complete machining?
It wasn't a spontaneous decision, and when I first arrived at the company I wasn't completely sure. But after an extremely impressive interview with the managing director and my first look at the WFL machines, something just clicked. It was precisely then that I knew it was a good fit and that this would be my new home.

How do you get started as a new, driving force, and where can you tap into new potential?
For preparation, I set myself small goals without knowing where the ones I was striving for actually were. On the first day, I sought out my expert colleagues and

co-workers to have a chat. I introduced myself and tried to find out what the current situation was, where there was untapped potential, and where there were any issues. I absorbed these findings and planned my next course of action. How can the flow of information be improved, where is there even more potential, how can we make our processes more reliable, and which systems can help us? These were my initial thoughts and tasks, so to speak. One of my biggest concerns was to ensure smooth, friendly, fast and above all technically adept teamwork.

What does your typical day look like?
'Business as usual' is my morning motto. There are certain projects and milestones that you need to schedule and pursue. However, I really value having such a varied working day. In the morning, it may happen that jobs and priorities turn around in a matter of minutes. But this is why I love working in this area. Acting fast and being flexible above all are what make this work so interesting for me. I've always felt at home in after sales and wanted to make use of my years of experience when I came to WFL.

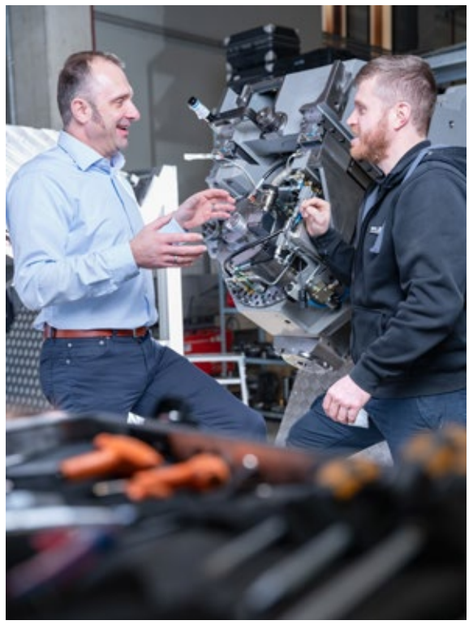
How do you find a balance after a tiring day at work?
On the one hand, I need a day filled with jobs to do, and on the other I have my family to balance things out. They are my absolute top priority. After that come friends and my current hobby project: motorcycle construction. I've just finished building my fifth bike by hand, following all the relevant vehicle criteria, and I completely forget the time while I'm doing it. I even have a small lathe, which I can use to build certain parts myself. As I already mentioned, I really value my dynamic working day at WFL and complement it with my family, friends and my hobby.

What makes the Service department so special?
I've come to really appreciate my colleagues at WFL in particular. They're so open, constructive and sometimes critical too. I really like that. You'll never win with a soft-line approach. I really value the proper, honest way of communication, as then you know exactly what you need to do next. I also love the friendly, open reception you get in the WFL team. Despite time pressures with customers and smaller issues, it's always lovely to see how the experienced Service team responds and handles certain matters in the right way and with a smile. I see everyone in this department as the 'supporter generation'. Everyone helps each other every day. This is the only way you can achieve your goals and deliver professional service even under huge pressure.

Where do your strengths lie and what do you value in your team?
The colleagues here are open, helpful, professional and are incredibly knowledgeable. Everyone here is incredibly motivated and friendly towards customers, and are very committed in this regard. My colleagues in Field Sales in particular travel all over the world. Whether it's minus 20 degrees or 40 degrees, our engineers do a great job – under very difficult circumstances. I'd like to highlight all of this and give a huge thank you to everyone.

A STRONG TEAM
Helpful, professional and extremely knowledgeable.

How is your department divided up and how do you communicate with internal and external departments?
We have several organisational areas. On the one hand there is the spare parts: all orders regarding parts and parts availability as well as all offers to our customers are created here. All invoices and calculations also take place in this area. In addition, there is our hotline - i.e. the technical support. Among other things, we use Teleservice for this - a software that allows us to connect directly to the machines. This enables us to solve a large number of problems remotely or at least to narrow them down better. One of the main tasks is the planning and coordination of the field service engineers. After consultation with the departments, they report directly to the customer in order to get an idea of the current problems directly on site. Another important aspect is training, which I would like to push ahead with in the near future. It's important to train new colleagues and upskill existing staff.



"I see everyone in this department as the 'supporter generation'. Everyone helps each other every day."

Who or what comes to mind when you hear the word 'successful'?
One way of measuring success is in euros. That's definitely an important aspect when setting our objectives. In another vein, employee and customer satisfaction is an important contributor to success. To this end, we have a larger project with Salesforce in our pipeline. This will focus on generating customer satisfaction and making our interactions better/winning back former customers and fostering these 'new' relationships. It also aims to build up many loyal customer relationships and ensure that they are satisfied for the long term. For me, success is defined by the aspects mentioned above.

Do you have a personal vision for your time at WFL?
I am extremely happy at WFL and will pursue my set goals and implement them as best I can. It's really important to me that we work as a team in order to implement a multi-stage plan. I'm a big fan of psychologist Maslow, who talks about needs and motivation. These step-by-step plans mean that the objectives can only be achieved if the right foundations have been laid. There's no point in skipping steps and believing you'll reach your goal faster. It's important to build up projects slowly and properly from small to large. My goal and the future for me and my team is that we can work together in small, continuous steps and do top-quality work and stay extremely committed.

PROFILE
Name: **ROLAND STEINGRESS**
Home town: Hohenzell
Married with two children

Career:
32 years in customer service/after sales, including

- 27 years at BMW in the following roles:
  Apprenticeship, master craftsman's diploma,
  BMW Austria in field sales and sales administration,
  most recently as Head of Technical Service/Warranty &
  Channel and Process Development for the region of
  Central and Southeast Europe.
- 5 years at KTM: Head of Global Area Management,
  Technical Support/Warranty & Product Improvement
- At WFL since July 2022

Part-time degree (2014-2021):

- IFM Salzburg (BA Operational Management and Administration)
- University of Klagenfurt (MBA General Management),
  Mendel University in Brno (MSc in Economics & Business
  Administration)

All eyes on…

Innovative automation solutions

by FRAI Robotic Technologies

Highly economical production systems are produced through the combination of a productive complete machining centre and a smart automation solution. WFL subsidiary FRAI Robotic Technologies is an innovative automation partner that develops highly flexible robot systems.

All eyes on

Innovative automation solutions

by FRAI Robotic Technologies

Autonomous production methods have long been used by automotive manufacturers, the aerospace industry and mould construction companies to produce equipment for machine tools. Other sectors with less of a focus on automation are now showing increased interest in this area, above all due to the possibility of introducing autonomous night and weekend shifts.

Depending on the customer's requirements, WFL and FRAI use automation solutions such as articulated robots, automated linear and area gantries and even mobile robots for automated workpiece loading. Peripheral transport and storage systems for workpieces, tools and clamping devices can be integrated as required.

FRAI as the perfect partner

WFL subsidiary FRAI Robotic Technologies is the perfect partner, from initial concept development of an automated system to implementation and set-up, right through to system maintenance. The range of gantry loaders and robotic cells makes it possible to offer comprehensive automation concepts with maximum customer benefits and to the highest quality standard. This brings some key benefits for the user, such as continuous productivity with minimal operating effort, in particular when it comes to repeat orders. However, robots are not only used in large-scale series production; there are also many advantages to automation for small batch sizes, when used in combination with easy-to-program software. Customer-specific options, such as unloading samples, inscribing, cleaning, measuring blank parts and even additional processing tasks performed by the robot (e.g. deburring) enable further increases in efficiency.

How automation has changed over time

The ever-greater variety of models has meant that transfer lines have tended to be replaced by flexible line chains or by individual cells with a variable material flow. Using intelligent software in combination with the relevant automation solutions not only enables workpieces to be loaded and unloaded but also means that machining centres can be set up fully automatically through the automatic replacement of tools and clamping devices. In addition to the classic handling solutions, WFL turnkey projects are often fitted with a higher-level host computer system. This 'brain' takes over the entire logic and logistics from within the fully self-sufficient, flexible production cell. In addition to workpiece measurement and tool management, ODA (operational data acquisition) data is also transferred to the customer's MES (manufacturing execution system).

One of the most flexible automation versions of machine tools or processes is the articulated robot in a robot cell.

Linear and area gantry solutions consist of the same basic assemblies: gantry, set-up station for workpieces, external tool magazine (if required), buffer/lung/warehouse for multiple workpieces (optionally mounted on jigs), gripper changeover station (if required) (gripper for jigs and tools).

Robot systems can also link up multiple machining centres

An automation solution implemented by WFL and FRAI has been specially developed for flexible batch production and is designed for the automation of four machine tools for handling different shafts. The 6-axis robot with 500 kg payload is mounted on a seventh axis. An automatic gripper exchange system has also been attached so that a wide variety of grippers can be connected and disconnected fully automatically as required when the system is operating in automatic mode. An integrated drip tray collects cooling lubricant and chips. Automatic changeover of jaws, tailstock tips and prismatic tools in conjunction with a servomotor gripper for covering an extremely large product range allows for set-up-free operation of the machines and automation solution.

Holistic solutions – mobileCELL

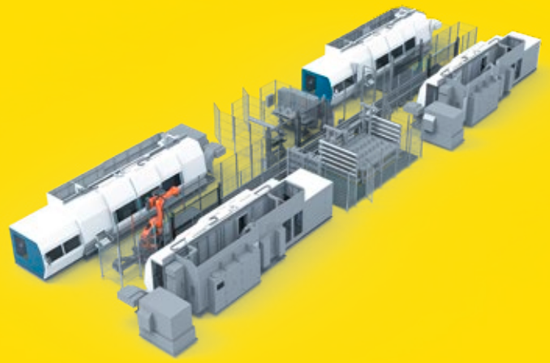
mobileCELL is a hybrid solution, which impresses with its combination of wide-ranging functions and advantages. There was a time when the classic robot cell could only load and unload workpieces. This basic function was then enhanced with gripper exchange systems.

Due to the significant disadvantages of a location-bound robot cell and the costs for intralogistics tasks, a solution was discussed which would produce benefits for the customer.

mobileCELL consists of an appropriately large automatic guided vehicle (AGV) with a robot cell construction: The robot, workpiece and tool gripper, along with buffer positions for workpieces and tools, and the necessary control & safety technology. The machine moves completely freely. It is not blocked or obstructed. The AGV collects the required tools and workpieces in the warehouse, it then travels to the front of the machine, locks itself in place on the floor and exchanges parts and/or tools. The vehicle then moves away again and receives the travel instructions for the next machine. The space in front of the machine it has just loaded becomes clear again.

Watch the interview with Franz Plasonig and MTD CNC:

The set-up station can be used to set up tools parallel to machining time and introduce new workpieces without restricting the automation.



Customers are increasingly looking for holistic solutions. The mobile robot solution – mobileCELL – makes companies more competitive.

TRANSMISSIONS
Roughly 60% of all parts to be machined for vehicle transmissions are rotating parts, practically all of which can be produced on the MILLTURNs.

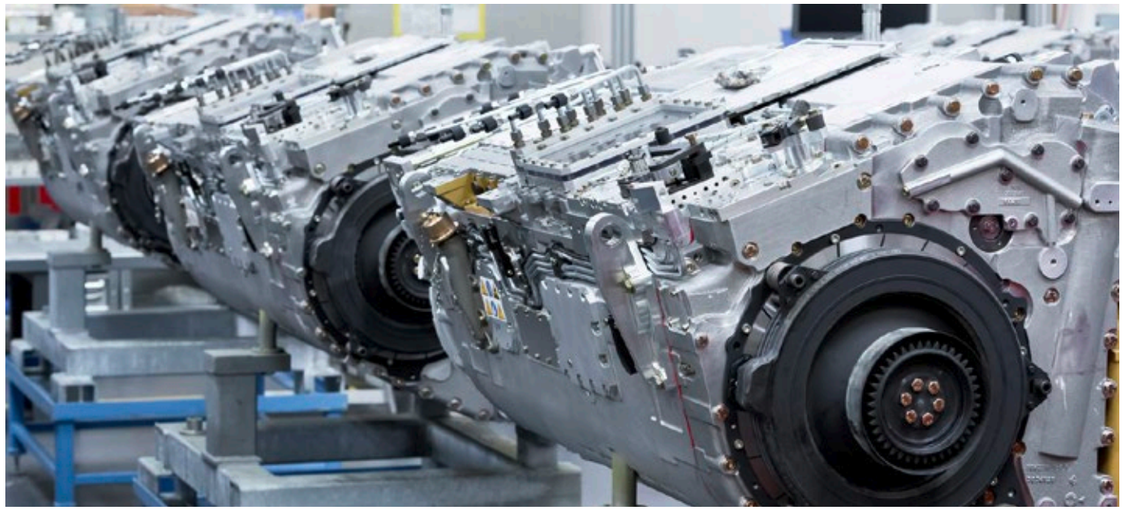
Complete machining of parts for vehicle transmissions

Armoured vehicles need huge levels of drive torque to get going. In order to deliver the necessary propulsive force, manufacturers rely on transmissions from Augsburg-based Renk GmbH, the specialist in fully automatic transmissions for heavy tracked military vehicles. And wherever top performance is required, you can be sure that solutions from WFL are not far behind. But first things first...

Unlike in your car, a tracked armoured vehicle can be driven, steered and even braked all through its transmission. On vehicles kitted out by Renk, this braking effect is delivered by two different braking systems – one for low speeds, one for high speeds – working together by means of a mechanical brake in the lower speed range and a built-in hydrodynamic eddy-current brake known as a retarder. Being responsible for changing gears, steering and braking, the transmission is essentially the central mobility unit of these vehicles and therefore plays a mission-critical role – and that's even before we consider that these 70-tonne monsters need to be extremely manoeuvrable at speeds of up 72 km/h on both roads and open terrain. Renk is the global market leader in transmissions for tracked military vehicles weighing over 40 tonnes and supplies more than 40 armies around the world. Every transmission is designed for a specific type of vehicle and is specially adapted to suit the respective level of equipment and powertrain. In other words, Renk takes the respective basic transmission type and customizes it for its specific application in the vehicle. The vehicle is steered by controlling the output speed via the final drive, then on the sprocket wheel drum, and then directly on the track itself. The driving direction can therefore only be influenced by changing the speeds of the individual tracks. Braking or accelerating is achieved by decreasing or increasing the track speeds at the same time. Different speeds at each of the tracks will steer the vehicle in one direction or another, or the vehicle will rotate around its own vertical axis if the tracks run in opposing directions. All this – as well as the enormous forces that are generated as a result – must be handled by the transmission in every ambient condition imaginable. What's less surprising is that achieving this is dependent on a wide range of complex parts manufactured to stringent quality requirements.

The parts needed for the transmission are divided into three categories: housing parts, small cubic parts (force-carrying parts, valve blocks, brake parts and fluid mechanics-related parts) and rotating parts with gear teeth for speed transmission. The latter are the typical parts installed in the powertrain of the transmission – and parts perfectly suited to complete machining on machines from WFL Millturn. In fact there isn't a single part in this segment that is produced through turning alone as complex milled geometries and a range of holes are often also required. Rod and forged parts are predominantly made of high-strength steels from 1200 to 1300 N/mm2. "If it's round and has a gear cutting, it goes on a WFL machine," is the general rule. "Typically these parts are produced in small batch sizes of 1 to 300 units, whereby the average batch size is around 50 pieces," explains head of production Martin Wimmer. But parts for prototype transmissions in batch sizes of 1 to 5 units are also not unusual. Due to the flexibility of the sophisticated WFL machines, a separate prototype production line with a different manufacturing process is not required: even the smallest of batch sizes can be produced extremely economically using the existing machinery. Cost-intensive special clamp-

EFFICIENCY THROUGH AUTOMATION
To boost efficiency even further, Renk has successfully deployed automation solutions from FRAI Robotic Solutions on two machines. From left to right: Wolfgang Neukäufer – Foreman, Complete Machining; Martin Wimmer – Head of Production, Vehicle Transmissions; Stefan Müller – Production Manager, Vehicle Transmissions.



MOBILITY
Driving, braking and steering: the transmission is the central mobility unit of these 70-tonne monsters.

ing devices are thereby rendered unnecessary, as workpieces are clamped on the Millturns by either standard jaws or a few special jaws with a three-jaw chuck.

A critical factor in determining the productivity of a machine is its programming, which is carried out exclusively using the Siemens NX CAD-CAM programming system. "For the first four WFL machines we had different postprocessors due to the different machine models. In the meantime the PPs have been standardised so that every machine uses the same PP. The advantage here is that production can initially be planned independently of the machine. In other words, a program is created without having to know which machine it will ultimately be executed on. Only once the order is started will the Production Logistics team decide on which machine the respective parts will be produced," explains Wimmer. The entire production process is simulated in the CAD-CAM, where the consistency of the data from the design of the parts to the production on the machine plays an important role. In the CAM itself is a model of the machine, the chuck, clamping jaws, unfinished and finished parts as well as the tools, which allows the reality to be simulated extremely accurately to ensure the programs tested work faultlessly in practice. "This approach works really well. Thanks to the comprehensive simulations we have practically no collisions anymore," summarises Wimmer. The gear teeth are a certain exception during the simulation. Gear teeth are cut on the Millturns up to Module 4, whereby it is predominantly special WFL cycles that are used for gear hobbing, as these can be applied very quickly and easily be entering the gear cutting parameters.

> "Even the smallest of batch sizes can be produced extremely economically using the existing machinery."

The first WFL Millturn was delivered in 2010 and Renk has been working intensively with complete machining ever since. "We analysed our entire range of parts from the very small up to those with diameters of roughly 600 mm with the goal of standardising what was at the time a very diverse machine park. We wanted to have a machine concept that followed an identical structure for all parts of all sizes. WFL had the perfect offering for us with the M35 to the M50. In addition to turning, drilling and milling on a single machine, it was important to us that the gear cutting – especially of Module 3 in Quality 8 – could be performed with a hobbing cutter clamped at one end. While many manufacturers could promise us this, it was only WFL who actually delivered. A positive impact in this respect is the extremely stable indexing of the B-axis with the large Hirth coupling in particular. The WFL-typical setup of the turning-boring-milling unit, whereby the milling spindle is designed as a high-torque gear spindle, ensures exceptionally high machining performance in all speed ranges. The benefits of the extremely stable machine frame are not only measured in terms of productivity, but ultimately the constant adherence to the tightest geometrical tolerances and the optimum surface qualities that are achieved," explains Wimmer on the varied technical reasons behind opting for WFL, before continuing to outline the clear benefits of Renk's decision: "The machines are fitted with an 80 bar high-pressure coolant unit that can also be switched to air. In addition to the standard Capto C6 tool system, each machine is equipped with an extra, particularly stable tool accommodation on the turning-boring-milling unit. Heavy boring bars or special tools are securely held in place by a hydraulic prismatic tool accommodation. Machines with a 3000 mm centre distance also feature a built-in pick-up magazine for the automatic use of long boring bars in addition to the standard magazine. "We no longer want to have to use different machines or external suppliers for the occasional special tasks," explains Wimmer. "Not only does this bring about a significant reduction in lead times, but the number of operations can be dramatically cut too. Individual operation sequences have been halved thanks to the complete machining. The combination machining has also allowed us to make savings in the runtime, with the capacity freed up through the more efficient use of our machine resources being used to perform additional work with the machine. For example, when the machining processes produce burrs, they are immediately deburred on the machine, improving productivity and safety while simultaneously minimising the risk of injury. The user training from WFL has proven particularly helpful in this respect. As well as explaining how to program the machines, users were given a detailed insight into the conceptual planning of the entire machining sequence as well as selecting the right clamping device. In the meantime we now have nine WFL Millturns of three different sizes and two different turning lengths operating on our vehicle transmission production lines."

To boost efficiency and the level of utilisation even further, the M35 delivered in 2017 was kitted out with an automation solution from FRAI Robotic Solutions, which has led to the more efficient production of workpieces such as planetary gears. An M40 has since been automated too. "We have got exactly what we wanted: machines tailored precisely to our requirements that are a perfect match for our applications and space situation. With the second system we want to integrate a further turning station so that our staff can concentrate on demanding tasks," says Wimmer, delighted with the results of the investment.

Renk is especially well prepared for servicing and maintenance with its own in-house maintenance team that takes care of small to medium repair tasks. "It was only right at the beginning that we had to learn that a tool change can take place at

any length position and that you can sometimes find that there is a workpiece in the way, but that hasn't been an issue for a long time now," jokes Wimmer, looking back on those early days.
Machine data acquisition is a topic of growing importance at Renk. To this end a system is already in use that displays the respective status of the machine via a dashboard. As it is important that the same solution can be used in every plant, Renk has opted for a universal solution that is not dependent on any one machine builder – and like with CAD-CAM, there is a close collaboration with Siemens here as well. Renk is already in a strong position with regard to predictive maintenance and condition monitoring with its own solutions: Renk Monitoring, which is also tried and tested with Renk transmissions, has been adapted for machine tools and forms the basis for this important future topic.

DIVERSIFIED
In 1873 Johann Renk founded his self-titled company in Augsburg, which later became known as the Augsburg Gear Factory. In addition to its headquarters in Augsburg, the modern company also operates production plants in Germany, Switzerland, the United Kingdom, Canada and the USA.

facts

- 3,000 employees at 20 locations worldwide
- Joint-stock company since 1897
- The divisions of RENK AG include: vehicle Transmissions, special gear units, standard gear units and slide bearings
- In 2012, RENK opened a central base with RENK Shanghai Service and Commercial Ltd. Co.
- The world's largest test stand for gear boxes up to this point is built in 2016.

All eyes on…

Deep hole drilling in the complete machining centre

by WFL MILLTURN Technologies

Deep hole drilling counts among the special disciplines within the field of machining, particularly as these kinds of machining steps usually require special equipment in terms of both tools and machines. As a machine manufacturer, WFL equips the machine in such a way that it has a number of decisive advantages over a classic deep hole drilling machine.

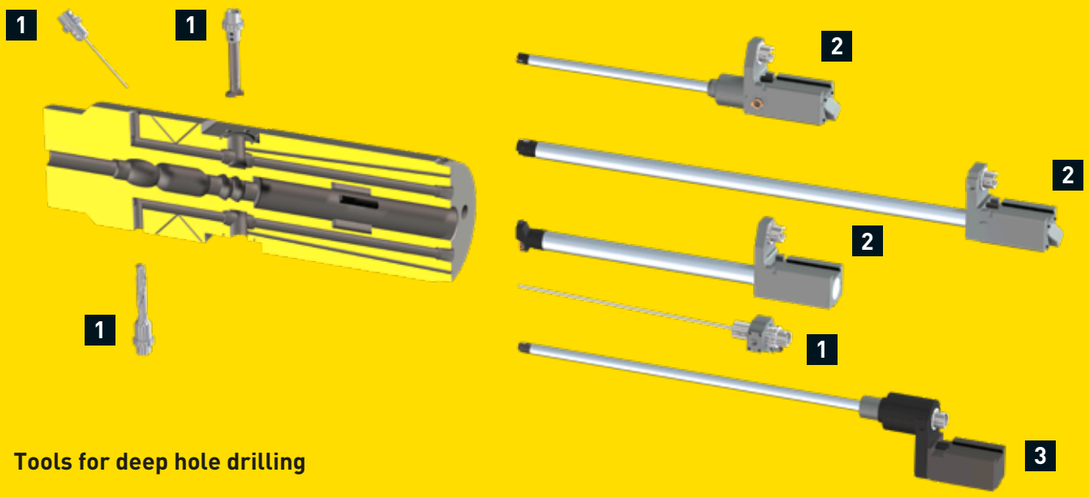
All eyes on

Deep hole drilling in the complete machining centre

by WFL MILLTURN Technologies

Why deep hole drilling with WFL MILLTURN?

- Continuous drilling or counter boring is extremely cost-effective during complete machining
- WFL MILLTURNs have large centre distances, a special coolant supply and optimum tool clamping
- Fully automated machining process and tool change are possible
- Any hole centre deviations can be corrected very easily using the WFL measuring cycles



Tools for deep hole drilling

1

Rotating tool
- Directly incorporated (HSK, Capto, etc.)
- Cooling lubricant by means of milling spindle or externally

2

Non-rotating tool
- Prismatic tool accommodation
- Automatic coolant supply

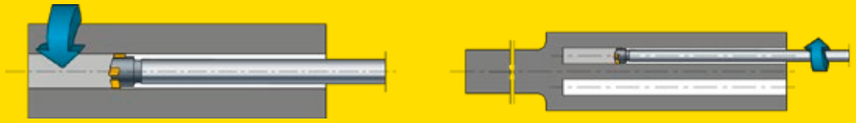
3

Rotating tool
- Prismatic tool accommodation
- Automatic coolant supply

The drilling method

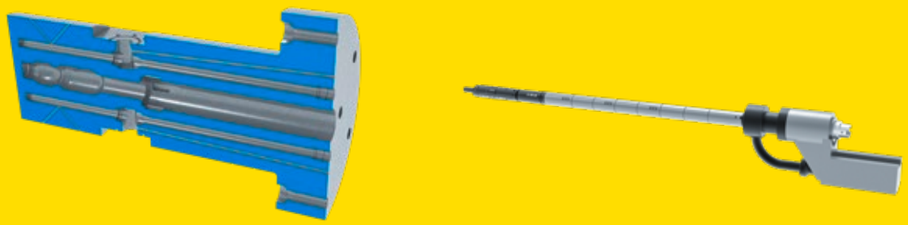
Gun drilling | HTS drilling | ejector drilling | counter boring

The best results are achieved with a rotating tool with simultaneous opposing workpiece rotation.



Rotating workpiece | Rotating tool

Machining with rotating tool:
This method can be used to drill large hole diameters in the centre of the workpiece. The workpiece rotates in the main spindle and is driven via the main motor.



WFL TOOLING SOLUTIONS

myToolFinder
Find your perfect tool solution

Specially developed MILLTURN machining tools allow users to achieve maximum productivity while maintaining outstanding performance. WFL helps you to increase the added value of your production through the use of optimum tools.

The **ToolFinder** offers you unique options:

- Clear information and explanations
- Independent search for new WFL tool solutions
- Inspiration for new machining options
- Contact our experts directly to find out more about our tool solutions
- Detailed telephone consultation

ANTIQUITY

In the fourth century BC, Celtic fortifications were built. In the first century AD, the Romans built a fort and called it Lentia.

MIDDLE AGES

799: First documented mention as "Linz". Royal market and customs town, sometimes even a royal seat of the Holy Roman Empire of the German Nation.

EARLY MODERN PERIOD

After the Thirty Years' War, the city was reconstructed in the Baroque style. In 1672, Christian Sint established the 'Wollzeugfabrik' (wool factory), Austria's first textile factory.

18TH-19TH CENTURY

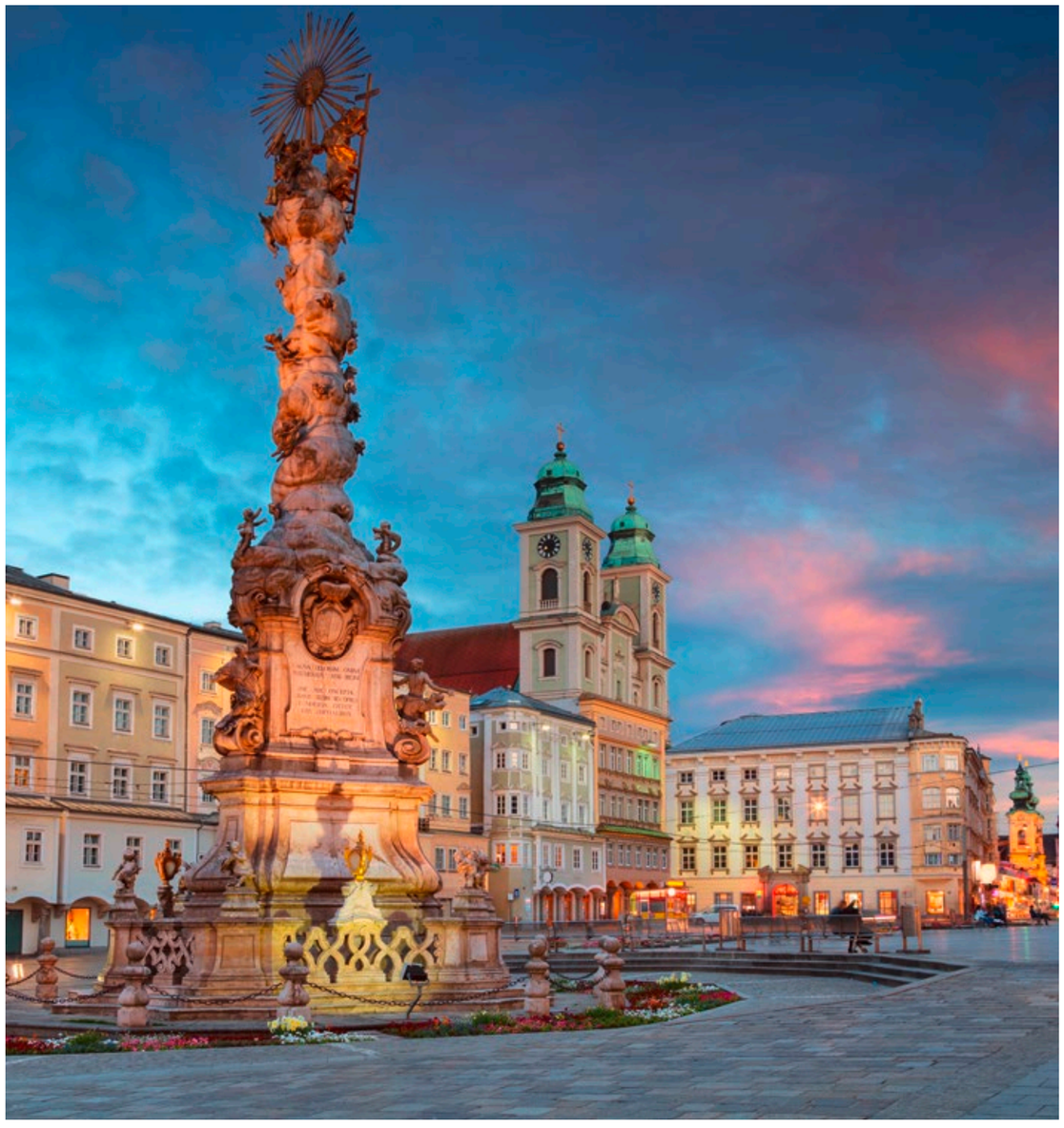
Steam navigation, horse-drawn railway in 1832, industrialisation in 1850, shipbuilding, locomotive construction, metal processing.

20TH CENTURY

Linz becomes a city, a university and cultural city and a key place of business.

21ST CENTURY

City of Culture 2009. Convention city, tourist hotspot, site of research and development.



Lentia – the Roman Linz

In this issue of Complete magazine, we unveil the history of the city of Linz. We're starting with Roman times. Over the next few issues, we will continue through the Middle Ages, the Early Modern period, and on through the 18th/19th centuries, the 20th century, and onto the 21st century. You'll be surprised by the variety of this cultural metropolis!

Linz has an eventful history which has strongly shaped the city. Lentia (Linz) was a Roman settlement for 500 years. In the first century AD, they built a fort here with the name Lentia. The first recorded use of Linz is in a document from the year 799. At its largest, the Roman military settlement surpassed the subsequent Medieval city. Despite a lack of visible historical monuments, traces of a rich past have been found at around 100 excavation sites.

City on the river bend

The Roman name Lentia is derived from the Celtic word 'lentos' meaning 'bend'. Linz was therefore intended as a settlement on the bend in the river, which corresponds to its location on the Danube. To protect this important transport route over the Danube, Roman soldiers built a fort towards the end of the first century AD (now the courtyard of the Landestheater) as part of the border system for the region of Noricum. The associated civilian settlement, which never received city status, lay west of today's main traffic artery between Hauptplatz and Landstraße. A 'sacred district' with a Mithraeum[1] was uncovered in the area of Tummelplatz. A burial ground with rich grave goods from the Late Antiquity period (4th/5th century), when the centre of the settlement moved from Niederterrasse to Martinsfeld, is known to have existed on the Römerberg hill.

Roman life

Discoveries of especially high quality, ancient Roman fine ceramics (known as terra sigillata) provided evidence of the use of items of a higher standard and were therefore the first indications of how the people of Linz lived in Roman times. The topography of a Roman settlement was localised in the Linz old town and the adjacent zones.
One milestone in the archaeological research was reached in the 1920s when Roman-era urn graves were unearthed on the land of the Sisters of the Cross, upon which a school complex was to be built. Over 140 graves were recorded in 1926 and 1927 and are still considered to be unmatched source material because

RESPLENDENT
Reconstruction of the cult image of the eastern god Mithras.

RAETIAN VASE
Imported piece from the neighbouring province of Raetia. Location found: From the site of the Roman fort of Lentia.

ROMAN SETTLEMENT AT THE ALTER MARKT
Half-timbered houses and stone houses, complete with wall murals, were located on a paved street that led from the Danube into the Roman settlement. Burnt pieces of wood and the weaving weights of a loom were found here.

of their uniformity. Several of the excavated cremations contained, alongside the usual ceramic pots, glass and jewellery from northern Italy, statuettes from Gaul and bronze vessels which not only attest to widespread trade relations, but also to a certain level of prosperity among some Lentians.

Life in ancient Lentia

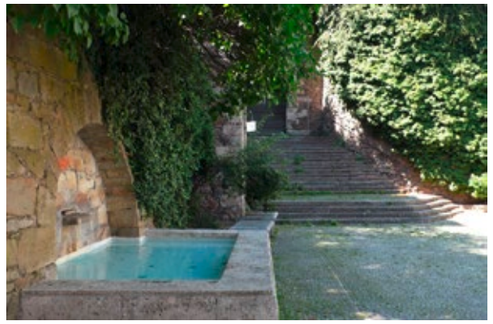
The discoveries in and around St. Martin's Church suggest that civilians led a simple life. A kiln and millstones preserved in the church provide evidence of workshops and simple lodgings which appeared to give way to stone structures in the second century.
Based on excavations in the 1980s, Linz archaeologist Erwin M. Ruprechtsberger concluded that there was an artisan district along Lessingstraße and the Römerberg hill, where some working of iron and bone took place. In terms of architecture, Roman rule brought both brick construction and a mixed technique of stone/timber construction to our city. Load-bearing timber structures were built onto brick stone foundations, the walls of which were made with clay-plastered wattle. A particular highlight is that the smaller living areas back then were fitted with wall and underfloor heating.

The Cult of Mithras

Special mention is made of an unearthed monument to the Cult of Mithras (an eastern deity) in the former vicus area of Lentia. This is because this find is evidence of the exceptionally long duration of the cult into the late period of ancient Lentia and so for the entire Roman Empire, which is seen as plausible for this type of military/civilian settlement. The Cult of Mithras is a mystery religion that only disappeared at the beginning of the fifth century due to the ban on 'pagan cults' by Christianity. For believers, mystery religions meant that they had to pass certain tests in order to become a 'member'. Another characteristic of the cult was the secrecy. It was not crucial for a person to admit to being a member of the Cult of Mithras, but they were bound to secrecy about the content of the belief system and what rituals were performed for what purpose, which makes it very difficult to draw conclusions on these topics. This silence also resulted in a flood of speculation surrounding the content and rituals of the Cult of Mithras. This then culminated in accusations against this religion, particularly from Christians, that the devil imitated the Christian sacraments in their ritual acts.

[1]Mithraea are temples from the Cult of Mithras. They were usually underground or in caves.

A particular highlight is that the smaller living areas back then were fitted with wall and underfloor heating.



SANCTUM IN TUMMELPLATZ
Soldiers erected a temple to the eastern deities Mithras and Jupiter Dolichenus on the edge of the Roman settlement, which was used up to the end of the fourth century.

Photo credit: Photos page 28: cult image: CE-Projekt Donaulimes, Raetian Vase: Nordico – Museum der Stadt Linz, Photos page 29: Roman Settlement: Nordico – Museum der Stadt Linz, Tummelplatz: CE-Projekt Donaulimes

EDITOR'S TIPS:

In the **Nordico Stadtmuseum**, you can learn all about the history of Linz. The museum has an extensive collection of art, photography, archaeological pieces and items from folklore. The Nordico – a networked, vibrant place for storytelling and innovative museum work – is also a place for learning and education. Alongside the permanent exhibitions which provide insights into the city's history, the Nordico Stadtmuseum features temporary exhibitions on various topics.
With its show '100% Linz', the city museum reveals hidden items from its memory store. Much like a kaleidoscope, it reflects Linz in its many facets and puts its museum pieces into new contexts. The open exhibition offers exciting insights into the city's history.

The **Schlossmuseum Linz** features 10,000 m² of exhibition space, providing an extensive insight into the natural, cultural and art history of northern Austria from the dawn of time until the 21st century.
The permanent exhibitions in the historical castle and in the new south wing are incredibly varied. They range from the history of the Earth to contemporary history and bear witness to diverse, extensive areas of specialisation.

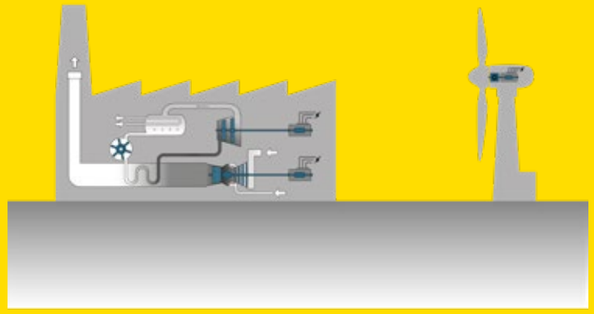
Archives of the city of Linz
Since 8 July 2015, part of the foyer of the old town hall has showcased Linz history from its beginnings up to the present, covering politics, social history, daily life, culture and the economy. The aim of this permanent exhibition is to provide a structured outline of Linz's history for both city tours and for individual visitors.

All eyes on

Complete machining of components for small power plants

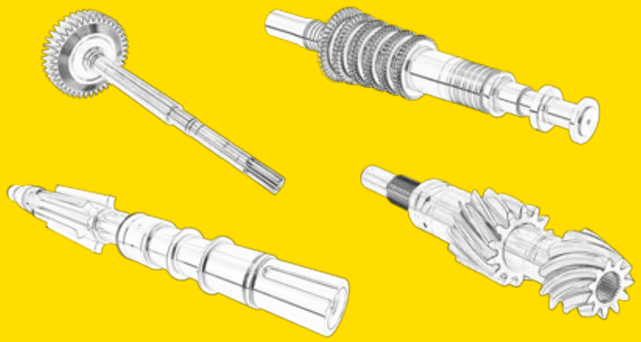
by WFL MILLTURN Technologies

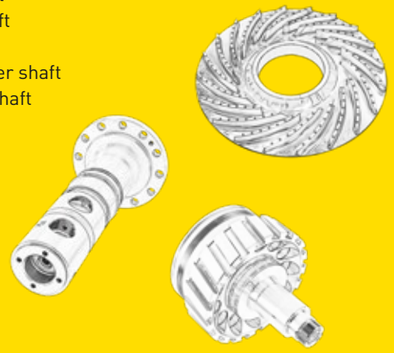
Up to the end of the 19th century, energy was generated by means of human and animal power. The rapid progress brought about by the industrial revolution meant that faster, more efficient solutions were found. We're talking about all kinds of special small power plants. WFL is established in this sector and offers complete machining for a range of different small power plant components. Workpieces for energy technology applications and components for small power plants such as turbine and generator shafts and wind energy plant components are produced with extremely stringent tolerances and place great demands on the machining process. A MILLTURN provides the necessary special technologies for efficient production of such workpieces, such as milling special profiles or large gear teeth, as well as grinding shaft components, including measurements of true run-out and concentricity to ensure compliance with the very highest requirements for precision.



Components for small power plants:

- Valve
- Pump wheel
- Turbine shaft
- Gear shaft
- Turbocharger shaft
- Generator shaft





Technologies:

- Milling of dovetail profiles
- Milling of fir tree profiles
- Grinding
- Run-out and concentricity measurement
- Turning with pivoting B-axis

Example:
One sector of components for small power plants is generator shafts:

The untensioned blank in the generator shafts is often pre-turned and turned into a MILLTURN with welded-on bars. One of the most important aspects of machining the welded-on bars is ensuring that the blank is aligned in the circumferential direction in such a way that the longitudinal grooves are inserted in the centre of the bars. Thanks to the WFL measuring cycles, measurement of this blank is fully automated, with it even being possible to determine and correct welding errors. In the shaft area, inclined ø 60 mm bores must be inserted, which meet the ø 100 mm centre bore at a depth of approx. 500 mm. All bores can be inserted in the MILLTURN without any tools, with very elegant rounding of the edges of the bores being carried out too. The precise outside diameter of the bars that is to be machined is finished in IT7 quality by means of turn-milling. Bearing seats on the pins are rotated with maximum precision and subsequently rolled. The WFL in-process measuring guarantees process reliability, even with IT6 quality.

Potential savings with generator shafts:

Saving on machining steps (OPs)	Saving on set-up time	Saving on machining time
60-70%	**80-90%**	**30-70%**

Traditional process chain		MILLTURN complete machining	
OP 10	Pre-turning	OP 10	Complete machining 1st clamping
OP 20	Milling of bars	OP 20	Complete machining 2nd clamping
OP 30	Ø 100 mm centre bore on the machining centre		
OP 40	Inclined borings ø60 in machining centre		
OP 50	Finish turning with grinding allowance		
OP 60	Grinding – bar outer Ø		
OP 70	Grinding of the bearing seats		
OP 80	Edge rounding of bores		
OP 90	Deburring of the bars		

Saving of
60 %

Scalable warehouse lift system solution
with direct SAP integration for WFL

Increasing efficiency and gaining space in existing building

Confined space conditions often restrict the scope when modernising warehouses. SSI Schäfer solved these structural challenges, which are particularly widespread among smaller and medium-sized companies (SMEs) with the installation of SSI LOGIMAT® warehouse lifts at WFL Millturn Technologies. By increasing the storage capacity for small parts vertically, it was possible to free up a remarkable 110 m² of floor space in the existing hall. The devices are controlled directly from SAP, which means that sub-systems and interfaces are not required. The successful machine building firm has also recorded an increase of up to 50% in picking output in this area.

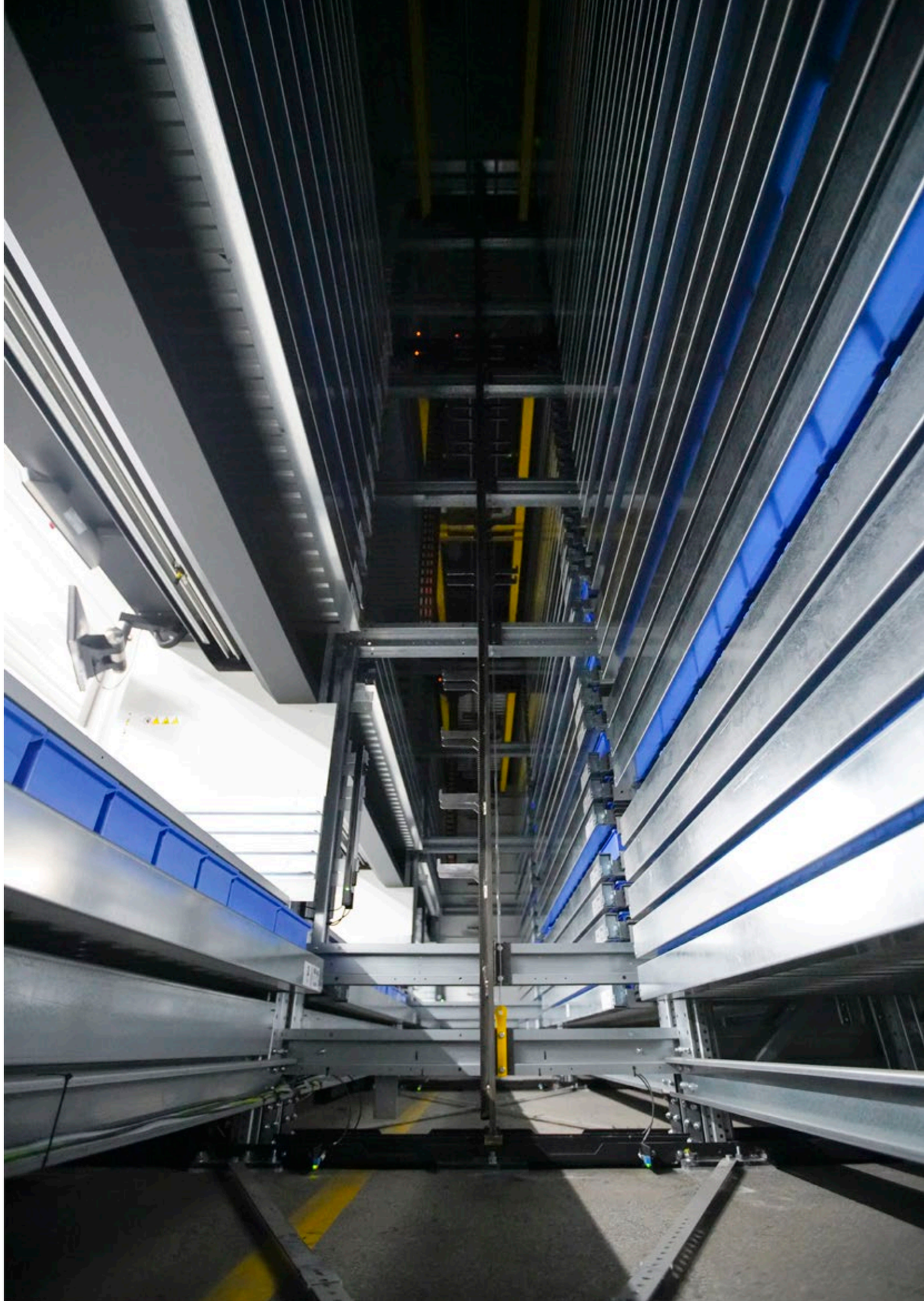
Based in Linz, Austria, WFL Millturn Technologies GmbH & Co. KG is the only manufacturer worldwide that concentrates exclusively on the production of multifunctional complete machining centres. Every individual complete machining centre supplied under the MILLTURN brand is a special machine. Consequently, the current stock levels, which stand at around 30,000 active articles, including spare parts, will continue to increase in future – not least thanks to new machine types such as the M20 MILLTURN.

Focus on process changes

Alexander Hofmann became Head of Logistics Operations at WFL in 2019. His job is to stay abreast of the increasing logistical challenges and develop new approaches to optimisation. In this way, for example, standard drawer cupboards have largely been used to store small components. Even though, in line with WFL's SAP strategy, warehouse management software was and is in use with SAP WM, the question of where to find free storage space became increasingly impossible to answer. The different sizes of the compartments in the drawer cupboards also caused issues as they had to be repeatedly adapted to fit the stored goods. Process times became longer and space in the warehouse became increasingly tight.

Modernisation of small-parts storage through partial automation

In order to get to grips with this problem, SSI LOGIMAT® warehouse lifts from SSI Schäfer were sought out by WFL from the very beginning, as they enabled partial automation of small-parts storage and picking: "We were looking for a solution that is tailored to our requirements. The one we found is so successful that it is now an established system in the market which can store a wide range of different materials in very little space and, moreover, is intuitive to operate alongside being robust and reliable," stresses the Head of Logistics. SSI Schäfer's software skills in conjunction with the SAP expertise of system partner Status C, which is unique on the market in this specification, was key to placing the order. "We didn't want any additional software that would be connected to additional interfaces, as



that would involve maintenance and update costs – we wanted to work directly in SAP. Status C has provided the perfect solution that is tailored to our individual needs," continues Hofmann.

Installation while retaining structural integrity

The order to supply six SSI LOGIMAT® warehouse lifts including integration into the existing SAP environment was placed at the start of November 2019. The warehouse lifts were then installed in the existing building in January 2020. "However, we then had to overcome a number of structural challenges," says Alfred Spicker, Head of Dynamic Systems, Products & Equipment business unit, at SSI Schäfer. "The existing platform practically had to be cut out in order to enable installation of the automated storage and picking systems. WFL also took this opportunity to redesign the platform and optimise it." SSI Schäfer provided further support with finding the concept and selecting suitable storage containers as well as with the process of relocating initially around 12,000 of the some 15,000 articles in the small parts area.

Storage density increased vertically to 70 m²

Things started to ramp up in April 2020. Prior to this, the old drawer cupboards were relocated to alternative areas and the new warehouse lifts were also filled during ongoing operations without significant restrictions. The current SSI LOGIMAT® system consists of two rows with three devices each, with the dimensions 3.8 x 3.1 x 7.3 m (L x W x H). They are fitted with 58 trays (3225 x 815 mm) and enable loads of up to 550 kg. 64 trays can be switched per hour for each lift. Around 15,000 LMB containers are in use. LMB containers are specially designed by SSI Schäfer for use in warehouse lifts and have been optimised to the shelf board depth of 800 mm. Four different types of container from the LMB range were selected, which can be varied within a tray and divided by means of robust partition walls. This enables fast, simple assignment of articles and prevents products from being sifted through and mixed up. The trays provide a direct overview of the parts to be removed, while the containers are accessed manually from above, making them ergonomic and eliminating any tiresome stooping and stretching in day-to-day work. The additionally initiated batch picking system enables WFL to process multiple orders simultaneously, which has significantly increased picking output even further.

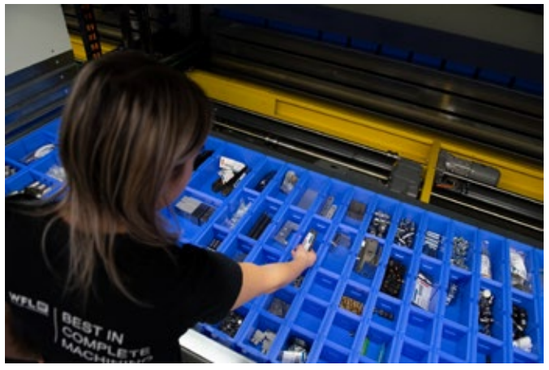
Warehouse lift control in SAP without third-party system

SPS EasyConnect was used to enable the SSI LOGIMAT® warehouse lifts to be integrated directly into WFL's existing SAP environment. This SAP add-on from partner Status C enables a direct connection without additional sub-systems. "All of the functions of the warehouse lift are mapped in it," explains Alfred Spicker. "Transport orders generated in SAP are thereby visualised on the lifts in real time and converted into tray movements." The direct lift control makes processing of the order queue faster by hand, further supported by user-friendly touchscreens that can be operated intuitively. SPS EasyConnect further ensures maximum stock reliability. There is no duplicate inventory management, and future software updates from SAP are incorporated straightaway.

Prestige project as the basis for further optimisations

"We are delighted with the results achieved," concludes Alexander Hofmann. "SSI Schäfer and Status C have delivered us a solution that meets our exact requirements. The collaboration and implementation went very well, despite a few challenges." Another highlight was managing to stick to the tight schedule. This was all thanks to the best possible preparation and well-structured planning with ongoing operations. "What's more, we managed to increase picking output by around 50% on average, and, thanks to the lift system, saved 110 m² of 180 m² warehouse space, which can now be put to other use."

The machine building firm is now much less reliant on staff availability, as all six warehouse lifts can be easily operated simultaneously by one person.
Following this project, WFL has already made further process optimisations, including tool stations on the lifts and a label printer with central printing station. To top it all off, only one shift operation rather than two-shift operation is now required to achieve the required performance levels. The plan for 2023 includes improvements to the goods-inward processes and the dispatch of spare parts. Should the range of small parts continue to grow out of proportion, the number of SSI LOGIMAT® warehouse lifts can be increased accordingly. There would definitely be enough space!



MODERNISATION OF SMALL-PARTS STORAGE THROUGH PARTIAL AUTOMATION
There are around 15,000 articles in total in the small parts area.

PRESTIGE PROJECT AS THE BASIS FOR FURTHER OPTIMISATIONS
With the Logimat system, Alfred Spicker, Head of Dynamic Systems at SSI Schäfer (left), and Alexander Hofmann, Head of Logistics Operations at WFL (right), are laying the foundations for an efficient workflow.

All eyes on

Complete machining of crankshafts in small series

by WFL MILLTURN Technologies

The complete machining of crankshafts including deep hole drilling of oil channels or milling of gear teeth proves to be the best alternative to conventional manufacturing processes with a MILLTURN. With our many years of experience and the use of flexible and multifunctional complete machining centers, we efficiently produce prototypes and small series of crankshafts. Whether highly productive rough machining or precise pre-finishing - all geometries of crankshafts can be completely machined in a MILLTURN from WFL.

Traditional process chain		MILLTURN complete machining	
OP 10	End machining	OP 10	Complete machining roughing
OP 20	Roughing of main bearing	OP 20	Complete machining finishing and deep hole drilling
OP 30	Roughing of crank pins	OP 30	Heat treatment
OP 40	Finishing of main bearing with grinding allowance	OP 40	Grinding
OP 50	Finishing of crankpins with grinding allowance		
OP 60	Counterweight – mounting surfaces		
OP 70	Deep hole drilling		
OP 80	Boring		
OP 90	Heat treatment		
OP 100	Grinding		

Saving
60 %

Potential savings in complete machining of crankshafts in small series

Saving on machining steps (OPs)
50-70%

Saving on set-up time
80-90%

Saving on machining time
40-60%

craNx
THE CRANKSHAFT PROFILER

Cranx - the crankshaft profiler

Wit the WFL cycle packages for crankshaft machining branch-specific requirements are handled quickly and efficiently.

- Cranx-Basic (basic crankshaft package)
- Cranx-Advanced (extended crankshaft package)
- Cranx-Plus (complete crankshaft package)

Typical technologies for crankshaft machining

Turning

Milling

Boring

Deep hole drilling

Pin milling
(Eccentric milling)

In-Process Measuring

Gear machining

Learn more about pin milling here:

Advantages of the production of crankshafts in a MILLTURN

- Reduction of machining operations
- Minimal set-up effort
- Low space requirement
- Reduced manpower
- Clamp once - machine complete (including all turning, milling, measuring and turn-milling operations)
- Optimum form and position tolerances due to elimination of clamping mistakes in multiple clampings
- Process monitoring with WFL iControl
- Process reliability
- WFL cycles for crankshaft machining
- Flexibility in machining especially with regard to small series and prototype production
- Integrated workpiece measurement

A new level of added value

Market changes and mutual dependencies between value creation stages require both new technical and economical solutions. How can companies face these challenges with greater resilience? How can we exploit the benefits of increased cost effectiveness? These questions are being posed by the transnational 'EuProGigant' project. The aim is to ensure smart, sovereign use of data for production and bring this to Europe.

In the "EuProGigant" project, production-related data is identified, extracted and organised. Through Gaia-X (a sovereign data infrastructure for Europe), a data sovereignty rule is established, communication structures are considered as part of a European data cloud environment, and these concepts are carried over into the area of production. An initial demonstrator was presented at the Hannover Messe in May 2022, featuring data trading, data sovereignty aspects and data protection-related issues. This is mapped in the structure, information data and technical mechanisms. The next step is about projecting this technology onto actual use cases and bringing it into production. WFL is one of the key implementation partners in the project.

In order to obtain meaningful data, users of WFL machines are part of the consortium. Plasser & Theurer, for example, bought a WFL machine with automation in 2022. The machine is supposed to run without human interference and use process monitoring to move data from the machine to a control level. The assessments will be made in house, but thanks to the communication standard Gaia-C, this is set to take place beyond the company's borders to enable integration in a production network and the exchange of information – on tolerance values, for example. Other machine manufacturers in the consortium include Heller and Arburg. At Heller, a WFL machine is in spindle production, where it performs the essential turning machining process. Arburg has other machines which perform the essential turning/milling processes for hydraulic functions when introducing the subsequent injection moulding tools. At the IFT (Institute for production technology) in Vienna, there is an M35, which is used to perform tests and evaluations. The aim is to transfer the results its partners' production sites.

Perfect component matching

The M35 MILLTURN, which is at the IFT at Vienna University of Technology, is integrated into a data communications network as part of a collaboration line. There is also an application/working group called 'Perfect component matching'. It poses the following questions: How can we ensure that the function of an assembly is guaranteed following the assembly process? How can we influence production steps and assembly processes here? And how can we skilfully bring together finished components with the right join partners so that they meet the functional requirements straightaway? After all, this saves having to perform a goods inward inspection. It saves on infrastructure, as testing infrastructure is used by both suppliers and customers. Ultimately, it speeds up the assembly process. You no longer need to search for the right component or perform rework, as this is considered from the outset in terms of functional fulfilment and fed back to the production steps.

What can we specifically do now to ensure that the right counterpart is found for an existing component? This is a real issue that is currently being performed with manual intermediate or storage work steps. This brings to mind, for example, the recurring grinding of spacer rings, which need to be machined with high precision in the tenths to hundredths of µ range. Approaches to this are provided by means of intelligent support in the form of a component matching service. This helps with the batch that is delivered by customer A: do such and such components match the components from supplier B with the exact type number? We already have this information before the parts even reach installation. Accelerated support through digital processes and thereby faster value creation are the clear outputs here. However, behind it all there must be a data infrastructure that facilitates this type of service.

> "With the vision of a joint data infrastructure like the one in the EuProGigant project, we are experiencing a new generation of the internet."

A new generation of internet

Everyone knows what the internet is and everyone uses it in a way that couldn't be more intuitive. With the vision of a joint data infrastructure like the one in the EuProGigant project, simply put, we are experiencing a new generation of the internet. This means an internet that contains a great deal more data and digital services. The search functionality can be used like a kind of web browser. For example, you can search for data from machine manufacturers, such as information about the CO_2 assessment. Interfaces provide a connection between computers (peer-to-peer).

The data is available to everyone in this ecosystem. Searches are performed much in the same way as Google: I enter my search term and can use filters as necessary, etc. What makes this system special is the sovereignty. For EuProGigant, this means that you can always control what you disclose in an interaction. Here we need to pose questions such as: For what purpose should you be allowed to interact with me and for how long? How much influence do I have and what control measures are in place? This sovereignty is ensured thanks to mutual trust.

Faster value creation

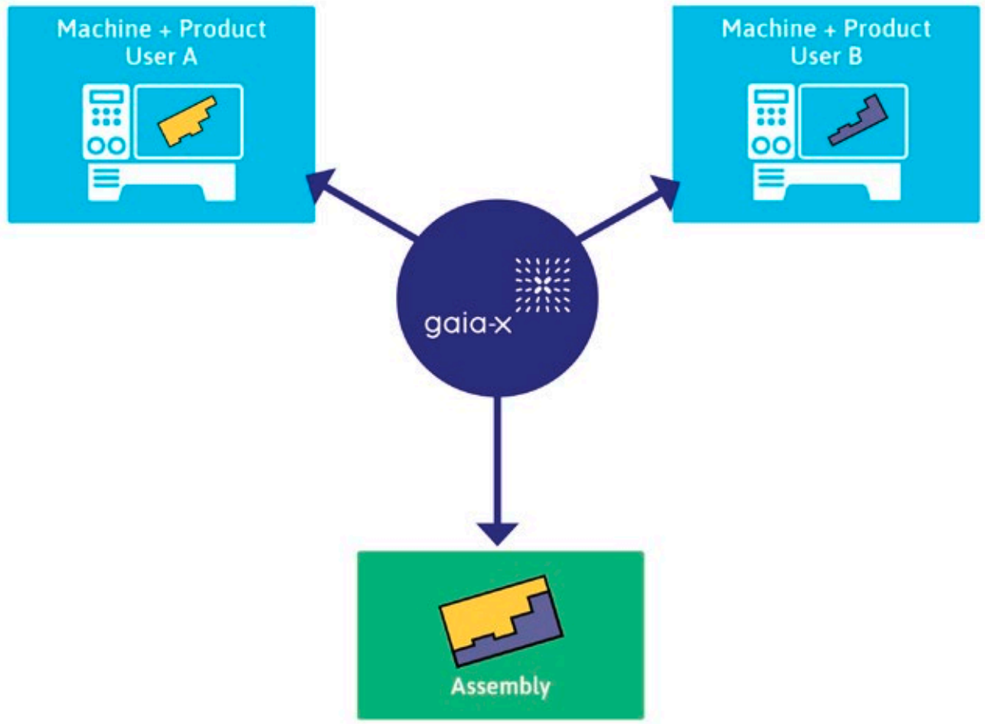
In the production industry, lifting off swarf from a workpiece or a finished workpiece is seen as a value-creation process. In other words, whenever energy is used to form things and change their shape and position, thereby giving them new added value. The upstream and downstream processes for logistics, warehousing and production planning all help to create value. How can these processes be simplified and accelerated? Digital tools are a key part of this, with digitalisation being a fundamental requirement for continuing cross-company standards. How can a well thought-out, standardised process be digitalised using digital tools and then automated?

This has already been implemented with regard to tool, process and machine monitoring. We know the status of the machine or process at any time and can respond quickly to changes. These are shown immediately, allowing us to ensure the availability of the machine. The quality of the workpiece is checked and ensured. And if it is possible during production, this information can be sent

straight to the customer, so that, for example, they then only need to perform the goods inward inspection at random. These areas are accelerated, which is a huge asset.

From testing to implementation

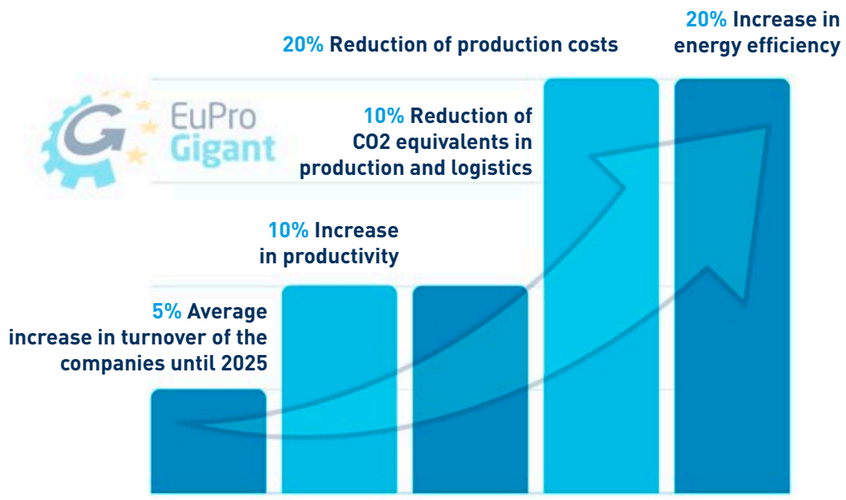
The third milestone was reached in October 2022. It demonstrated that the first throughput phase of the research-related testing has reached a conclusion. The next phase concerns implementation. Together, the aim is to be able to demonstrate concrete successes in implementation, such as with the further development of demonstrators in the area of "perfect component matching". These goals need to be active in the machine tool like sensors, for example, so they can therefore close off end tolerances. Corresponding parametric adaptation of the machine to the correct tolerance is therefore possible. The aim is to keep pace with the Gaia-X development and integrate the key experiences into the other working group topics. The knowledge gained from the demonstrator is therefore fully transferred over to the companies.



PERFECT COMPONENT MATCHING
This working group is planning an automated comparison of individual parts, taking account of tolerance deviations. Information from different data sources is brought together here, enabling optimised grouping of assemblies. This creates added value which is reflected in the reduced amount of time for manual installation, as well as fewer rejects.

PROJECT PARTNERS
The EuProGigant project consortium consists of eight Austrian and eight German partners. These 16 project partners develop the infrastructure of the European production giganet and are involved through their work on the project's work packages.

EuProGigant aims to achieve the following, quantified effect:



Internal machining expertise of WFL:

A SYSTEMATIC APPROACH TO DEEP HOLE DRILLING

The most basic form of internal machining is drilling. In drilling terms, holes with a diameter between 0.2 and 500 mm and a drilling depth typically greater than three times the diameter are generally considered to be 'deep' holes.

Special challenges call for special tools

The perennial challenges associated with deep hole drilling are how to introduce cooling lubricant to the cutting edge, how to remove swarf at a steady rate, and how to create the straightest possible hole. With deep hole drilling procedures, the drilling head next to the actual main cutting element (mostly an individual cutting edge or one made up of interchangeable cutting inserts) consists of a secondary cutting edge and additional guide strips. This arrangement ensures the drill bit is supported at the wall of the hole, which increases accuracy and makes it easier to centre the drill bit during the process. The support provided to the drill bit also produces a smoothing effect, which improves the surface quality inside the hole.

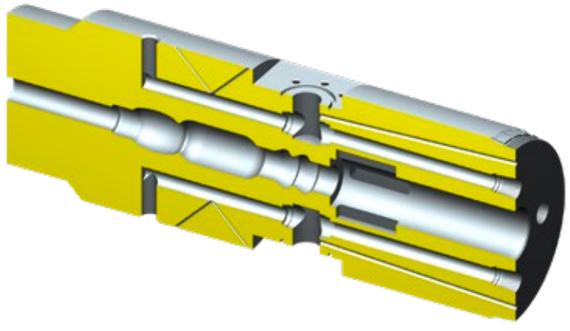
Different processes

Deep hole drilling processes are divided into two main categories, depending on whether chips are removed externally or internally. External chip removal is mainly associated with gun drilling and, more rarely, double-lip deep hole drilling, whereby cooling lubricant is introduced to the cutting edge via inlet holes in the drill bit and the chip/cooling lubricant mixture is transported away along a V-shaped longitudinal slot in the tool. This process is typically used for drilling diameters between 0.5 and 40 mm.
Another option, at drilling diameters of 16 mm and above, is the BTA process. This is one of the processes whereby the chip/cooling lubricant mix is transported away internally. The advantage with processes where chips are transported away internally is that outgoing chips no longer come into contact with the surface of the hole and therefore cannot damage it. Ejector drill bits, a special form of BTA bit, may be used at diameters of approximately 25 mm and above based on a two-pipe arrangement. These drill bits have additional cooling lubricant outlets around the edge of the drilling head, and some of the lubricant is fed directly into the internal pipe through a ring nozzle. This creates negative pressure in the front section of the drill bit, which accelerates removal of the chip/cooling lubricant mixture.

Integrated machining

With extremely deep holes or materials where machining is difficult, excessive tool wear often requires that drilling is performed in stages using tools of different lengths but the same diameter. WFL MILLTURN machining centres offer decisive advantages as far as these kinds of machining steps are concerned. For one thing, the various drilling tools used can be stored and kept ready in the tool magazine; this minimises interruptions and manual processes while significantly improving positional accuracy. Not to mention the fact that genuine six-sided deep hole machining can only be performed during one clamping operation or two at the most.

Automatic workpiece measurement and adaptive control



Any number of holes can be made at any position in no time at all. This provides the flexibility to carry out different machining steps consecutively.

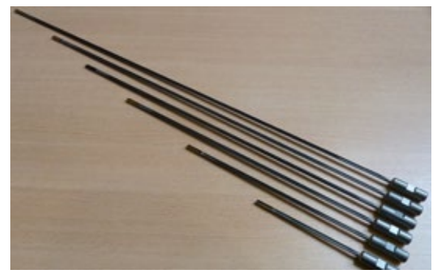
Due to the large tool projection, deep drilled holes are subject to hole centre deviation that increases with the hole depth. These machining errors cannot be fully eliminated, even when machining on MILLTURN machines.

Hole centre deviations are measured by intelligent in-process measuring following the completion of deep hole drilling. This is performed either with an extended measuring probe or by means of ultrasonic wall thickness measurement, which involves measuring the thickness of the wall at various circumferential positions and calculating the middle of the centre hole. New clamping points are then produced on the workpiece concentrically to the defective deep drilled hole by means of turn-milling. This allows the realisation of all subsequent machining processes with very close form and position tolerance to the deep drilled hole.
The benefits are clear. Set-up times are reduced enormously and any finishing work due to deformation resulting from other work steps can be carried out immediately. Process steps can be carried out consecutively without having to compromise on accuracy.

With small drilling diameters, the coolant is fed through the milling spindle with a coolant pressure of max. 200 bar. With larger drilling diameters, the coolant volume is crucial.

An automatic tool change with long tools takes place using a pick-up magazine and prismatic tool changer.

Deep hole drilling is particularly difficult with materials such as Inconel or titanium, because the indexable inserts are subject to heavy wear. This requires that the machine manufacturer possess comprehensive expertise.



Thanks to the tool magazine in the machining centre, it is possible – without much extra work – to use different drilling tools at different stages when working on extremely deep holes.

TECtalks
Technology worth spreading
by WFL Millturn Technologies

TECHNOLOGY AND INNOVATION ARE OUR PASSION.

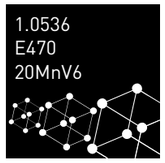
Machining process: Turbine shaft

Technology:

- Complete machining with 2 clamping operations
- Milling of the 30° chamfer in the centre
- Rough turning of the surface
- Rough turning of the outer contour
- Rough turning of the inner contour
- Turning of outside thread
- Rough machining/finishing of gear teeth
- 2 x grooves, turn-milling in the centre of the component
- Milling and deburring of the grooves in the longitudinal direction as well as the circumferential slot
- Calculate length automatically with the measuring probe
- Rough/finish turning of the inner contour by means of the boring bar
- Rough/finish turning of bottle bore contour
- Shaping of internal gear
- Pilot hole ø 4 mm
- Deep hole drilling ø 4 mm – 300 mm deep (35 x Ø)
- Milling of 3 slots

Highlights:

- Complete machining with just 2 clamping operations
- Automated measurement of the length, diameter and positions
- Internal machining with Ø 100 mm boring bar – overhang 1325 mm (13.25 x Ø)



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You have questions regarding our products, technologies or machining? We are looking forward to your mail at **office@wfl.at**

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Our customer magazine „COMPLETE" is available in German and English. Additionally a download link can be found on our homepage.

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