

# Results Today

The global customer magazine

N°13

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Yiben's success

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tech, high quality

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# A source of strength in challenging times



Dear readers,

In the wake of the coronavirus disease 2019 (COVID-19) and its impact on the global supply chain, it is clearly more important than ever for manufacturers to have strong, integrity-based supplier relationships. That is exactly what GF Machining Solutions delivers. Our broad portfolio—Milling, Spindles, Electrical Discharge Machines (EDM), Laser texturing and micromachining, Automation, software, and Customer Services—as well as our application and process expertise make us a source of strength and a single point of contact to customers worldwide.

Whatever your market segment or application challenge, you can work in confidence that your success is at the center of everything we do. As a Division of the global GF group, we are in a uniquely strong position to help your business navigate a changing manufacturing landscape and achieve the next level of success.

In these unprecedented times, we know you are counting on us and that's a responsibility we take very seriously. We are eager to prove our customer-centric orientation to you—and the success stories and solutions detailed in this Results Today issue are a great place to start.

Lastly, I will be retiring as president of GF Machining Solutions at the end of June 2020 and I thank all of our customers for your loyalty. I will continue to support the Division in an advisory capacity until September and ask that you join me in supporting my successor, Ivan Filisetti.

**Pascal Boillat**  
**President, GF Machining Solutions**

# Committed to your success in the “new normal”



Dear readers,

Welcome to GF Machining Solutions' customer magazine, Results Today, your gateway to inspiration from our successful customers around the world and our complete solutions that help enable their success!

I am proud, as president of GF Machining Solutions, that our Division of GF has your confidence. Your success is our success, and we are keenly focused on helping our customers bounce back from the current pandemic and flourish in this “new normal.” This commitment goes beyond simply selling machines. It means supporting you with best-in-class service, application support, and expert advice and training that only we, with our broad technology portfolio and technology leadership recognized across the globe, can offer. Our complete solutions can help your business recover—and help customers grow in the future—whether you are looking to extend your capacity or adopt a new technology.

Last, I thank my predecessor, Pascal Boillat, for his many years of leadership as president of GF Machining Solutions. He will remain in the organization to support the Division by working on dedicated special projects for the months to come. Together with our teams around the world, we are passionate about your success and we are eager to prove this to you.

**Ivan Filisetti**  
**President, GF Machining Solutions**

# Organizational changes

## New GF Machining Solutions' president named

With the retirement of GF Machining Solutions President Pascal Boillat at the end of September 2020, Ivan Filisetti will take the reins as President, effective July 1, 2020.

Boillat, who became president in January 2013, led GF Machining Solutions to its position as a world-leading machine tool manufacturer with a strong focus on Digitalization and new technologies. He joined GF Machining Solutions as Head of Operations in October 2010, after serving for seven years as President and CEO of GE FANUC Automation Europe.

Filisetti, a mechanical engineer in automation and robotics, first joined GF Machining Solutions in 1990, holding a number of management positions. From 2000 to 2009, he held production, logistics, operations and division manager roles at two European machine tool companies, rejoining GF Machining Solutions in 2009. As GF Machining Solutions Vice President for Operations, he has had global responsibility for the Division's production and research and development activities.



Pascal Boillat, President of GF Machining Solutions, will retire at the end of September 2020



Ivan Filisetti will take reins as new GF Machining Solutions President, effective July 1, 2020

## Commitment to quality, innovation and growth drive leadership changes

As part of GF Machining Solutions' commitment to quality, innovation and long-term growth, two key leadership changes were implemented on September 1, 2019.

Scott Fosdick, former GF Machining Solutions US President and Head of Market Region North and Central America, was promoted to the role of Head of Sales, Marketing, Business Development and Communications. Phil Hauser, formerly the Director of Sales and Head of Turbine Group at GF Machining Solutions USA, assumed Fosdick's former position with responsibility for sales, marketing and service operations in the region.



Scott Fosdick, Head of Sales, Marketing, Business Development and Communications



Phil Hauser, GF Machining Solutions US President and Head of Market Region North and Central America

# Smart, advanced technologies showcased at EMO 2019

More than 3,200 guests representing the worldwide manufacturing industry experienced firsthand how GF Machining Solutions is “connected to your needs,” at EMO Hannover 2019 last September in Hannover, Germany. On its 1,156-square-meter stand, the GF Division gave visitors a peek into the future, with Industry 4.0-enabling solutions ranging from machine tools to digital products and Customer Services, all developed to take manufacturers’ processes to the next level of productivity.



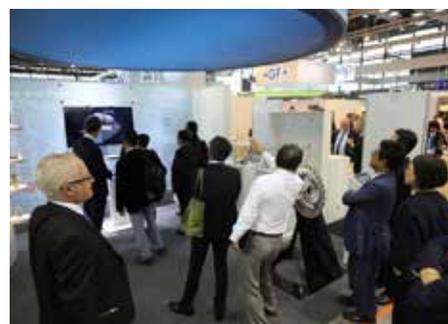
“Connected to your needs” was the theme of GF Machining Solutions’ EMO showcase.



More than 3,000 guests from around the world got a peek into the future of manufacturing at GF Machining Solutions’ EMO 2019 booth.



GF Machining Solutions President Pascal Boillat speaks at the EMO press conference.



In the aerospace corner of the GF Machining Solutions’ booth, visitors discovered dedicated solutions and optimized manufacturing processes for engine compressor and low-pressure turbine applications.

# Customers are at the heart of expansions worldwide

In September 2019, the Division inaugurated its new, CHF 100 million, 44,000-square-meter innovation and production center in Biel/Bienne, Switzerland. Situated on a 24,500-square-meter site, the center unites former GF Machining Solutions sites in Nidau, Ipsach and Luterbach all under one roof. The new building, which also is the Division's headquarters, boasts 13,000 square meters for production and assembly, and allows room for a research and development center as well as a modern application center. At this facility, customers can experience GF Machining Solutions' broad portfolio firsthand and take part in on-site training. Employees benefit from bright, spacious project rooms fostering creativity and interdisciplinary collaboration.

Additionally, in December 2019, GF Machining Solutions moved to its new, 32,000-square-meter plant on 51,550 square meters of land in Changzhou, China, with dedicated assembly lines for its Mikron MILL P, MILL E U, HEM and HSM products and a team of 200 employees. The facility also includes application, office and storage areas.

To further strengthen direct sales and service to customers, GF Machining Solutions and GF Piping Systems last year broke ground for new joint headquarters in Mexico and Canada. In October, work began on a 7,000-square-meter facility in Nuevo Leon, Mexico, and in November, the two GF Divisions officially began work on a 6,225-square-meter facility in Ontario, Canada.



Officials from GF Machining Solutions and GF Piping Systems last November commemorated the start of work on new joint headquarters in Ontario, Canada.



GF Machining Solutions and GF Piping Systems officials last October broke ground on a new joint headquarters in Nuevo Leon, Mexico.



GF Machining Solutions' new innovation and production center in Biel/Bienne, Switzerland, unites former sites in Nidau, Ipsach and Luterbach under one roof, with 13,000 square meters of production and assembly space.

# Key figures 2019

GF Machining Solutions generated sales of CHF 972 million, an organic decline of 7.5% compared to the previous year. Businesses in China and Western Europe have been impacted the most, whereas the Division was even able to grow in the United States, based on its strong position in aerospace and medical technologies. Innovations and a strong focus on the defined strategic market segments allowed the Division to clearly outperform the North American market.

The reduction in sales and the lower utilization of production capacities affected the operating result. It fell from CHF 88 million to CHF 57 million, resulting in 5.9% return on sales (ROS) compared to a strong 8.3% in 2018.

Innovations in the field of new technologies such as Laser texturing and Additive Manufacturing continued to see a high demand from customers, growing 41% in 2019.

**ROIC**  
18.4%

**EBIT**

57 MILLION CHF

**EBITDA**

71 MILLION CHF

**EBIT margin**  
5.9%

**Sales**

972 MILLION CHF

**Employees**  
3,358

## Successful launches in 2019

### New AgieCharmilles LASER S series sets new productivity milestone

Launched in Asia in February 2019, GF Machining Solutions' new high-performance LASER S series of Laser texturing solutions establishes a new milestone in terms of productivity.

### Revolutionary Spark Track technology prevents wire breakage

GF Machining Solutions' revolutionary new Spark Track technology for wire-cutting Electrical Discharge Machining (EDM) represents a big breakthrough. Launched in Switzerland in April 2019, Spark Track prevents wire breakage, an age-old dilemma that can arise from irregularly shaped workpiece features.



The new high-performance LASER S series helps users achieve unprecedented levels of productivity and quality.



GF Machining Solutions' and 3D Systems' new DMP Flex 350, launched at EMO Hannover 2019, improves print productivity, drives time to market, and slashes operating costs.

# Complete solutions for a highly complex region

Encompassing more than 22 million square kilometers, over 1.1 billion people, and a diverse cross-section of manufacturing segments with often differing needs, Market Region Europe and South America demonstrates how GF Machining Solutions' complete solutions help manufacturers keep their customers coming back.

**“We had the vision, we listened to the market, developed the products, and adapted our organization.”**

Antonio Faccio, Head of Market Region Europe and South America

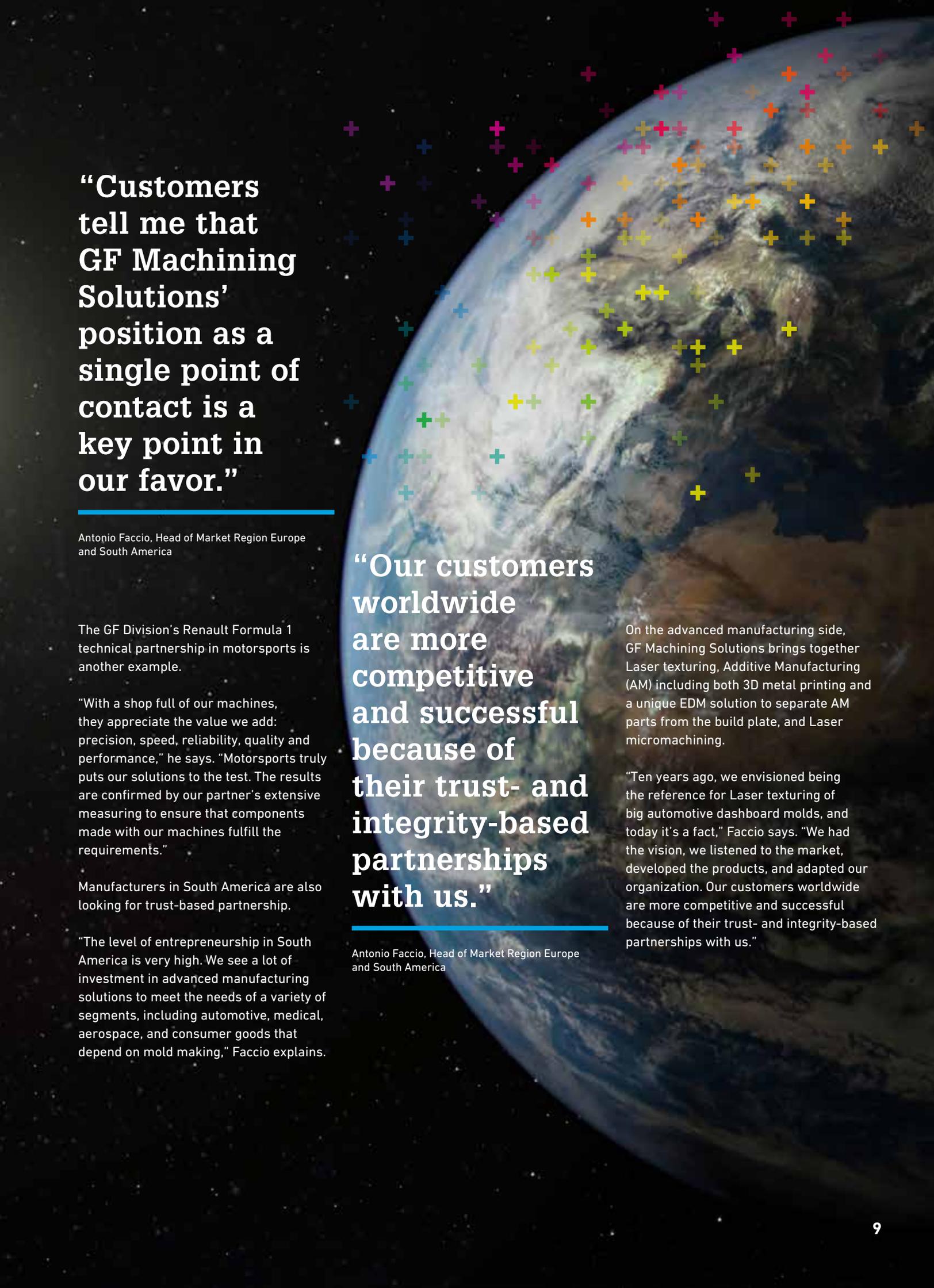


“This region is extremely complex, with countries and manufacturers of various sizes and segments. The manufacturing industry across the entire region is highly competitive,” says Antonio Faccio, Head of GF Machining Solutions Market Europe and South America. “Customers tell me that our position as a single point of contact for complete solutions to resolve their manufacturing challenges is a key point in our favor.”

From large organizations with their own supplier strategy and a need for key account management to smaller businesses seeking a competitive edge, the GF Division has plenty to offer.

“The way we take care of customers is shaped by the innovation, Swiss quality, and efficiency pillars of our business strategy. Every new solution is evidence of the strength of these pillars,” Faccio says.

He cites a complete solution—including Electrical Discharge Machining (EDM), Milling, Automation and Software—GF Machining Solutions conceived and installed for a global, Germany-based pharmaceutical industry powerhouse. “The customer wanted to achieve targeted return on investment and reduce production costs. They are very happy to have been able to achieve this—and even improve their results—with our multi-technology solution, project management, and after-sales support,” Faccio adds. “They rely on us as a key supplier and we are accountable for the project’s success.”



**“Customers tell me that GF Machining Solutions’ position as a single point of contact is a key point in our favor.”**

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Antonio Faccio, Head of Market Region Europe and South America

The GF Division’s Renault Formula 1 technical partnership in motorsports is another example.

“With a shop full of our machines, they appreciate the value we add: precision, speed, reliability, quality and performance,” he says. “Motorsports truly puts our solutions to the test. The results are confirmed by our partner’s extensive measuring to ensure that components made with our machines fulfill the requirements.”

Manufacturers in South America are also looking for trust-based partnership.

“The level of entrepreneurship in South America is very high. We see a lot of investment in advanced manufacturing solutions to meet the needs of a variety of segments, including automotive, medical, aerospace, and consumer goods that depend on mold making,” Faccio explains.

**“Our customers worldwide are more competitive and successful because of their trust- and integrity-based partnerships with us.”**

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Antonio Faccio, Head of Market Region Europe and South America

On the advanced manufacturing side, GF Machining Solutions brings together Laser texturing, Additive Manufacturing (AM) including both 3D metal printing and a unique EDM solution to separate AM parts from the build plate, and Laser micromachining.

“Ten years ago, we envisioned being the reference for Laser texturing of big automotive dashboard molds, and today it’s a fact,” Faccio says. “We had the vision, we listened to the market, developed the products, and adapted our organization. Our customers worldwide are more competitive and successful because of their trust- and integrity-based partnerships with us.”

# Yiben Mold's success in automotive industry

Founded in 2003 with ¥10 million (USD 1.4 million, €1.3 million) in capital, Yiben today is an automotive industry success story: Specializing in tooling and molds for post-processing sealing of vehicles, Yiben's gold-star list of customers includes Mercedes Benz, BMW, GM, Volkswagen and Renault.



↑ Yiben Mold owner Ni Liping says GF Machining Solutions helps drive the company's production efficiency with both machine tools and Automation.

From its sprawling 12,000-square-meter factory in near Shanghai, Yiben's 350 employees produce up to 700 molds, 700 sets of tooling, and 100 machines each year. To make that happen, Yiben relies on a total of 36 GF Machining Solutions Mikron Mill, AgieCharmilles Electrical Discharge Machining (EDM), and System 3R Automation solutions—the results of ten years of trust-based collaboration.

Evidence of that solid relationship is found in Yiben's two full Automation cells featuring the Mikron MILL E 700 U manufactured at the GF Machining Solutions factory in

**“The technology and solutions from GF Machining Solutions help us achieve great improvements in production efficiency.”**

Yiben owner Ni Liping

Changzhou. From concept to installation, the collaboration between Yiben and Changzhou AgieCharmilles had the solution up and running within a year.

The results for Yiben are clear: Quality errors and labor costs have been significantly reduced while production efficiency and quality have increased dramatically.

“The technology and solutions from GF Machining Solutions help us achieve great improvements in production efficiency,” says Yiben owner Ni Liping. “We plan to integrate additional GF Machining Solutions EDM machines into our production lines in the next half year.”

Those are important considerations at Yiben which, like other automotive industry suppliers, faces formidable challenges, including the costs of raw materials, cutters and tool holders, labor, and mold testing. At the same time, Yiben must deliver high-quality molds to its customers, reduce its five-axis machining cycle times, and manage the costs of training new employees. The automated Milling cells have proven themselves a real game-changer, reducing Yiben's manufacturing costs and lead time, optimizing its manufacturing process, and underscoring its leadership in its automotive subsegment.

Those achievements cement Yiben's leading position among Tier 2 suppliers to the global automotive original equipment manufacturers and demonstrate GF Machining Solutions' customer-centric orientation—for ten years and counting.



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**GF Machining Solutions machines**

- 16x MILL E 700 U
- 1x HPM 1350U
- 1x HEM 700 U
- 6x UCP 800
- 2x FORM E 350
- 1x FORM 20
- 1x FO 23 UP
- 1x CUT 20 P
- 1x CUT 30 P
- 4x CUT 200 BP
- 2x CUT E 350



A perfectly machined mold for post-processing vehicle sealing is made possible by GF Machining Solutions' five-axis Mikron Mill technology and System 3R Automation.



Yiben Mold's 12,000-square-meter factory near Shanghai, China



One of the 700 flawlessly executed molds produced by Yiben each year



Yiben specializes in manufacturing molds and tooling for post-process sealing for the automotive industry.

# Pankl Racing Systems leads with high speed, high tech, high quality

Pankl Racing Systems' mission, "High speed, high tech, high quality," comes to life in Bruck an der Mur, Austria, where a 380-member team develops and produces the bespoke pistons, piston pins and connecting rods essential to both race cars and high-performance road cars. Behind their success is an impressive fleet of automated Mikron Mill high-speed Milling machines.

**"Our Mikron Mill machines support our mission of high speed, high tech, and high quality."**

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Peter Rattinger, Head of the Piston and Piston Pin Department, Pankl Racing Systems

"Supplier relationships are always important. Our suppliers are worldwide, since our products are quite special and all of our materials and coatings are nonstandard and often designed and evaluated just for Pankl," says Peter Rattinger, Head of Pankl's Piston and Piston Pin Department. "Our Mikron Mill machines support our mission of high speed, high tech, and high quality. They allow us to produce our parts very quickly and efficiently with five-axis simultaneous Milling. The Workpiece Changer (WPC) on the rear of each machine allows us to run our machines nights and weekends, even unattended."

That's important, he says, because Pankl pistons—machined primarily from exclusively developed aluminum alloys and high-strength steel—often have long cycle times due to their complex shapes and the requisite high surface quality.

"A piston for an engine with rpm level higher than 18,000 and ignition pressures up to 300 bar is highly stressed during its use, so every surface must be perfect in such a critical part in order to prevent the risk of engine failure," Rattinger says.

Pankl bought its first Mikron Mill machine for piston manufacturing 15 years ago when the business was rethinking its manufacturing process due to changing piston designs. When evaluating Milling machine suppliers, quality, geometric accuracy and fast machining times were at the top of the list. All these factors, plus a high degree of automation, are necessary to guarantee the output of Pankl's fastest-growing profit center manufacturing approximately 30,000 pistons per year for the racing industry.

#### GF Machining Solutions machines\*

2x Mikron XSM 400U  
2x Mikron XSM 400U LP  
1x Mikron HSM 400U LP  
3x Mikron MILL S 400 U  
2x Mikron MILL S 600 U

\*All with Workpiece Changer  
(WPC) Automation

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At Pankl Racing Systems, a 380-member team develops and produces the bespoke pistons, piston pins and connecting rods essential to both race cars and high-performance road cars.

## “With GF Machining Solutions, we have a strong partner at our side.”

Peter Rattinger, Head of the Piston and Piston Pin Department, Pankl Racing Systems

“The Mikron XSM 400U was a natural fit for us because it meets our requirements and has compact Automation to increase both efficiency and our productivity per square meter,” says Rattinger, adding that available smart modules also contribute to his department’s success.

“At the same time, GF Machining Solutions provides complete solutions. We don’t have to talk with three or four different companies to get solutions related to our machining process,” he asserts, noting that Pankl will soon add a new Mikron MILL S 600 U to its fleet. “With GF Machining Solutions, we have a strong partner at our side, whether our question is related to hardware, software, or some other technical issue.”



GF Machining Solutions’ Mikron Mill machines master Pankl pistons’ complex shapes and requisite high surface quality.



Crankshaft components are highly stressed during engine use, so every surface must be perfect in order to prevent the risk of engine failure.



The crankshaft rotates, in conjunction with connecting rods, to convert the reciprocating motion of the pistons into rotational motion essential to engines in race cars and high-performance road cars.

# Thin-wall mold maker Moulexpert finds “Swiss Army knife” of solutions in Mikron MILL P 800 U ST

Quebec, Canada-based multicavity injection mold designer and manufacturer Moulexpert Inc. today machines high-quality, thin-wall molds for round plastic food containers in hours instead of days. GF Machining Solutions’ highly versatile Mikron MILL P 800 U ST (simultaneous turn) machining center plays a key role.

Moulexpert boasts a customer base spanning eastern Canada, Europe and the United States. Focused primarily on molds for food packing from the start, the business also took on mold making opportunities in different industry segments and in 2011 decided to concentrate on its strengths in designing and manufacturing thin-wall molds for food packaging.

Thin-wall molds present big challenges: It’s more difficult to inject plastic into the molds because the flow channels are incredibly thin—just 0.015 inches (0.381 cm). During plastic injection, these thin flow channels create tremendous pressure inside the tool. Even with a good mold design, any uneven wall thickness will have physical effects on the mold and prevent it from producing good containers. For that reason, it is essential to rely on a machine that can produce molds within a tolerance of 5 microns.

Moulexpert also wanted to maintain the agility to meet customer expectations for faster production without sacrificing quality and reliability. It essentially needed a “Swiss Army knife” of machines, something small that could do a lot: high precision, high speed and high capacity.

GF Machining Solutions’ Mikron MILL P 800 U ST (simultaneous turn), purchased in 2018, checks all the boxes. With its high removal rates and precision on round and other challenging mold cavity components, it meets Moulexpert’s need for productivity, part table capacity, and superior quality.

“With the Mikron MILL P 800 U ST, everything was there: roughing, finishing, five-axis, accuracy, and the ability to turn very big parts,” Project Manager Marc De Grandmont says.



New molds are generally being produced by Moulexpert every two weeks, and the company plans to expand its footprint in Canada and expand further into the U.S. market.



The Mikron MILL P 800 U ST mills and turns and features a powerful, specifically designed 20,000 rpm spindle with a hydraulic system that firmly locks it in place for turning operations.

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Website: [moulexpert.com](http://moulexpert.com)  
E-mail: <https://www.moulexpert.com/contact-us>



Moulexpert Project Manager Marc De Grandmont (left) and CEO Steve Nadau (right) are convinced of the value the MILL P 800 U ST brings to the firm's production of high-quality, thin-wall molds for the food packaging sector.



**GF Machining Solutions machines**  
1x Mikron MILL P 800 U ST

**“If we had purchased a turning machine instead of the MILL P 800 U ST, we would not have five-axis milling capabilities, and we would have had to purchase two machines.”**

This all-in-one solution enabled Moulexpert to increase the overall capacity of the plant, reduce lead time to widen profit margins, meet demand and quality specifications to strengthen the customer experience, and make the business more competitive by improving productivity for those thin-wall molds for round-shaped containers. It has also positioned the shop to boost its capacity by 25%.

Additional equipment and programming technology for automation integration are likely on the horizon for Moulexpert as it looks to manage growth-driven production volume.

“GF Machining Solutions helps us with all of this,” CEO Steve Nadau confirms.



Prior to acquiring the Mikron MILL P 800 U ST, Moulexpert's 25 employees were making about 125 molds per year. Today, the company produces about 270 molds, depending on size, with the same number of employees—a 116% improvement in productivity.

Marc De Grandmont, Project Manager,  
Moulexpert Inc.

# Driving manufacturing's digital transformation

GF Machining Solutions Head of Software Engineering Digital Business Jonas Ruesch explains how the GF Division's digital solutions are making manufacturing more efficient, productive and measurable—all at the touch of a finger.

**“Capital cost pressures and demand for flexible manufacturing solutions are accelerating a shift toward service-oriented manufacturing solutions.”**

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Jonas Ruesch, Head of Software Engineering Digital Business



**What can you tell us about GF Machining Solutions' Digital Business?**

Around the globe, digitalization is rapidly transforming how customers use and integrate our equipment. In parallel, capital cost pressures and demand for flexible manufacturing solutions are accelerating a shift toward service-oriented manufacturing solutions. Our Digital Business establishes a services ecosystem, empowering customers to leverage the true value of our machines with less effort.

**What does all of this mean for customers?**

Customers' needs drive everything we do. With our extended machine connectivity capabilities, they can tightly integrate our machines into their digital environments. Second, our web-based customer portal, the Digital Hub—cocreated with customers—serves as a unique access point for software measuring and improving our machines' performance. It will also bring us closer to our customers. With this approach, we are responding to demands for extended software services, which must run on top of traditional human-machine interface (HMI) functionality, can be installed at the click of a button and are accessible from browsers and mobile devices, anytime, anywhere.



**“The Digital Hub—  
cocreated with  
customers—  
serves as  
a unique  
access point  
for software  
measuring  
and improving  
our machines’  
performance,  
and will  
also bring us  
closer to our  
customers.”**

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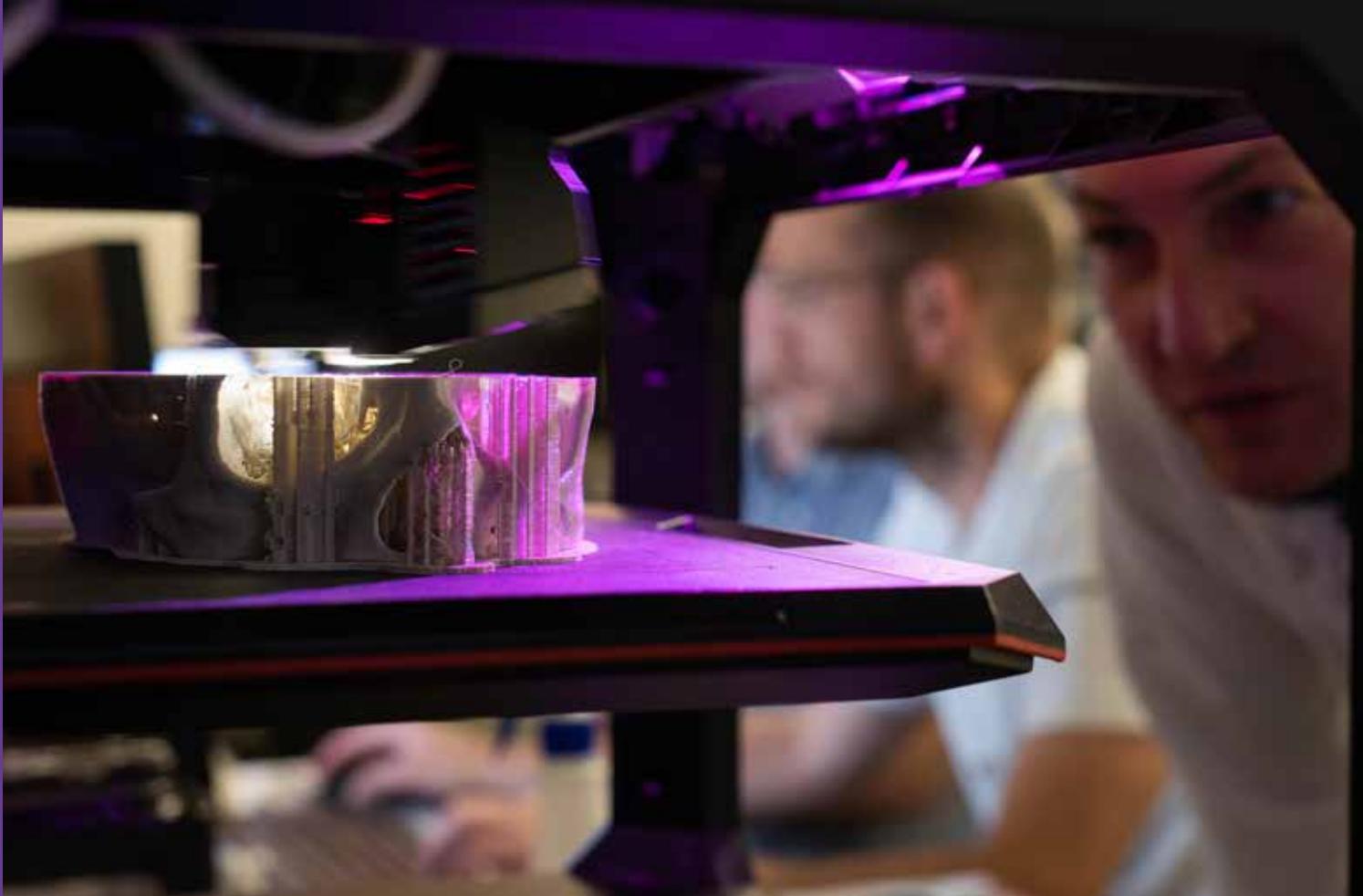
Jonas Ruesch, Head of Software Engineering  
Digital Business

**Tell us about GF Machining Solutions' state-of-the-art digital solutions.**

Our OPC UA Interface v1.0 provides a first unified connectivity layer across our technology portfolio, so all of our machines can speak a common language. With this option, relevant data is readily available and can be easily integrated into shop floor dashboards, so it becomes easy to measure key performance indicators and overall equipment effectiveness (OEE). OPC UA is available for all new AgieCharmilles and MicroLution machines and our solutions developed with 3D Systems. For Mikron Mill and Liechti machines, it will become available later this year. We also offer software applications supporting the data flow around our machines. Our Multi-Process Planning tool suite, MPP/eTRUE, brings the right data to die-sinking EDM machines, allowing customers to optimize electrode geometry and process parameters based on the true target mold shape. Our eTracking software allows operators and process engineers to “listen” to the wire-cutting EDM process and track and trace process data with respect to a qualified reference.

**What's on the horizon?**

The Digital Hub will allow for self-service access to digital solutions like we are used to on our mobile phones. Being connected, we can react to customer needs faster and deliver updates with new functionality within minutes. We foresee commercial availability of Digital Hub-based applications in 2021. One of the first will be the Part Inspector app. It leverages recorded process data like EDM generator signals to identify and tag problematic patterns indicating production issues. We're also working on an app with our Milling team to enable effortless tracking and control of machine equivalence for multiple machines.



A polymer (PLA) 3D skull model for surgery planning, is produced on a fused deposition modeling/fused filament fabrication (FDM/FFF) printer.

## On the leading edge: printing the human body

From 3D models of the human skull to 3D-printed patient specific implants and biocompatible guides that tell surgeons exactly where to cut during operations, the University Hospital Basel's state-of-the-art 3D Print Lab is revolutionizing surgery and improving patient outcomes.

# “I feel that patient-specific implants are the future of medicine and that there will be a huge demand.”

Dr. Florian Thieringer, cofounder and codirector, University Hospital Basel 3D Print Lab

At just 42 years old, Dr. Florian Thieringer doesn't consider himself a digital native: His first personal computer didn't even have an internet connection. Today, though, the tools his team is using to transform patient care extend far beyond an internet connection: 3D printing, the key medical additive manufacturing technology (MAM), plays a central role. Thieringer is University Hospital Basel (USB) Assistant Medical Director, head of a research group

at the University of Basel's Department of Biomedical Engineering and a lecturer for cranio- and maxillofacial surgery, and cofounder and codirector of USB's 3D Print Lab.

“Although my first computer, a Commodore 64, had no internet connection, I was really fascinated by the possibilities and the opportunity to visualize solutions on a computer screen,” Thieringer explains. “Today, these visualization and manufacturing technologies are everyday tools in craniomaxillofacial (CMF) surgery. When I began my career, computer-based planning, virtual surgical planning, and patient-specific implants were reserved for very rare cases. Today, these are very powerful tools that we can use on a daily basis to facilitate the treatment process—not only in CMF but across a wide range of medical disciplines.”

Thieringer recalls that early in his career, a single computer workstation used to analyze 3D images of the human skull was a staggering investment.

“The workstations then were larger than the biggest refrigerator and cost hundreds of thousands of dollars,” he

recalls. “Today, you just need a mobile phone or a laptop to visualize complex anatomy.”

And, as 3D printers become less expensive and more accessible, they are more commonly used.

“Today, at our hospital it is routine for doctors to order a 3D-printed model to support them in planning surgical procedures for craniomaxillofacial defects, to work with patient-specific titanium implants, or use biocompatible-certified polymer surgical guides intraoperatively,” Thieringer adds. “With surgical guides, you transfer information from the computer into the operating room: The guide shows you exactly where to cut the bone, drill a hole, or where a biopsy should be taken.”

The benefits of medical additive manufacturing are many and Thieringer is quick to add that additive manufacturing is a complement to—rather than a threat to—conventional manufacturing technologies.



Improving treatment processes through virtual surgical planning and 3D printing also includes postoperative quality control using radiological 3D data.



3D skull models such as this one help surgeons at Basel University Hospital to plan and safely perform complex operations.

“Compared to other workflows more ideal for serial production—like milling of molds for plastic injection—additive manufacturing can, with little effort, produce individualized models, implants, guides and instruments. If you have to produce many parts of the same shape, a more traditional production method would be more suitable.”

**“We have demonstrated that MAM can speed up orbital reconstruction by 30%.”**

Dr. Florian Thieringer, cofounder and codirector, University Hospital Basel 3D Print Lab

On the patient-specific implants side, titanium and high-performance polyether ether ketone (PEEK) are the materials of choice, he says. 3D-printed patient-specific implants can be adapted to the patient’s specific anatomy so that function can be restored in the best possible way.

“I feel that patient-specific implants are the future of medicine and that there will be a huge demand. I foresee a real demand, for example, in CMF surgery for patient-specific implants to repair the cranial walls or for mandible reconstruction after tumor surgery, since the mandible should be perfectly reconstructed to avoid impediments to function,” Thieringer says enthusiastically. “Complex orbital defects or dental rehabilitation after severe trauma or tumor treatment are other areas where patient-specific implants can make a huge difference in the patient outcome.”

While restoring the facial functions like chewing and speaking are important considerations in CMF surgery, they aren’t the only determinants of a satisfactory patient outcome. Thieringer says the aesthetic outcome is also of key importance, because the human face can

shape not only self-image but how others perceive the patient. Technologies like MAM can make an enormous contribution to both functional and aesthetic outcomes, and he’s looking forward to big breakthroughs in MAM technology in the coming decade.



The 3D Print Lab of the University Hospital of Basel prints models from a variety of polymers and other materials and conducts research in new application areas such as intelligent implants and biomaterials for medical use, as well as in medical image analysis and segmentation.



Binder jetting 3D printing allows large-scale, full-color printing without support structures. This process is used in the 3D Print Lab mainly for complex anatomical models such as skulls.



Dr. Florian Thieringer, University Hospital Basel (USB) Assistant Medical Director, shows how 3D printing can be used to bring 3D planning data from the computer to the operating room.



Surgeons especially count on the 3D Print Lab for patient-specific printed models and surgical guides to support them in planning surgical procedures.



With the help of a workflow developed at Basel University Hospital, patients can be individually treated for complex cranial defects based on 3D planning data.



The models produced with the binder jetting process require infiltration with liquid acrylate to achieve optimum strength.



Prof Florian Thieringer (right in white jacket) observes a computed tomography (CT) scan. Such scans produce the digital radiological images on which individualized 3D-printed skull models, surgical guides, and patient-specific implants are based.



A positive side effect of the use of 3D models in the treatment process is the possibility to improve the training of residents. With the help of 3D printing, even complex pathologies become "tangible."



The use of handheld 3D scanners and 3D-printed models is now standard for many operations at the University Hospital Basel.

"The technology is already quite sophisticated today, but I look forward to being able to print patient-specific implants without the need for complex, time-consuming post-processing," he says. "Medical device regulation is another big challenge as we enter an era in which hospitals can become manufacturers. For example, we have demonstrated that MAM can speed up orbital reconstruction by 30% at the same, or even superior, quality compared to a conventional operation using stock implants."

Even with those challenges afoot, Thieringer's enthusiasm for MAM is unbridled.

"I think patients realize the value of MAM, too, because we can show a patient—on a 3D-printed model of his or her own skull—exactly what we're going to do in the operating room," he says. "Postoperative patient compliance is better, too, because the patient becomes invested and part of the surgical planning process."

# Into the great wide open— with drones

With a history going back more than 180 years and once limited to military applications, unmanned aerial vehicles (UAVs), better known as drones, today tackle a host of civil and commercial applications. It appears that the future is drone enabled—and wide open.

Some authorities trace the history of drones to 1839, when Austrian soldiers used explosive-filled unmanned balloons to attack the city of Venice—a misadventure that resulted in balloons being blown back and bombing the Austrians' own lines. In 1898, Serbian-American inventor, electrical and mechanical engineer, and futurist Nikola Tesla was granted a patent for a wireless, radio-controlled, unmanned boat, setting the course for modern wireless drones.

Since its earliest iterations, drone technology has evolved to a staggering degree. The global drone market, according to some estimates, is on target to grow by 15 percent through the year 2025, propelled in large part by commercial sectors, including oil and gas, construction, energy, entertainment, medical, and parcel delivery industries. In fact, multinational professional services network PricewaterhouseCoopers (PwC) estimates the value of the total emerging global drone market at US \$127 billion through 2020.

“Over the past several years drone technology has proven its value in serving the greater good, from saving lives, mitigating risks to first responders, to preventing diseases like malaria,” says DJI Senior Director of Public Safety Integration Romeo Durscher. DJI is the world leader in civilian drones and aerial imaging technology.

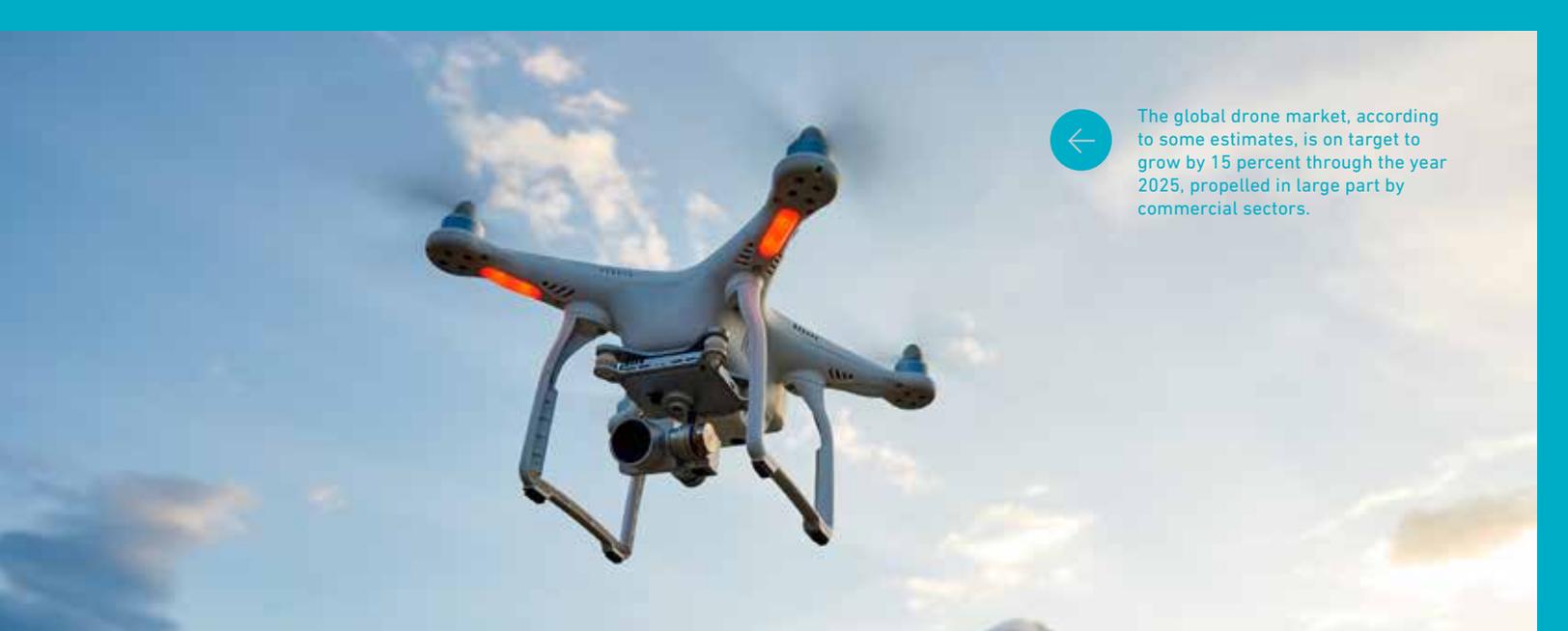
Indeed, the humanitarian applications of drones are especially impressive:

- Following the 2013 typhoon Haiyan, small and lightweight UAVs were used to identify places where non-governmental organizations could set up camp and which roads were passable, to assess post-storm-surge damage and flooding, and to gauge which villages had been most affected.
- As the famed Notre Dame Cathedral in Paris, France, was burning in 2019, Paris firefighters sent in commercial drones with thermal cameras to track how the fire was spreading and where it originated. Those images were used to determine the most effective way to position fire hoses, preventing even worse damage to the 850-year-old landmark.

- During the coronavirus pandemic (COVID-19), drones were used to enforce lockdowns in China and France and were employed to spray disinfectant in crowded urban areas.

How might drones shape society in the future? Predictions run the gamut from self-flying vehicles to construction aided by drones equipped by 3D printers. Flying cars, for example, have long occupied the public's collective vision of how technology could transform mobility. Today, aerospace and automotive manufacturers, world-class research institutes, and governments are leading the charge to open the skies to drone-inspired self-flying vehicles.

If futurists are right, the horizons for drones are indeed wide open.



The global drone market, according to some estimates, is on target to grow by 15 percent through the year 2025, propelled in large part by commercial sectors.

**“Over the past several years drone technology has proven its value in serving the greater good, from saving lives, mitigating risks to first responders, to preventing diseases like malaria.”**

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Romeo Durscher  
DJI Senior Director of Public Safety Integration



Self-flying vehicles could be the next frontier for drone technology—and the mobility sector.

# FORM P 330 Dedicated connects you to performance in automotive and ICT

Asia connector mold manufacturers for the automotive and information and communications technology (ICT) sectors are connected to success, thanks to the AgieCharmilles FORM P 330 Dedicated.

Delivering high repeatability, output and exceptional homogeneity, the tailored and ready-to-use FORM P 330 Dedicated die-sinking Electrical Discharge Machining (EDM) solution positions mold makers for performance in these highly demanding market segments. Conceived especially for these users, this machine ensures perfect quality to reduce scrapped molds and puts perfect results at the touch of a finger. Its simple, effective Tooling and competitiveness-driving Automation solutions further advance users' success.



The AgieCharmilles FORM P 330 Dedicated supports mold manufacturers in the automotive and ICT sectors.

# Manufacturers can choose the package that best suits their individual production needs

Manufacturing connector molds for automotive and ICT requires not just speed and high precision, but high machining performance as well. The FORM P 330 Dedicated reduces scrap to the bare minimum; it also eases mold assembly, effectively eliminating the need for repairs or reworking of mold inserts.

This solution's high precision and dedicated EDM technology for connector molds makes it fast and easy to achieve sharp cavity profiles and smallest bottom cavity radii, as well as perfectly flat bottom surfaces. It also eliminates the need to remove particle deposits on the final part. Ensuring stable accuracy, perfect repeatability and homogeneity, unbeatable finish, and stable cavity quality, it allows users to achieve perfect results. Moreover, offline programming is possible because the AC FORM human-machine interface (HMI) can be installed on any computer.

## Tailored configurations

The FORM P 330 Dedicated is available in tailored configurations, so manufacturers can choose the package that best suits their individual production needs—no special adjustments required:

- The job shop package offering best price-performance ratio for fast, simple connector manufacturing

- The production cost package with the Rotary Tool Changer (RTC) or an external robot to fulfill the needs of manufacturers confronting challenging labor costs
- The advanced package with a C axis, aimed at middle- to large-size manufacturers focusing on mold quality and increased productivity.

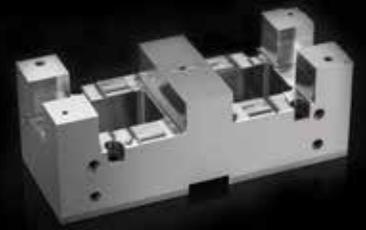
## Customer-approved solution

The FORM P 330 Dedicated has already impressed the chairman of a global strategic mold supplier to top 500 companies. He said the improved HMI makes the machine easy to operate, so operators can work more efficiently and with greater motivation, while achieving precise calibration during mold repair. Moreover, it meets users' expectations: For example, if 5 µm more in depth is needed, this solution will reach 5 µm exactly.

## Tooling and Automation

The FORM P 330 Dedicated's simple, effective Tooling helps manufacturers achieve superb accuracy: The machine can be equipped with both manual and automatic chucks, including System 3R's automatic chuck system, which provides repeatable accuracy within 0.002 mm. The available rugged C axis ensures a high positioning accuracy of 0.001 degrees.

Automation is another success driver, allowing FORM P 330 Dedicated users to ramp up their competitiveness by limiting the need for human intervention and maximizing running time. Solutions include the RTC with eight positions and a maximum electrode size of 150 x 50 mm; System 3R's WorkPartner 1+ (WPT1+) compact part changing robot; and third-party external robots.



Perfect homogeneity is essential in the production of plastic injection molds for automotive connectors. The FORM P 330 Dedicated masters this challenging mold requiring a homogenous surface (roughness of VDI 18–22) and <0.03 inner radii.



This mold insert for connector manufacturing presents several challenges, including sharp radii, surface quality, and dimensional precision, and the FORM P 330 Dedicated overcomes all of them.



The FORM P 330 Dedicated puts perfect mastery of electronics sector connector mold details at mold makers' fingertips.

# The future starts today with the CUT P Pro series' groundbreaking HMI and Spark Track

As the future unfolds at high speed and reshapes the way manufacturers work, GF Machining Solutions' AgieCharmilles CUT P Pro wire-cutting Electrical Discharge Machining (EDM) series break new ground.

Developed in collaboration with customers to meet their needs, the CUT P Pro wire EDM series takes users' flexibility, productivity, speed and quality to a new level. Featuring the new and easy-to-use Uniqua human-machine interface (HMI) and Intelligent Spark Protection System (ISPS) with Spark Track technology, the CUT P Pro series represents a new approach to work management and planning.

## **Unleashing high flexibility**

Specifically, Uniqua is easy for machine operators to manage because its attractive, easy-to-understand graphics guide the way to successful processing and increased productivity. By simplifying the operator's tasks, the HMI unleashes high flexibility to increase production efficiency and reduce operating costs.

Customers currently using the Uniqua HMI say it is easy to learn, has onboard intelligence, and provides immediate, visual operator-machine communication.

They also appreciate Uniqua's enormous contribution to workshop productivity, as it helps them achieve increased efficiency and a drastic reduction of the machine's non-productive time.

Whether the machine operator is used to working with the Vision interface or is a high-level job customer accustomed to ISO programming, Uniqua's object-oriented approach is an unprecedented alternative that enables highest productivity. Typically demanding tasks like stopping the machine, changing machining strategy, or changing a part are dramatically simplified by Uniqua. In fact, processes become logical with its intuitive onscreen icons, all available with a simple touch. Moreover, its low learning curve makes mastery easy, whether the user is new to machine programming, a seasoned Vision user, or a veteran ISO code programmer.

## **Don't worry, just cut**

At the same time, the CUT P Pro solutions' groundbreaking Spark Track technology

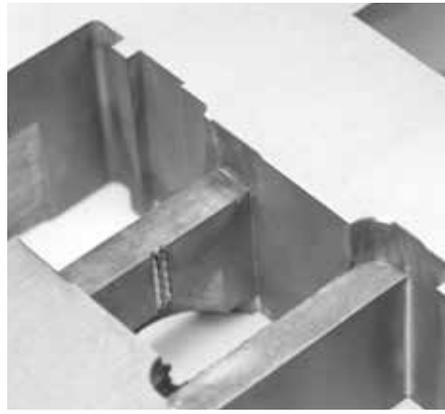
ensures that users experience the best possible EDM performance—without the risk of wire breakage. Spark Track, with its state-of-the-art ISPS, monitors and measures sparks generated during the EDM process and uses that data to adjust machine parameters accordingly. The result: greater EDM process security, higher efficiency, and easier execution of applications.

The completely automatic process enabled by the ISPS is highly effective, even in the most difficult cutting conditions and for the most complex part shapes. That means users can focus on cutting without worrying about wire breakage: Efficiency and the vision of zero-defect manufacturing are built into the system.

As the fourth industrial revolution—Industry 4.0—changes the way manufacturers work, the CUT P Pro series with the new Uniqua HMI and Spark Track technology underscores GF Machining Solutions' customer-centered innovation legacy.



Screen display: The illustrated demonstration piece contains very difficult geometries: bevels, protrusions, and points. On the screen, there is real-time control of the energy density on the wire. The ISPS detects when sparking becomes too intense. Wire breakage is thus prevented even with complex shapes.



GF Machining Solutions' Intelligent Spark Protection System (ISPS), available for the CUT P Pro wire-cutting EDM series, resolves the issue of wire breakage during machining of complexly shaped parts.



The AgieCharmilles CUT P Pro's new and easy-to-use Uniqua HMI simplifies the machine operator's job, increases production efficiency, and reduces operating costs.

**Uniqua enables a high flexibility to increase production efficiency and reduce operating costs.**



The AgieCharmilles CUT P Pro's high flexibility and ease of use are made possible by the new Uniqua HMI and available Intelligent Spark Protection System (ISPS) to prevent wire breakage on irregularly shaped workpiece features.

# Mikron MILL P 500 advances mold makers' productivity, accuracy and autonomy



Multicavity molds in certain industries require high positioning accuracy and high surface finishes. The MILL P 500 meets these demands, thanks to its 42,000 rpm Step-Tec Spindle and a stable structural design that ensures no cutting marks on glossy finishes.

30 m/min feed rate  
42,000 rpm Step-Tec Spindle



The MILL P 500 delivers the highest precision achievable on a standard three-axis high-speed Milling machine. With its high productivity and long-term stability over long machining times, this solution is a game-changer for mold and die makers.



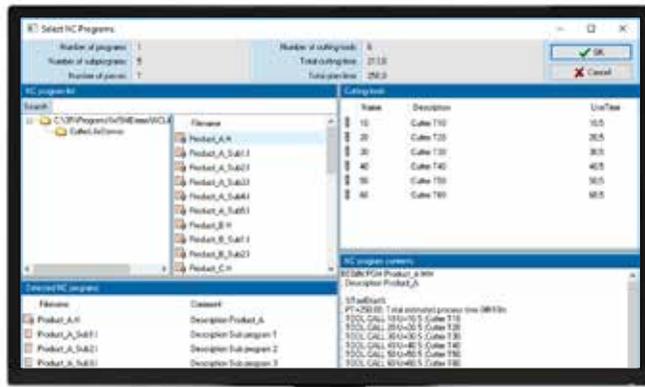
The highest precision achievable on a standard three-axis high-speed Milling machine is a hallmark of GF Machining Solutions' new Mikron MILL P 500—but its advantages don't stop there.

The MILL P 500 high-performance Milling solution delivers long-term stability over long machining periods as well as a competitive edge in terms of productivity. The MILL P 500 extends GF Machining Solutions' three-axis performance portfolio with new solutions dedicated to mold and die makers in the information and communications technology (ICT) and electronic components (EC) sectors. At the same time, due to its large axis ratio, the

MILL P 500 satisfies the needs of mold and die makers serving the automotive, home appliance and packaging for consumer goods markets.

Mold and die makers serving the ICT and EC segments require more consistent precision and processes. The MILL P 500 delivers that crucial support with machine setup and tool management. In parallel, these manufacturers' needs for greater

reliability, availability and stability are met by the MILL P 500's mastery of machine behavior related to temperature fluctuations during machining as well as in the production area. Moreover, manufacturers' demands for best productivity per square meter, including optimal operator access to the machine, are answered by the MILL P 500's compactness in comparison to competing machines.



When using the CutterToolMonitoring (CTM) option, the user can see all the needed cutting tools to be used in the job as well as their lifetime.



In the job list, the operator can also view the cutting tools and their status, as well as whether any tools are missing.

Building on a stable machine base, the MILL P 500 provides the high accuracy and dynamics essential to the quality production of mold cavities for plastic injection as well as stamping die plates. Extending user's competitive edge is the solution's excellent material removal rate, made possible by the high-speed Step-Tec Spindle.

#### ±4 µm precision

The formidable manufacturing challenge of ensuring less than ±5 µm deviation on parts machined over long periods—often 24 hours or longer—is resolved by the MILL P 500. Moreover, the solution's good roughing behavior is enabled by the thermostabilized machine body. High quality is guaranteed—regardless of the duration of the program—by the process-supporting machine body. On top of precision, users' productivity is advanced by state-of-the-art components, high technical machine availability, and an attractive array of Automation possibilities. Together, these characteristics mean manufacturers can achieve both precision and top surface finish without compromising on machining time.

#### Ra ≤ 0.1 µm

Manufacturers get their molds to their customers faster and at the expected quality, thanks to the MILL P 500's ability to machine finishes finer than Ra 0.1 µm. This solution reduces time-consuming, labor-intensive manual polishing work by days, so manufacturers can more quickly meet their customers' mold making demands.

#### Excellent dynamic behavior

With its significantly high dynamics, the MILL P 500 significantly reduces production costs. An additional competitive edge in terms of productivity is ensured by the MILL P 500's 30 m/min feed rate and 42,000 rpm Step-Tec Spindle with 8.8 Nm of torque and HSK-E40 tool interface.

#### 24/7 automated process

Around-the-clock productivity is within easy reach, thanks to the automated processes made possible by the MILL P 500's well-integrated tool magazine and the affordable Mikron Work Pallet Changer WPC 10.

A variety of System 3R software options are available to even further boost the MILL P 500's autonomy. These include CutterToolMonitoring (CTM) when working with System 3R's WorkShopManager

CellManager software or JobTool Manager (JTM) to verify that all necessary cutting tools are available before the Milling operation begins; Alarm Server that sends messages from the machine to the user by e-mail or text message; CellMonitor to display the status of all cells and individual machines and processes; and CellStatistic that retrieves and analyzes cell utilization and order data.

#### Step-Tec HVC 140 Spindle

The MILL P 500's HVC 140 Spindle with HSK-E40 tool interface ranks best in class in terms of precision and thermostability. At the same time, this Spindle delivers highest-ever static and dynamic stiffness with the least amount of runout. It has a dust-dry Spindle nose for medical or graphite machining.

In mold and die, the HVC 140 Spindle is the go-to solution for mold component manufacturing for information and communications technology (ICT) applications and other super-precision moldmaking applications. On the parts production side, it is particularly suitable for high-precision machining and grinding applications in medical, dental, watch and jewelry applications.

# New Liechti g-Mill 1000 takes your airfoil manufacturing to a new level

Premier aircraft engine providers count on Liechti's new g-Mill 1000 airfoil machining center for flawless, economical production of bladed integrated disks (BIDs) up to 1,000 mm in diameter.

The recently launched g-Mill 1000 has quickly earned big interest among some of the world's most demanding aerospace players. That is because it delivers the high rigidity, high dynamics, and high roughing rates essential to their five-axis simultaneous machining of titanium and nickel BIDs (also called blisks or integrally bladed rotors) up to 1,000 mm in diameter. Advanced ergonomics allow easy, fast loading and unloading of the workpiece and secure operator safety.

Developed in collaboration with aircraft engine manufacturers, the Liechti g-Mill 1000 brings together g-performance tuning, state-of-the-art TURBOSOFT plus software, and process development leadership. This solution ensures best surface quality and tool life at the lowest cost per part, due to direct drives on the A, B, X and Y axes. Additional damping can be added to the torque motor-driven axes. Together, these characteristics establish a solid foundation for lowest cost per part.

As aircraft engines become smaller and lighter weight to drive fuel efficiency, BIDs are subject to greater pressure and higher temperatures, requiring more temperature-resistant, difficult-to-

machine materials, including titanium alloys. The Liechti g-Mill 1000 masters these challenges due to its unique ROLANT (Rotations-Linear-Antrieb) kinematics.

ROLANT kinematics enable low machine height and lower center of gravity which, along with superb rigidity, extend the service life of costly cutting tools and provide greater cutting tool access to the workpiece. The part is loaded horizontally and then the table can be swung into an overhead position which allows both optimal cutting tool access and chip flow.

In parallel, the four direct drives allow more accurate and highly dynamic machining. The continuous 3.5 m/min (140 inches per minute) feed rate guarantees the same tool tip velocity around the whole blade and its edges. This is 40% faster compared with other airfoil machining centers.

With its HSK 80 tool interface, adjustable coolant nozzles, 1 g acceleration, and a rigid monobloc base, the g-Mill 1000 is the go-to solution for highest quality, lower cycle time and ergonomics to support both part handling and operator safety.



## 4P: Solutions for lowest cost per part

### Plan your profit

Solution engineering of your technical and economical production requirements

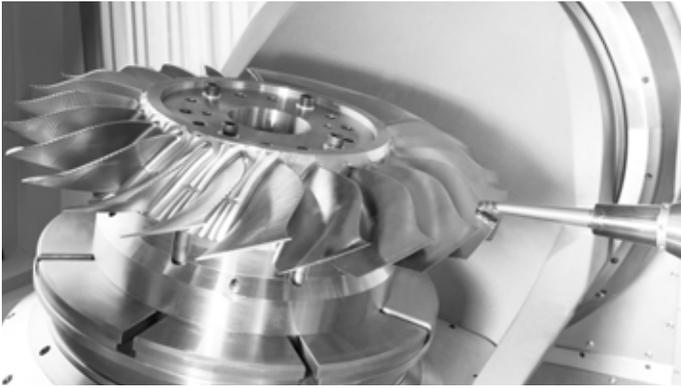
### Performance

Innovative technology for highest quality and quantity output

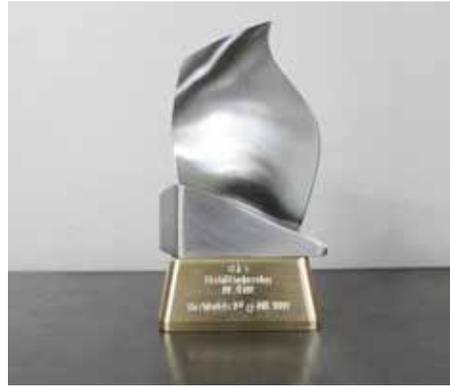
### Partnership

Support and performance updates over entire machining solution life cycle

**Profitability increase**  
More than 30 percent,  
lowest cost/part



As aircraft engines become smaller and lighter weight to drive fuel efficiency, BIDs are subject to greater pressure and higher temperatures, requiring more temperature-resistant, difficult-to-machine materials, including titanium alloys.



This inscribed trophy machined by the Liechti g-Mill 1000 demonstrates this solution's performance in terms of surface quality at Ra 0.8 by reduction of 25% cycle time compared to current g-Mill product line.



Liechti's new g-Mill 1000 brings together highest quality, lower cycle time, and carefully considered ergonomics for both part handling and operator safety, making it a go-to solution for machining BID up to 1,000 mm in diameter.

# Medical machining at the speed of light with the Microlution MLTC

High accuracy and productivity are the real-world advantages of the femtosecond Laser technology built into GF Machining Solutions' Microlution MLTC ultrafast Laser tube-cutting platform.

Minimally invasive surgery (MIS) is a growing trend in medicine today due to its clear benefits: smaller incision size, reduced hospitalization and healing times for patients, and less risk of pain and complications. Higher productivity, improved quality, and the regulatory compliance essential to producing microparts for the medical device industry are hallmarks of the MLTC platform. With its extreme precision, this solution quickly and accurately machines complex features in metal and polymer tubes for medical devices, eliminating most or all costly, time-consuming post-processing.

The MLTC's ultrashort pulsed Laser machining process produces no heat-affected zone, delivers perfect microholes in seconds, and produces medical devices in a single process. It puts burr-free engraving of a wide range of materials—from steel, aluminum, carbide, brass, graphite and copper to gemstones, ceramics, and polymers—at medical device manufacturers' fingertips today. Users can count on high overall form

accuracy on parts, thanks to the MLTC's best-in-class thermal stability and granite base construction; high-performance optics due to the high-precision Laser beam delivery system; highly dynamic machining made possible by the high-acceleration spindle; and first-rate linear axis accuracy enabled by linear motors and high-resolution glass scales.

Stents, marker bands, and catheter tubes are among the lifesaving medical devices and components perfectly machined by the MLTC, thanks to the precision and flexibility of Laser machining together with the ability to create even the most complex designs in a single setup. With the MLTC, medical device manufacturers can realize dramatic improvements in quality and efficiency.

#### **Clean ablation, higher quality**

Femtosecond Laser pulses allow for clean ablation of material, minimizing material lost during machining and providing superior surface finish, dimensional control, and burr-free surfaces.

The solution's integrated cooling and a water-based catch basin assure overall product quality, both during and after machining operations. A specially designed clamping system allows even the most delicate of workpieces—such as stents, marker bands and catheter tubes—to be safely and securely held during manufacturing.

#### **Flexible and efficient**

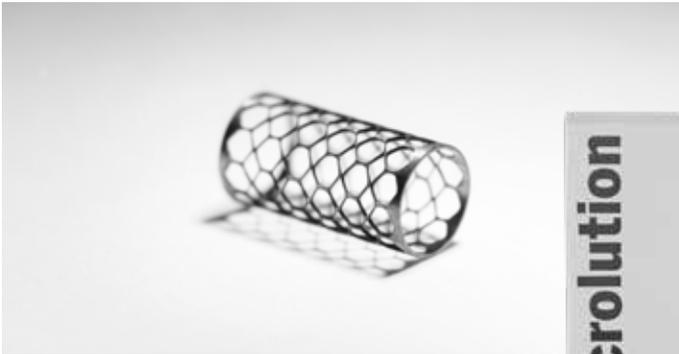
With the MLTC, changing product designs and features is easy, thanks to the solution's software—no need to manufacture new cutting tools or fixtures. Single part lot sizes can be tackled without impacting cycle rates or requiring operator intervention, and the machine's integrated vision system allows measurements and adjustments to be made in real time.

With its superb performance, zero scrap rate, high throughput, and Automation readiness, the MLTC positions makers of MIS devices and components for success today.

The MLTC's ultrashort pulsed Laser machining process produces no heat-affected zone and medical devices in a single process.



↑ Discover an easy cutting process for complex, flexible catheter tube contours. With the Microlution MLTC's simplified production process—including clean, no-burr cutting—post-processing operations are eliminated and operating costs are significantly reduced.



↑ Combine your drilling and cutting processes to reduce your manufacturing time—and produce perfect overall accuracy and burr-free parts.



↑ Achieve success in the medical device industry and other applications, thanks to the ultrafast MLTC Laser tube-cutting platform. Quickly and accurately machine complex features in metal and polymer tubes with high precision.

# New CUT AM 500 pushes EDM limits to advance Additive Manufacturing

Separating additively manufactured parts from the build plate and ensuring geometrical accuracy and assembly readiness are made easy by GF Machining Solutions' unique new AgieCharmilles CUT AM 500.



A titanium satellite bracket (left) and spinal cages (right) additively manufactured to perfection with the DMP Flex 350 and separated from the build plate with use of the new CUT AM 500.



3D Systems' and GF Machining Solutions' integrated production workflow combining additive and traditional metal technologies, and innovative software solutions enabled production of these spinal cages in LaserForm® titanium material.

GF Machining Solutions again pushes the limits of Electrical Discharge Machining (EDM) to advance customers' success with its new CUT AM 500 horizontal, fast wire EDM solution. This fast, precise and Automation-ready machine makes a significant contribution to an optimized and integrated AM workflow: It is a fast, precise, affordable and Automation-ready alternative to using standard EDM or a band saw to separate AM parts from the build plate.

The CUT AM 500 is the perfect complement to GF Machining Solutions' and 3D Systems' scalable, workflow-optimized DMP Flex 350 metal 3D metal printing solution. This completely integrated AM process brings together all of the factors for manufacturing success: state-of-the-art software for design, part preparation and optimization, inspection and CNC programming, the robust and flexible DMP Flex 350 3D metal printing solution for 24/7 part production, the Mikron HSM 200 U LP for post-processing—and the CUT AM 500 for part separation.

The CUT AM 500 eliminates the quality barriers associated with using a band saw to separate the workpiece from the build plate such as geometrical inaccuracy, loss of workpiece material (kerf) and damage to the part. By avoiding part contamination and damage, this solution maintains the integrity of the part, delivering a particularly crucial advantage for applications in risk-averse sectors such as aerospace and medtech.

## A robust process

Accommodating parts up to 510 x 510 x 510 mm including the plate base and up to 500 kg, the CUT AM 500 uses 0.2 mm wire to separate AM parts from the build platform. It delivers  $\pm 0.1$  mm accuracy and surface roughness of less than  $6 \mu\text{m}$ . This solution brings together horizontal wire orientation, an integrated basket to catch separated parts, and a rotary axis to create a robust process supporting the part, easy part handling, prevention of damage to the part, and full Automation readiness.



Satellite brackets for the aerospace sector are produced accurately and cost-effectively with the robust and flexible DMP Flex 350, and then securely separated from the build plate by the fast, precise and Automation-ready CUT AM 500 horizontal, fast wire EDM machine.



The production process to create this aerospace bracket in seven steps integrates additive technologies, traditional metal technologies and innovative software solutions to achieve high-quality, repeatable parts at an optimized cost per part.



This spinal cage demo part illustrates the end-to-end metal workflow enabled by GF Machining Solutions' and 3D Systems' new CUT AM 500 wire-cutting EDM solution for separating AM parts from the build plate after 3D metal printing with the DMP Flex 350.



3D printed injection nozzles fixed on top of the 180° tilting platform.

**Fast separation process, low running costs**

CUT AM 500 users profit from the fastest EDM process—at least three times faster than standard EDM—thanks to the machine's fast wire technology in combination with the generator, and they experience the most reliable separation of AM parts with specific support structures. Low running costs are ensured by the CUT AM 500's fast wire technology and double wire spool concept.

**Automation ready**

As AM becomes a mass production manufacturing technology, automated AM processes will be needed—and GF Machining Solutions designed the CUT AM 500 to accommodate integration of a clamping system for easier clamping and referencing. The GF Division, with its System 3R unit specializing in Tooling, Automation and Software, has the in-house expertise to put manufacturers on the fast path to success in AM.

# rConnect digital services platform links customers to success



rConnect

Manufacturers around the world are experiencing firsthand the value GF Machining Solutions' rConnect digital platform brings to their daily business—and the numbers prove it.

**“Around the world and across all of our focus market segments...our customers are realizing the benefits of our digital services platform.”**

Pascal Friche, Head of Software Business Marketing,  
GF Machining Solutions

Today, nearly 2,000 rConnect-enabled machines are connected to GF Machining Solutions—a 66 percent increase over the previous year. That increase is further proof of the market's enthusiastic embrace of rConnect, the machine tool industry's most in-depth digital services platform.

“Around the world and across all of our focus market segments such as aerospace, automotive, medical, information and communications technology, and electronic components, our customers are realizing the benefits of our digital services platform,” says Pascal Friche, Head of Software Business Marketing with the GF Division. “That means they are profiting by achieving quick return on their machine investment by using remote services rather than having technical personnel travel to their site when a machine issue arises. It is definitely a win-win situation.”

In addition to being empowered to react more quickly to technical issues, connected customers can get the software updates—and soon, a whole host of performance-enhancing apps—precisely when they need them, at the touch of a finger.

“We are in a leading position when it comes to digital services because every machine we install is rConnect capable and security is built into our solutions,” Friche says, noting that rConnect is certified with the TÜViT Trusted Product Certificate.

A key component of the Industry 4.0-enabled future is connectivity, the foundation for machine-to-machine communication, wireless data transfer, and data accessibility from remote locations. rConnect brings all that—and more—together across GF Machining Solutions' broad technology portfolio. Customers can easily connect with their own production facilities from their personal computers or mobile devices from anywhere at any time, and the rConnect Live Remote Assistance module allows them direct audio, video, and chat access to GF Machining Solutions' experts for fast, expert diagnostics and, often, resolution of machine issues.



"In fact, there are nearly 2,000 active LRA licenses today in Market Regions Europe and South America, China, Asia-Pacific, and Americas," Friche explains. "We've also seen tremendous growth—more than 200 percent in a year's time—in our rConnect Messenger app which gives users immediate access to all machine park data, like machine status, messages, and jobs, on their smartphones. Users can also send service requests and get fast, effective answers to diagnoses through Messenger."

More and more often, customers turn to GF Machining Solutions for support when they take their first steps into digitalization. Italian mold, tool and prototype mechanical product manufacturer Aldeghi s.r.l. did just that and today runs a fleet of GF Machining Solutions machines, several of which are equipped with rConnect LRA and Messenger. Managing Director Cesare Aldeghi has particularly high praise for the flexibility afforded by the Messenger app. When his machines are running nights or on weekends, he and his team can use Messenger to monitor their progress, right from their mobile devices.



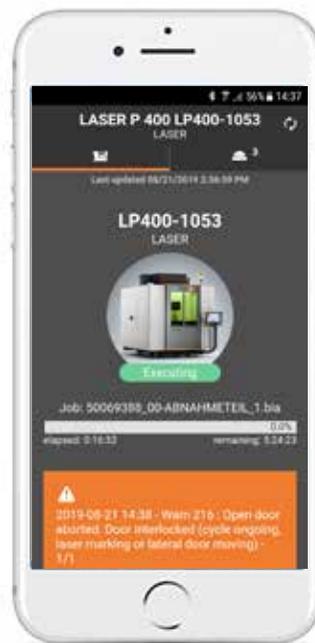
rConnect Messenger gives users an overview of all connected machines—and whether they are correctly executing applications—right on their mobile devices.



rConnect Messenger gives users clear, real-time information about their machining processes.



The rConnect Messenger app makes it fast and easy for customers to file a service request, so they spend less time waiting for assistance.



With rConnect Messenger, users can send a service request to get a fast and effective diagnosis.

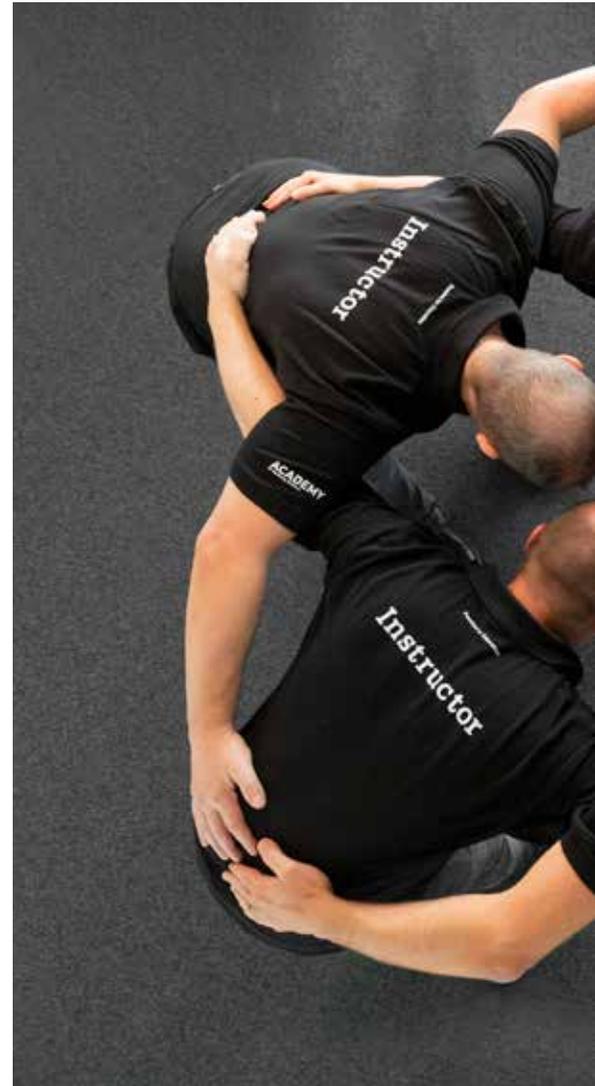
# Academy's "Passion for Education" facilitates key knowledge transfer

Knowledge is power when it comes to fully leveraging the potential of your GF Machining Solutions' machines—and there is no greater source of state-of-the-art knowledge about these solutions than the GF Machining Solutions Academy.

Exploiting the full potential of the GF Division's innovative products throughout their life cycle is a qualitative and valuable must for customers. Across its broad technology portfolio—including Electrical Discharge Machining, Milling and Spindles, Laser texturing, Laser micromachining, Additive Manufacturing, and Automation—the Academy facilitates a key knowledge transfer for both customers and GF Machining Solutions' own application and service engineers.

Knowledge is a key success factor in today's manufacturing world, where topics, capabilities and training itself are changing. With its "Passion for Education," the Academy has the remarkable, human-centric mission of managing the essential knowledge transfer from GF Machining Solutions' Research and Development, Customer Services, sales, and application support all the way to the customer.

The Academy's training modules, as well as on-demand options tailored to customers' specific requests, are aimed at helping users realize the maximum potential of GF Machining Solutions' machines throughout their life cycles. With a training philosophy based on GF Machining Solutions' legacy as a technological pioneer with vast field experience and a long tradition of quality, the Academy offers a three-tiered curriculum. Its "Learn to operate" modules provide in-depth training to help customers use their machines autonomously, and its "Maximize performance" modules are design to develop users' knowledge to an expert level and enhance machine performance. Customized training geared to users' needs is the third tier.



Expert instructors with a "Passion for Education" facilitate the Academy's three-tiered curriculum, with "Learn to operate" and "Maximize performance" modules.



The GF Machining Solutions Academy facilitates a key knowledge transfer for both customers and the GF Division's own experts.



Exploiting the full potential of GF Machining Solutions' innovative products throughout their life cycle is a qualitative and valuable must for customers, and the Academy helps them to do just that.



The Academy helps customers fully leverage the potential of their GF Machining Solutions machines.



GF Machining Solutions' training experts have more than 1,000 years of combined experience across five technologies—all at the customers' services. More than mere training, the Academy's standardized modules and customized training opportunities represent the highest quality knowledge transfer. It puts people at the center: GF Machining Solutions' premium products require the best operators in order to achieve highest quality machined parts. So, the GF Division focuses intensively on developing its own people, including well-educated technicians who are skilled at getting the best from the machines. Moreover, GF Machining Solutions continuously invests in its people in order to ensure a sustainably high level of trainer quality—and expertise that can be passed on to customers.

To ensure a truly global knowledge transfer, the Academy maintains trainers across Europe, Asia, and the United States, and within the Division's own ranks. It exists to help both customers and employees achieve their potential in order to best harness the maximum potential of the solutions in GF Machining Solutions' multi-technology portfolio.

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# Passion for Precision

## GF Machining Solutions

When all you need is everything, it's good to know that there is one company that you can count on to deliver complete solutions and services. From unmatched Electrical Discharge Machining (EDM), Laser texturing, Laser micromachining, Additive Manufacturing and first-class Milling and Spindles to Tooling and Automation, all of our solutions are backed by unrivaled Customer Services and expert GF Machining Solutions training. Our AgieCharmilles, Microlution, Mikron Mill, Liechti, Step-Tec and System 3R technologies help you raise your game—and our digital business solutions for intelligent manufacturing, offering embedded expertise and optimized production processes across all industries, increase your competitive edge.



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