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The global customer newspaper — English edition

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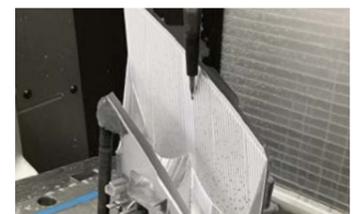
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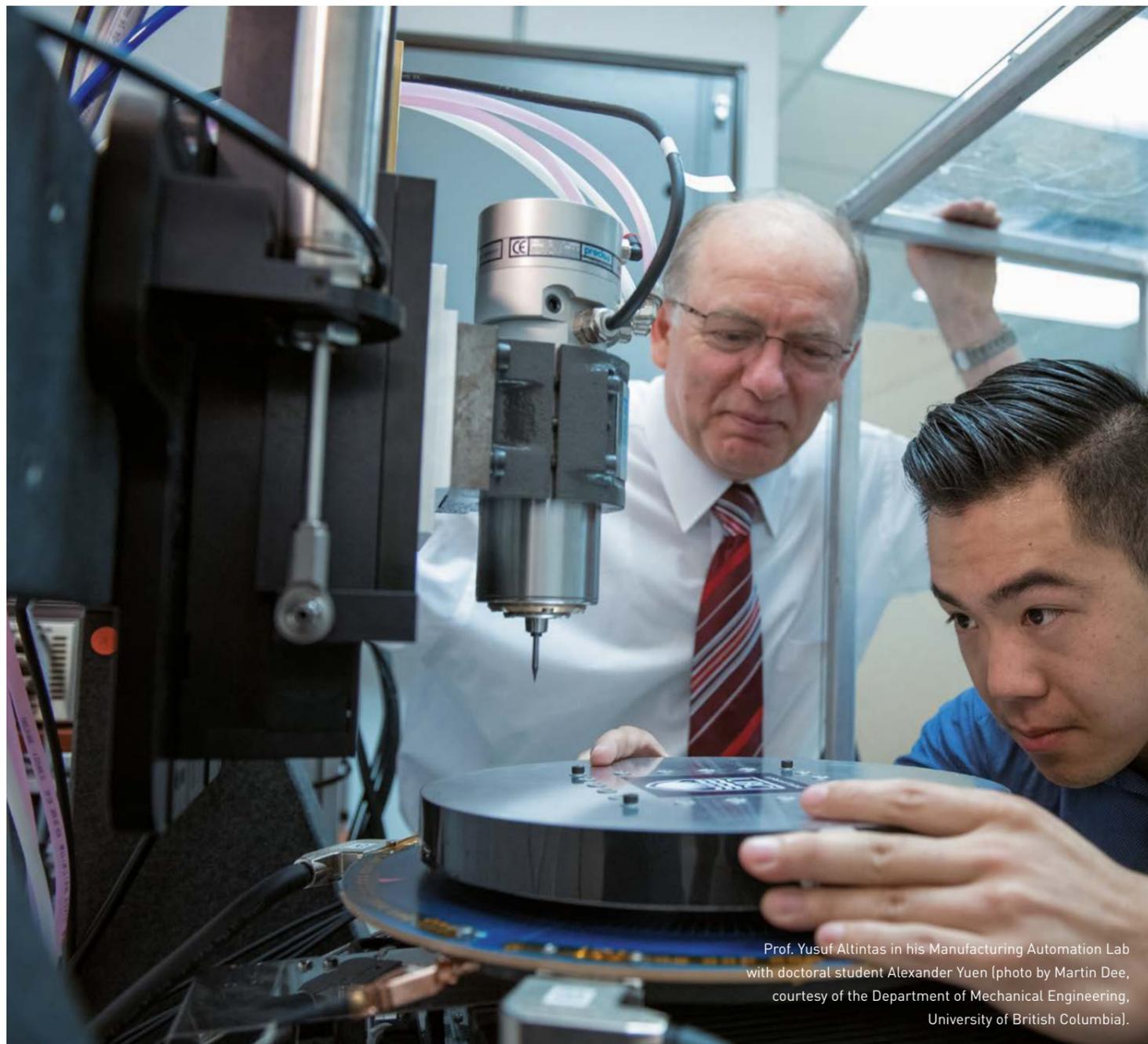
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Prof. Yusuf Altintas in his Manufacturing Automation Lab with doctoral student Alexander Yuen (photo by Martin Dee, courtesy of the Department of Mechanical Engineering, University of British Columbia).

Expert insights

Toward a new era of innovation

Prof. Yusuf Altintas, 2016–2017 president of the Paris, France-based International Academy for Production Engineering (CIRP), says strong collaborations between machine tool makers, industry, and applied research position manufacturers for a new era of innovation: Industry 4.0.

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Altintas holds the Natural Sciences and Engineer Research Council of Canada's (NSERC) Pratt & Whitney Industrial Research Chair in the Department of Mechanical Engineering at the University of British Columbia (UBC) in Vancouver, Canada and is director of UBC's Manufacturing Automation Laboratory. His research articles on machining and machine tools have received more than 20,000 citations, and his science-based digital machining solutions are used by more than 250 companies globally. He said milling technology has come a long way since he began his career in the late 1970s.

"At that time, spindles were gearbox driven with speeds of about 1,500 revolutions per minute (rpm)," he recalled. "The computer numerical control (CNC) was new and there were only a few NC machines in average machine shops."

Even when spindle speeds doubled to 3,000 rpm, it still took days to machine a titanium alloy turbine impeller. A breakthrough came in the early 1980s: the introduction of three research machining centers with belt-driven 10,000 rpm spindles. And—though milling has greatly evolved since then—chatter vibrations, machine tool breakage and premature tool wear remain manufacturers' biggest obstacles to milling productivity and quality.

Shaping the future under Industry 4.0

As founding president of Vancouver-based Manufacturing Automation Laboratories (MAL), Altintas is at the forefront of collaborative research to resolve those issues while shaping the future under Industry 4.0.

"We are now busy designing more sensors, intelligent machining process monitoring and control algorithms to make the machine self-adjusting, intelligent and totally unmanned," he said. "In the future, all process machine states will be recorded and the manufacturing history of each part will be traced using massive data collection, storing and processing them wisely in a cloud environment."

The challenge ahead is to develop algorithms to utilize the collected sensor and machine data to safely operate machine tools while improving manufacturers' productivity and quality. In collaboration with and in support of such aerospace luminaries as Pratt & Whitney Canada, Bombardier, Boeing, and Embraer, as well as solution providers like Sandvik Coromant and GF Machining Solutions' Liechti brand, MAL today follows the philosophy behind Industry 4.0, coupling virtual simulation of the part machining process with online monitoring and control of the machine.

"To advance technology, it is essential for industry and machine tool manufacturers to have strong ties to the research world," Altintas said. "We researchers need application engineers' insights in order to move technology forward."

Such collaborations, he added, lay the foundation for Industry 4.0, paving the road to intelligent, high performing and fully predictive manufacturing.



Prof. Yusuf Altintas, pictured here with master's student Tugce Tuysuz in the Manufacturing Automation Lab. (Photo by Martin Dee, courtesy of the Department of Mechanical Engineering, University of British Columbia)

« We are now busy designing more sensors, intelligent machining process monitoring and control algorithms to make the machine self-adjusting, intelligent and totally unmanned. »

Prof. Yusuf Altintas, Director, Manufacturing Automation Laboratory, University of British Columbia



Prof. Yusuf Altintas tests a tool holder assembly in the lab. (Photo by Martin Dee, courtesy of the Faculty of Applied Science, University of British Columbia)

EDITORIAL



Dear customers,

In the pages of this 11th edition of our *Results Today* customer newspaper, we invite you to discover our complete solutions and customer-centric commitment.

Our commitment to you lies in the value-adding intelligence, productivity and quality delivered by our solutions. It is further proven by the inspiring stories of our successful customers around the world and by the expert insights we bring you.

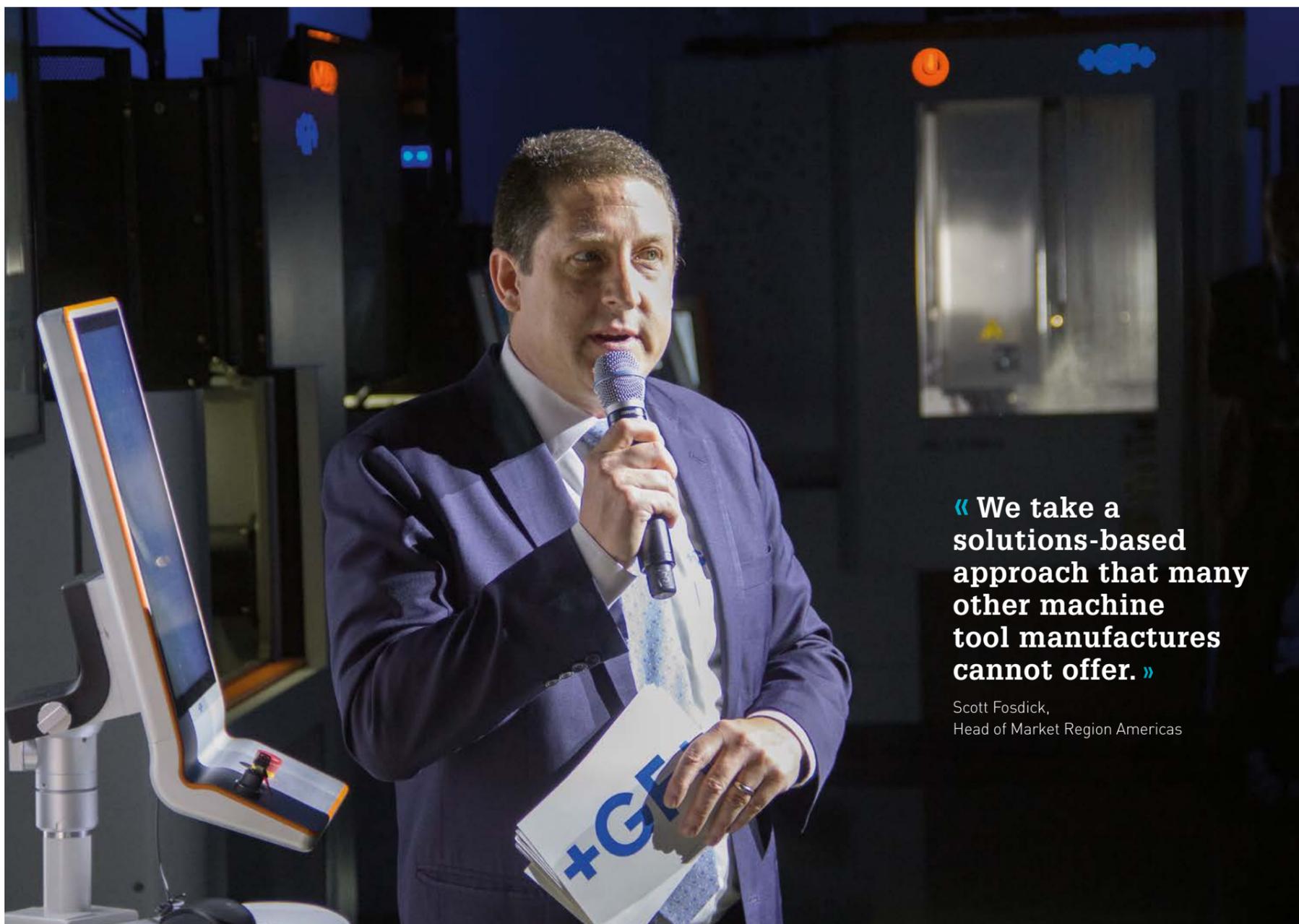
Your success is our chief motivator. That's why we are continuously advancing our legendary technical expertise. Today, our broad technology portfolio has you covered with:

- first-class wire-cutting, die-sinking and hole-drilling electrical discharge machining (EDM)

- Milling, including high-precision airfoil machining and our own in-house Step-Tec Spindle manufacturing
- new technologies, including Laser texturing, Additive Manufacturing, and Laser micromachining
- Tooling, Automation and software
- a continuum of Customer Services supporting you throughout the life cycle of your machine tools

When we say that GF Machining Solutions is all about you, we mean it, and our customers worldwide profit from it. Whatever your market segment and whatever the size of your operation, we have the complete solutions and the customer-centric commitment to accelerate your success—today.

Pascal Boillat,
President, GF Machining Solutions



« We take a solutions-based approach that many other machine tool manufactures cannot offer. »

Scott Fosdick,
Head of Market Region Americas

Scott Fosdick, Head of Market Region Americas

Market Region Americas, GF Machining Solutions

Leading the way with complete solutions for quality, productivity and autonomy

From mold-and-die-intensive sectors like information and communications technology (ICT) to precision parts manufacturing for aerospace, energy, and medical technology, GF Machining Solutions' complete solutions advance customers' quality, productivity and autonomy in Market Region Americas.

That is because over the past two decades, this GF Division has evolved from a machine tool manufacturer to a single, expert source of a complete range of manufacturing technologies, including Tooling, Automation, software, and services, said Scott Fosdick, Head of Market Region Americas.

"Having this wide range of technologies and the expertise to integrate them into a single solution for customers is unique," he explained. "Our goals are to save customers money, improve their return on investment, reduce their cost per part, improve their overall

quality, reduce their scrap, and drive their productivity. We take a solutions-based approach that many other machine tool manufactures cannot offer."

And that approach goes beyond machine tools, Fosdick underlined.

"Application expertise is an essential component of our approach," he said. "From working with customers' engineers on part design to process optimization and all of the services around our products, we can—better than anyone else—recommend and actually provide the right combination of technologies."

A good example of this is aerospace, where GF Machining Solutions' Turbine Group brings together extensive turbine knowledge from its worldwide organization and capitalizes on its greatest asset: a global network of its own sales and service organizations.

The partner of choice to manufacturing leaders

"Our great success in aerospace—and the energy sector—is due to the deep airfoil machining expertise of our Liechti team and our global Turbine Group's approach," Fosdick said. "Our blisk and blade machining technologies are inte-

grated into the engine platforms of two of the world's largest aeroengine manufacturers and our electrical discharge machining (EDM) technologies are a real asset in our customers' production of turbine disks, diffusers, and seal slots in blades and nozzle guide vanes."

In ICT, GF Machining Solutions' technologies play key prototyping roles in the development activities of four of the world's biggest US-based technology companies. And, in the rapidly expanding North American medical segment, the GF Division is a key player and partner of choice to top manufacturers of medical implants, surgi-

cal instruments and devices, and consumable products.

"In these segments and more, we continue to push the limits of technical innovation," Fosdick stated. "'How can we do this even better?' is the question we are always asking ourselves—and our customers'.



Steel Tool & Engineering counts on a vast array of GF Machining Solutions AgieCharmilles and Mikron Mill solutions and System 3R Automation to deliver best results to its aerospace customers.

Delivering best results

Complete solutions make a big difference at STE

In the risk-averse world of aerospace manufacturing, quality is non-negotiable and accountability is a given. Steel Tool & Engineering in Trenton, Michigan (US) relies on GF Machining Solutions' complete solutions, from electrical discharge machining (EDM), Milling and Automation to advanced training.

Steel Tool & Engineering (STE) President Pete LaFond joined the company at 16 when his father, as owner of the business, dragged him out of bed one Easter holiday weekend morning and put him to work operating a drill press at STE. Fifty-three years later, he's at the helm of STE, a longstanding supplier of precision engineering, machining, and fabrication services to the aerospace industry.

An unrelenting commitment to customer satisfaction has helped make STE the partner of choice to GE Aviation, one of the world's top aircraft engine suppliers and part of a multinational conglomerate. GE made Fast Company's World's Most Innovative Companies 2016 list for leading the Industrial Internet of Things.

Well positioned for digital transformation

Key clients' championing of digitization brings new challenges for STE in its production of jet engine components such as low-pressure turbine shrouds, compressor seals, and seal retainers.

"We are well positioned to deal with this transformation, but it does require a significant investment to meet aerospace customers' expectations of data delivery in a very short period of time—and by that I mean a couple of hours—as well as traceability on non-serialized parts," LaFond said. "We already are entirely paperless. Our database is significant in terms of how we process material from the day it comes in until it leaves the plant as a product. Our customers are driving the digital transforma-

tion. Anything that comes from the prime contractors is funneled down to suppliers—and that includes us."

In 10 years, he stated, jet engine parts manufacturing will be transformed. Even with steady year-on-year growth of five to seven percent—on par with overall aerospace industry growth—keeping pace in an environment of rapid technological evolution isn't easy, LaFond said.

GF Machining Solutions is a strategic choice

Technical leadership across a broad, multi-technology portfolio is among the chief reasons STE partners with GF Machining Solutions—a single source of complete solutions, including application expertise.

"Some might say it's risky to 'put all of your eggs in one basket,' but this was a strategic decision. We picked GF Machining Solutions because they offer three different processes that are important to our business: System 3R Au-

tomation, AgieCharmilles EDM and Mikron Mill solutions," he explained, adding that with one provider of complete solutions, accountability is built into the relationship. "If there is ever an issue, I can point my finger in one place.



The AgieCharmilles CUT E 350's intelligent, intuitive AC CUT HMI puts fast, safe machining at EDM Supervisor Dave Coates' fingertips.

« Our move to Automation, with GF Machining Solutions' support, has been the biggest factor in our growth. »

Pete LaFond, President, Steel Tool & Engineering



Low-pressure shrouds produced using space-saving, three-machine conventional EDM WorkMaster cells utilizing GF Machining Solutions' AgieCharmilles F0 350 and FORM 200 EDM machines

When we call for help, they respond very quickly. GF Machining Solutions treats us like we treat GE Aviation."

In fact, it was GF Machining Solutions that helped STE mount a smooth transition to Automation in 2006.

"Our move to Automation, with GF Machining Solutions' support, has been the biggest factor in our growth," said LaFond. "Automation is priceless when you grasp the value it delivers: faster setup,

fewer human errors and lights-out production."

Today, STE's fleet of GF Machining Solutions machines is vast: It includes five die-sinking EDM cells, each fed by a System 3R WorkMaster robot, and a three-machine wire EDM cell using System 3R A-axis rotary tables fed by a WorkMaster robot. On the Milling side, STE's Mikron HPM 450U, UCP 600 Vario and HEM 500U five-axis machines use seven-position pallet changers.

Those solutions help STE and its 150 employees get the job done for important and growing clients like GE and contribute to a work environment where success is measured in customer satisfaction.

"We have a bunch of hardworking doers who come in every day and do a great job," LaFond stated. "This environment makes me proud."



Flawless 321 stainless steel compressor stator shroud expertly executed with the five-axis Mikron HPM 450U and HEM 500U using seven-position pallet changers

STE President Pete LaFond says his team of "hardworking doers" helps make the company successful. Pictured (front row, seated) are CNC programmer Desmond Brown; toolmaker/CNC programmer Mike Janks; LaFond; EDM Supervisor Dave Coates; (back row standing) Manufacturing Manager Pete Grunwald; and Peak EDM President Bob Palmer.

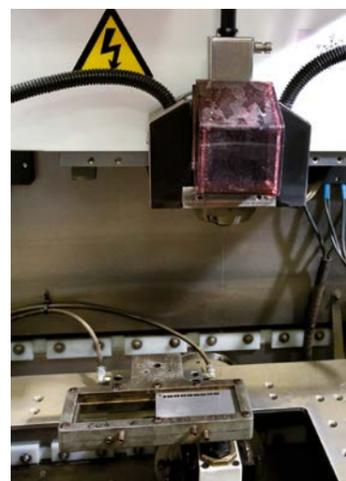


<p>Steel Tool & Engineering 28005 Fort Street Trenton, Michigan, USA</p> <p>Contact Phone: +1 734 692 8580 Fax: +1 734 692 8583</p>	<p>GF Machining Solutions machines</p> <p>Die-sinking EDM 1x AgieCharmilles Roboform 35P 2x AgieCharmilles Roboform F0 350 SP in a production cell utilizing a System 3R WorkPartner 14x AgieCharmilles Roboform F0 350 in production cells utilizing System 3R WorkMaster robots 2x AgieCharmilles FORM 200 Sp 1x AgieCharmilles FORM 300 Sp</p> <p>Wire-cutting EDM 1x AgieCharmilles AC Progress VP2 2x AgieCharmilles AC Progress VP3 1x AgieCharmilles AC Progress VP4 2x AgieCharmilles CUT E 350</p>	<p>Mikron Mill 3x Mikron HSM 400U LP in a graphite production cell utilizing a System 3R WorkMaster robot 1x Mikron UCP 600 Vario 1x Mikron HPM 450U 1x Mikron UCP 800 Duro 5x Mikron HEM 500U</p> <p>Automation 8x System 3R Automation 7x System 3R WorkMaster 1x System 3R WorkPartner</p>
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www.steeltool.com



Fast setup, fewer human errors and lights-out production are among the benefits delivered by STE's System 3R Automation solutions.



STE's wire-cutting (pictured here) and die-sinking EDM solutions are expertly supported by the GF Machining Solutions team in Lincolnshire, Illinois and Peak EDM in Wixom, Michigan.



STE toolmaker/CNC programmer Mike Janks prepares a Milling job.

« GF Machining Solutions treats us like we treat GE Aviation. »

Pete LaFond, President, Steel Tool & Engineering



« GF Machining Solutions' machine tools have been instrumental to our success and the technical and applications support provided by the company have been invaluable, too. »

Graham Gant, Development Machine Shop Manager,
Mercedes AMG High Performance Powertrains

A state-of-the-art hybrid power unit helps keep the Mercedes AMG Petronas Motorsport F1 team on the winning track.

Winning team

Mercedes AMG HPP on Mikron Mill solutions

World-class drivers are part of the winning formula for the Mercedes AMG Silver Arrows, but Mercedes' hybrid power unit (PU)—designed and built by Mercedes AMG High Performance Powertrains (HPP) in Brixworth, UK—has made massive contributions to the F1 team's success.

Designed in response to changes in engine rules that became effective for the 2014 F1 season, the Mercedes AMG hybrid PU integrates and harmonizes turbo, electric motor and internal combustion technologies and is the result of painstaking research, design, development, manufacturing and testing. Much of this work is done by HPP's in-house Development Machine Shop.

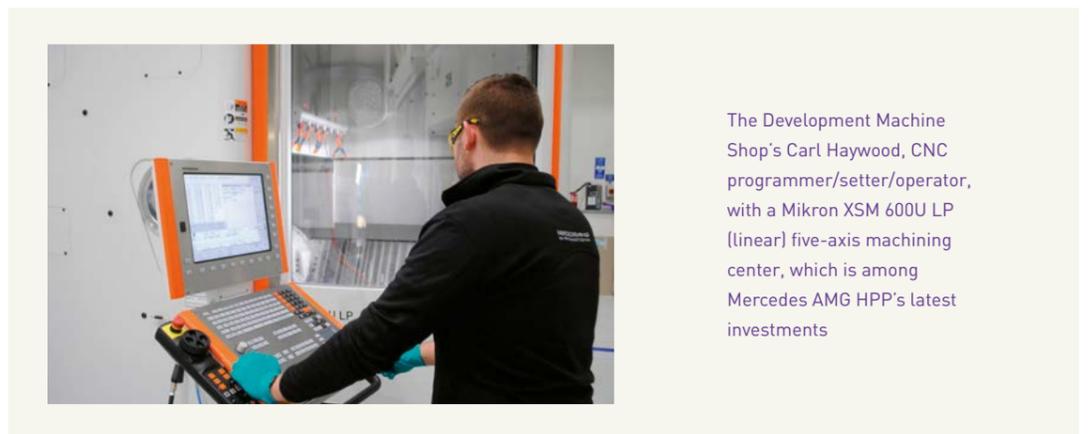
Working closely with the design engineers and acting as a bridge between design and production, the Development Machine Shop designs, develops and manufactures complex, high-precision and performance-critical race engine prototype parts and components. HPP has invested significantly in advanced Mikron Mill solutions from technical partner

GF Machining Solutions: four Mikron HPM 800U (MILL P 800 U) machines and two Mikron HPM 1000U high-performance five-axis machining centers.

Working around the clock

Those machines work around the clock: development work during the day and production during at night.

"We operate in a challenging and high-pressure environment," said Development Machine Shop Manager Graham Gant. "The machine tools we invest in must perform to exacting standards, machining components and complex component features to extremely tight tolerances, repeatable accuracies and high surface finishes."



The Development Machine Shop's Carl Haywood, CNC programmer/setter/operator, with a Mikron XSM 600U LP (linear) five-axis machining center, which is among Mercedes AMG HPP's latest investments

Gant values the Mikron Mill machines' five-axis simultaneous machining ability, advanced high-torque motor Spindles, direct-drive rotary tables, and rigid, thermally stable design and build, along with their superb, consistent perfor-

mance—from roughing to finishing—and fast process reliability. He also cited their large working envelopes, generously sized automatic tool changers (up to 240 tools) and optimized chip evacuation and management systems.

"You can machine small components on large machines but not vice-versa. The large working capacity of our HPM machines delivers much needed manufacturing flexibility. The machines' tool changers ensure quick and seam-

« The machine tools we invest in must perform to exacting standards... »

Graham Gant, Development Machine Shop Manager, Mercedes AMG High Performance Powertrains



Heat exchanger machined with GF Machining Solutions' AgieCharmilles CUT 3000 wire-cutting EDM solution to evaluate the potential use of wire EDM as both a complementary or, even an alternative, technology to more conventional machining methods.

↓ The AgieCharmilles CUT 3000 is used, for example, to produce heat exchangers for the Mercedes AMG HPP hybrid PU. Pictured here are Development Machine Shop Manager Graham Gant (front) and Carl Haywood, CNC programmer/setter/operator (back).



<p>Mercedes AMG High Performance Powertrains Morgan Drive Brixworth Northamptonshire NN6 9GZ</p>	<p>Contact Phone: +44 1604 880100 Fax: +44 1604 882800</p>	<p>GF Machining Solutions machines 4x Mikron HPM 800U (MILL P 800 U) 2x Mikron HPM 1000U 1x Mikron XSM 600U 1x AgieCharmilles CUT 3000</p>
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www.mercedes-amg-hpp.com

less production," Gant explained. "Many of the parts manufactured have long cycle times and involve the use of many tools. We simply cannot afford to stop production by spending valuable time selecting, changing and setting tools."

Additionally, the machines' efficient swarf management systems allow for the uncompromising productivity and reliability essential with long cycle times and the need for high-speed, high accuracy material removal when machining parts from block.

Spurring HPP's Mikron Mill investments were new F1 car engine rules to make the sport more eco-friendly. Engine size was the biggest change: 2.4-liter naturally aspirated V8s were out, and downsized 1.6-liter V6 liter units were in. To compensate, previously prohibited technologies

were now permitted, so direct injection, a turbo-compressor assembly, and a larger hybrid system became the focus.

More than machine tools

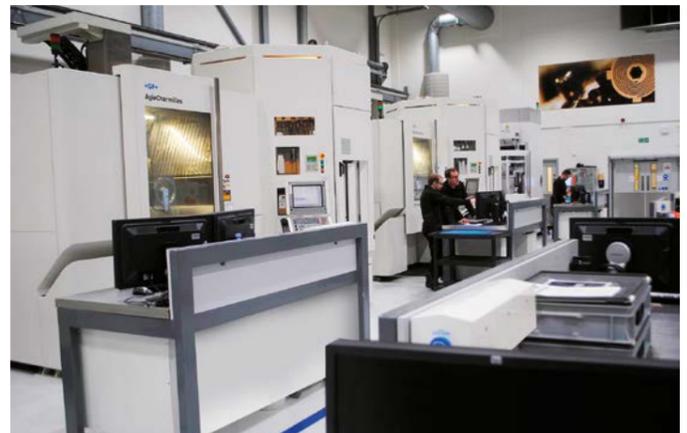
With little turbo design and manufacturing experience, HPP turned to the Daimler company's collective knowledge and to the expertise of technical partners, including GF Machining Solutions.

The GF Division's invaluable support included in-depth knowledge of five-axis machining, application know-how including turbo, blisk and impeller manufacturing, and prowess at manipulating cutting data and cutting parameters to optimize productivity and efficiency.

"GF Machining Solutions was involved in the development and manufacturing phases, and supported us by undertaking trials and tests at their Centers of Competence," Gant said. "Their 'offline' involvement helped us reduce our own learning curve and circumvent a number of engineering and manufacturing issues."

HPP and GF Machining Solutions are a winning team, all in all.

"GF Machining Solutions' machine tools have been instrumental to our success and the technical and applications support provided by the company have been invaluable, too," Gant said.



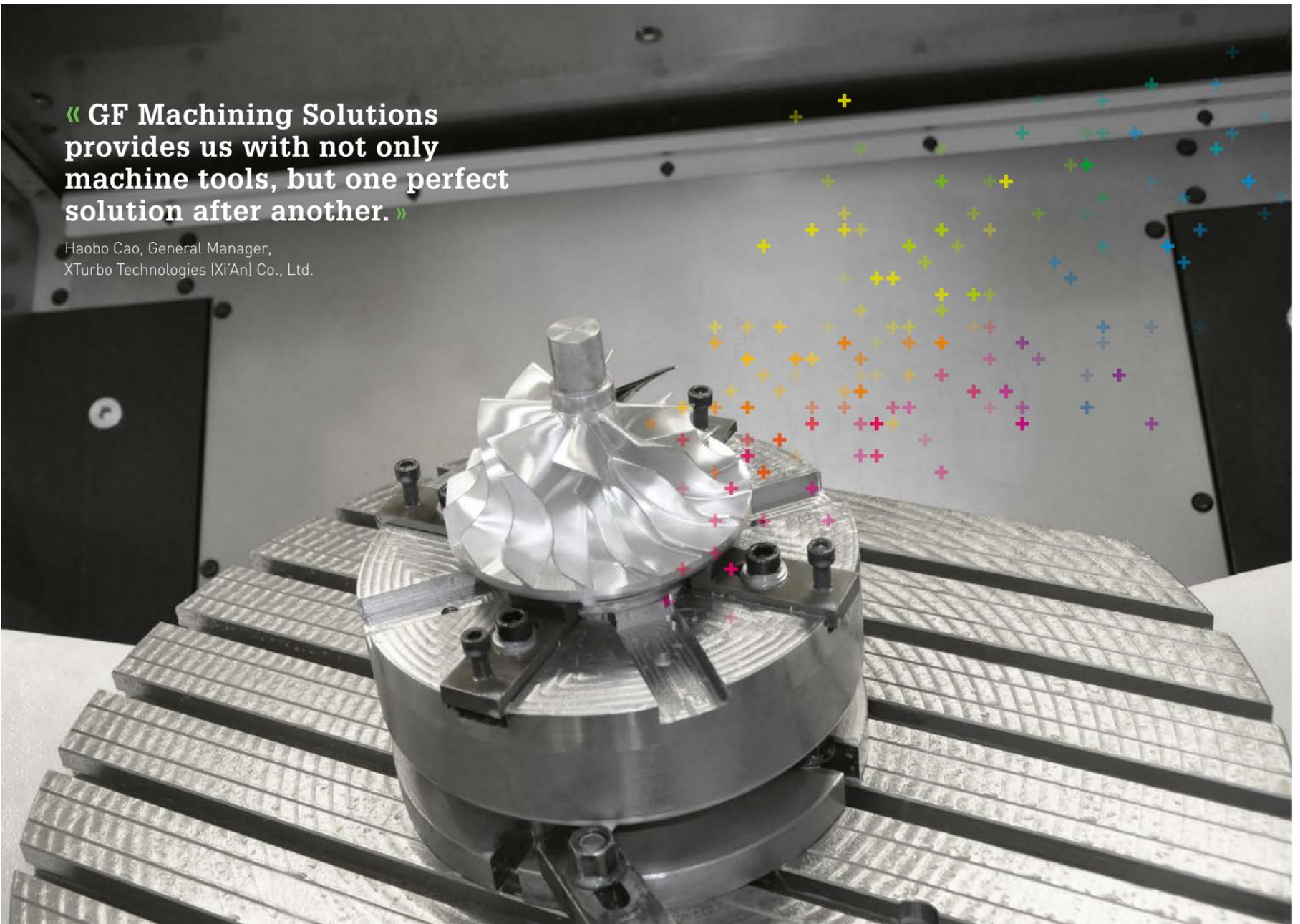
Much of the work to research, design, develop, manufacture and test the Mercedes AMG HPP hybrid PU is done by HPP's in-house Development Machine Shop, using technical partner GF Machining Solutions' high-performance Mikron Mill and AgieCharmilles wire-cutting EDM solutions.

The Mercedes AMG Petronas Motorsport F1 team's success depends in part on Mercedes' hybrid PU, designed and built by Mercedes AMG HPP's Development Machine Shop with support from GF Machining Solutions' Mikron Mill technologies.



« GF Machining Solutions provides us with not only machine tools, but one perfect solution after another. »

Haobo Cao, General Manager,
XTurbo Technologies (Xi'an) Co., Ltd.



The high stability of the Mikron HPM 800U (MILL P 800 U) ensures XTurbo's continuous, high-quality production of high-precision impellers as well as blisks.

Perfect solutions

China's XTurbo treats turbo parts as diamond cuts

In gemology, a diamond cut refers to the symmetry, proportioning and polish of the precious stone, and XTurbo Technologies (Xi'an) Ltd. treats high-value turbine components as diamond cuts—with expert support from GF Machining Solutions and its high-performance Mikron Mill machining centers.

Established on International Arbor Day in 2014, Xi'an, China-based XTurbo began with the dream of flourishing like a tree, said General Manager Haobo Cao. Beginning with just 10 employees, the business today employs 85 and aims to be the most professional turbo parts manufacturing partner in the global supply chain.

"The patience and efforts of our people attract new talent and our market today covers all of China's aviation field," Cao said. "We manufacture turbo parts including compressors, blowers, expanders, pulp impellers, polygons, turbo-charger wheels, scaled propeller and hydraulic turbine models, as well as gas turbine blisks and casings, molds and clamping tools."

Strategically located in China's Yanliang Aviation Industrial Base,

XTurbo focuses intensely on state-of-the-art manufacturing, insisting on advanced equipment and machining processes, as well as its highly skilled, professional team, to deliver advanced manufacturing services for arbitrary-surface turbomachinery like impellers and blisks.

"We have rich experience in machining parts from many different materials, such as aluminum, stainless steel, titanium, Inconel and other superalloys," Cao explained.

What sets XTurbo apart from its competitors is its broad range of expertise.

"We offer in-house machining, in-process quality control and inspection, balancing and spin testing," he said. "We support our customers with deep expertise



XTurbo machine operator Chen Huang (left) and GF Machining Solutions service engineer Bin Li (right) discuss an aluminum alloy impeller machined on the Mikron HPM 800U (MILL P 800 U).

« Our Mikron Mill solutions... help us meet a wide variety of requirements, from roughing to finishing. »

Haobo Cao, General Manager, XTurbo Technologies (Xi'an) Co., Ltd.



XTurbo machine operator Qipeng Ge (right) shows an apprentice how to use the Mikron HPM 1850U to machine large, difficult-to-cut aerospace parts.

for fast prototype development. We are an excellent partner to the turbo parts supply chain.”

That’s important, because China’s aerospace business development—with support from the government—holds an important global position.

‘One perfect solution after another’

Today, improving product quality is the industry’s greatest pursuit and one of XTurbo’s chief advantages.

“We constantly work to improve product quality in order to provide our customers with the great-est competitiveness,” stated Cao. “GF Machining Solutions provides us with not only machine tools, but one perfect solution after another.”

Case in point: XTurbo’s Mikron HPM 1850U and Mikron HPM 800U (MILL P 800 U).

“Our Mikron Mill solutions are completely suitable for high-performance processing. Their solid foundations help us meet a wide variety of requirements, from roughing to finishing,” said Cao.

XTurbo’s HPM 1850U machining center still works well two years after being integrated at XTurbo, surpassing similar machines in response time, machining quality, precision and stability. It is used to machine large, difficult-to-cut aerospace parts requiring more engagement and torque.

“This solution improves our machining speed and efficiency. The final accuracy of the parts is impressively achieved and certified by in-house inspection or our customer’s feedback,” said Chen Huang, team leader of XTurbo’s finishing machining workshop.

“We invested in the two machines which are decisive for improving product stability and quality, help-

↓ General Manager Haobo Cao counts on GF Machining Solutions’ Mikron Mill technologies in XTurbo’s quest to treat high-value turbine components as diamond cuts.

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GF Machining Solutions machines
1x Mikron HPM 1850U
1x Mikron HPM 800U (MILL P 800 U)

www.xturbo.cn



ing us enlarge our capacity and machine high-precision impellers and blisks,” Cao explained. “Particularly, the high stability ensures our continuous production. These machines are the backstage heroes of our excellent manufacturing centers.”

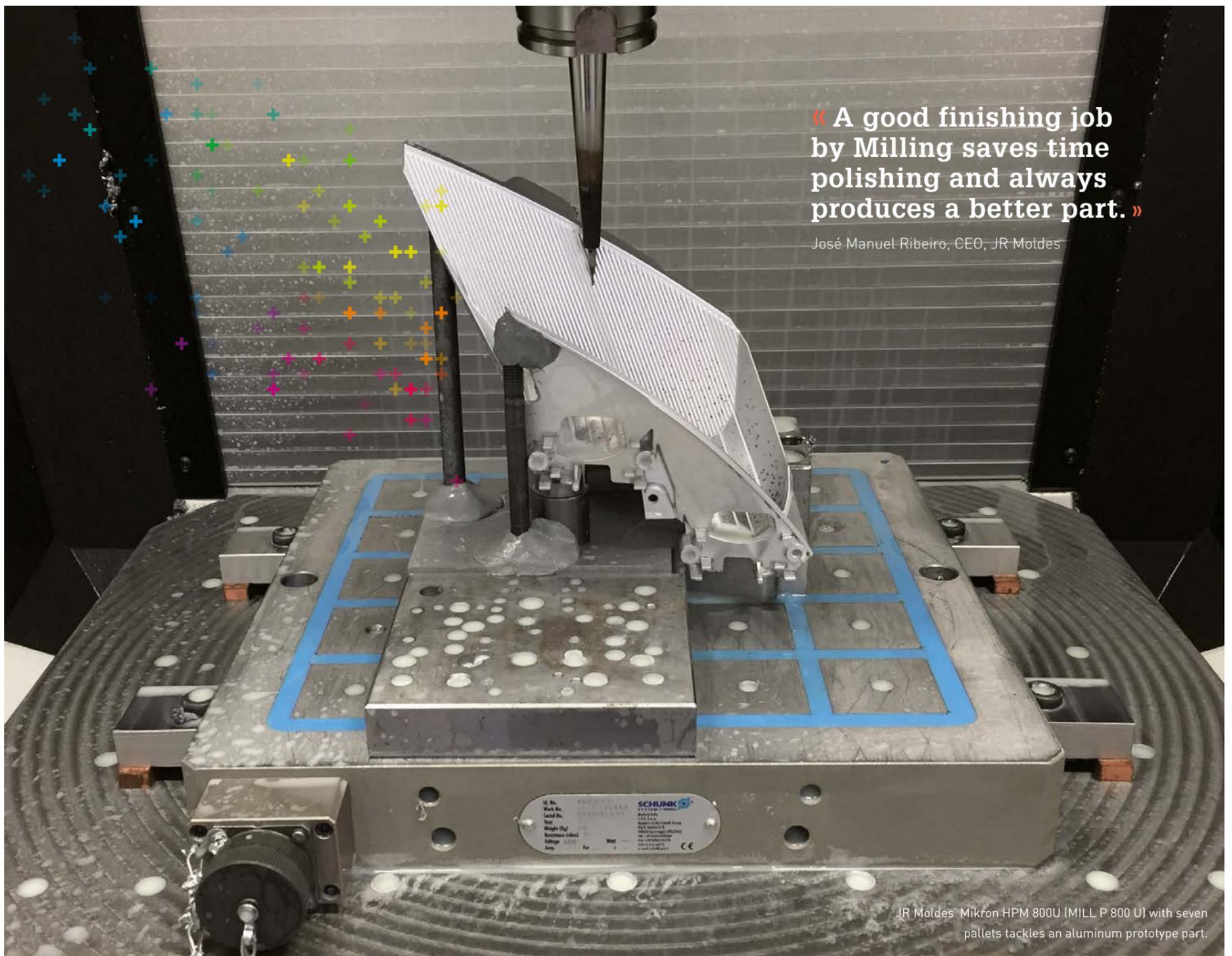
The Mikron HPM 1850U, he added, represents GF Machining Solutions’ accumulated high-performance

Milling (HPM) know-how and expresses that knowledge as a cutting edge solution—exactly what XTurbo expects from a solutions provider with a legacy of technical innovation.

“GF Machining Solutions is known for its solutions for world-famous aeroengine manufacturers,” Cao said. “The main advantages delivered by GF Machining Solutions

are the advanced processing of its Milling technology and integrated Automation. As our partner, GF Machining Solutions effectively resolves processing problems.”

This partnership helps XTurbo stand out like a precious stone and adds value to its customers’ high-value turbine components.



« A good finishing job by Milling saves time polishing and always produces a better part. »

José Manuel Ribeiro, CEO, JR Moldes

JR Moldes' Mikron HPM 800U (MILL P 800 U) with seven pallets tackles an aluminum prototype part.

Realizing a dream

Portugal's JR Moldes is partner for leading automotive suppliers

Twenty-two years ago, José Manuel Ribeiro was just out of high school, learning everything he could about moldmaking and nurturing a dream of opening his own business. Today, that business—JR Moldes in Oliveira de Azeméis, Portugal—is a partner to globally renowned automakers.

Oliveira de Azeméis' industries range from moldmaking to automotive components, and JR Moldes specializes in both. But that success didn't happen overnight. It began 30 years ago when José Manuel Ribeiro's father, a Portuguese toolmaker for a global company with a Long Island, New York facility, accepted a job offer and moved his family to the US.

As a Long Island high school student, Ribeiro worked part-time in a toolmaking shop and dreamed of one day opening his own business. After attending technical school in New York to gain computer numerical control (CNC) milling, part design and mathematics skills to help him realize that dream,

he returned to Portugal in 1994 and—with his father—opened JR Moldes in 1995. Today, he owns the business with his sister.

Partner to world's best automotive suppliers

"When we started, we supplied milling services to local companies," Ribeiro explained. "With perseverance and hard work, we developed our skills and technologies. Within two years, we were already working for the automotive industry. We have a wide range of customers all over the world, but Europe is our main market. Our clients are some of the best automotive industry suppliers, from lighting to interiors."

With 50 employees and a 2,300-square-meter (24,750-square-foot) workshop, the company produces molds up to 15 tons for automotive, including molds for headlight bezels, lenses, main bezels, in-mold textile molding, in-mold labeling (IML) and gas-assisted molding, primarily from blocks of 1.2711 and 1.2738 tool steel. With the mission of being a reference in the moldmaking market and growing in a sustainable way, JR Moldes doesn't compromise on technology.

"When people mention JR Moldes, they mean quality, seriousness, respect for our workforce and the environment, and safety," Ribeiro stated. "We aim high. To become a

reference in the global moldmaking market, it is fundamental that we have the best, most cutting-edge technology."

Ensuring quality with advanced technologies

Those quality enhancing technologies include 11 computer numerical control (CNC) machining centers—including five Mikron Mill solutions—, two six-axis deep drilling machines, and wire-cutting electrical discharge machines. Since 2010, he has steadily invested in GF Machining Solutions' five-axis, high-performance Mikron Mill solutions to help meet the automotive industry's demand for complex, high-quality molds.

"Continuous investment in state-of-the-art machinery, software and our staff contribute to our sustained growth," he said. "We focus on client satisfaction and to achieve it, we practice competitive pricing, we always deliver on time and we never disregard quality."

Mikron Mill solutions help tackle automotive moldmaking pressures

Solutions to help maintain competitiveness are essential, Ribeiro said.

"In the past years, automotive has become more demanding: Parts are more complex so the molds are also more complex and delivery times are shorter, but prices



JR Moldes employees Nuno Cunha (left, responsible for all milling activities) and André Oliveira (machine operator, right) analyze the best approach for a job on the Mikron HPM 1850U.



JR Moldes' five Mikron Mill solutions—including two Mikron HPM 1850U machines—enhance quality while saving the business time and money.

↓ JR Moldes CEO José Manuel Ribeiro doesn't compromise when it comes to technology. The business counts on five Mikron Mill machining centers in its production of big molds for world-renowned automakers.



JR Moldes

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GF Machining Solutions machines

- 1x Mikron HPM 600U (MILL P 500 U)
- 1x Mikron HPM 1350U
- 2x Mikron HPM 1850U
- 1x Mikron HPM 800U (MILL P 800 U)

www.jrmoldes.com

haven't followed this evolution," he explained. "Both our customers and we have to be flexible and adapt to changes in the automotive industry."

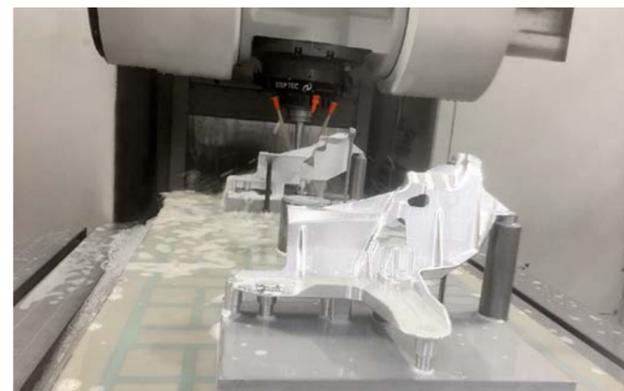
JR Moldes' Mikron Mill machines save the business time and money while enhancing quality.

"A good finishing job by Milling saves time polishing and always

produces a better part," said Ribeiro. "Our decision to buy our first five-axis machine was due to the fact that we have very complex parts that needed three to four setups and we needed to reduce these setups to one or two at most."

The value of that choice is confirmed by Ribeiro's continued investment in Mikron Mill solutions:

"We continue investing in Mikron Mill solutions because the first machine—and the four we have bought since 2010—met our demands," he said, adding that JR Moldes relies solely on GF Machining Solutions' Customer Services for maintenance solutions.



JR Moldes expertly meets the difficult challenge of machining prototype parts to 2 mm thickness with the Mikron HPM 1350U.



« We continue investing in Mikron Mill solutions because the first machine—and the four we have bought since 2010—met our demands. »

José Manuel Ribeiro, CEO, JR Moldes

Easily meet your customers' demands with these AgieCharmilles EDM solutions

Secure your accuracy, precision and productivity in mold and die and precision parts production with the AgieCharmilles CUT P wire-cutting series and FORM die-sinking portfolio.



Wire cutting

Shorter lead times and zero-defect manufacturing demand more efficient manufacturing solutions—and GF Machining Solutions' CUT P 350, CUT P 550, CUT P 800 and CUT P 1250 wire-cutting electrical discharge machining (EDM) machines are your answer to these requests.

The CUT P series, available worldwide, is engineered to help you achieve Limitless Possibilities: Its SMART machine and new Automation solutions help you reach previously unachievable productivity and flexibility in growing markets like electronic components, ICT, medtech, and automotive. Ensure your part quality with the CUT P's greater cutting speed and performance, and get the surface quality and accuracy for longer tooling life while reducing insert wear and manual adjustment operations.

Experience higher accuracy, advanced taper accuracy and stress-free machining under complex conditions, and cut your part costs with the latest-generation Intelligent Power Generator. Ramp up your success with smart, connected solutions, including SMART consumables, and eTracking's process monitoring and traceability as well as resource- and cost-saving Eco features.

The technological leap achieved with the CUT P is the result of GF Machining Solutions' years of research and unique EDM legacy.



AgieCharmilles CUT P 350



Die sinking

innovation, such as the renowned AC FORM human-machine interface and GF Machining Solutions' legendary EDM know-how.

Whether you need a single machine for straightforward use or full Automation, the new, easily integrable FORM solutions ensure that you're up to every challenge, from greater flexibility and machining accuracy to eliminating costly manual operations.

New FORM portfolio delivers full know-how

Whatever your challenge, the new AgieCharmilles die-sinking portfolio—the FORM E, FORM P, FORM S and FORM X series—has a solution.

The FORM machines advance their forebears' software and technical



Power your graphite processes with these Milling and Spindle solutions

Achieve superior process stability, parts quality and shop floor productivity with GF Machining Solutions' Mikron MILL S and HSM solutions with Step-Tec HVC140 Spindles.



Milling



Spindles

Meet the growing need for machining of graphite molds for glass end products in automotive, ICT, electronic components, aerospace and packaging with these solutions. In ICT—a critical market in Asia—graphite molds

for glass are a key trend reaching into automotive to trigger business challenges and benefits in Europe. Such molds require $\pm 5 \mu\text{m}$ precision, $R_a 0.2 \mu\text{m}$ surface finish, and hours of wet or dry machining. GF Machining Solutions started solving these challenges early on and offers different solutions upon applications and challenges.

With its Mikron HSM Graphite Solution, this GF Division is at the forefront of dry graphite machining.

Based on the Mikron HSM 500—a bestseller in Asia—the Mikron HSM Graphite comes with a dedicated configuration: A new HVC140 Spindle, new and integrated dust extraction as well as an integrated workpiece changer, WPT1+, from System 3R, ideal for small graphite electrodes and molds.

The new Step-Tec HVC140 Spindle was specially developed for best accuracy and fluid tightness. With 42,000 rpm and 13.5 kW of power, it ensures the precision you need to tackle graphite molds and thermal stability with less than 1.7 Kelvin around the machine support's contacting surface.



Mikron HSM 500 Graphite

Step-Tec HVC140 Spindle: enhanced performance due to a new bearing design increasing its radial and lateral stiffness by 16 percent and 60 percent respectively



Mikron MILL S 400 (U) / 500

The Mikron MILL S series machines with three and five axes are equipped with the new Spindle, too. They set a benchmark based on axis dynamics and Spindle speed, taking you beyond fast, dry graphite machining. Your results: long-term precision and wet and dry machining capability, as well

as the ability to machine graphite and other materials—including copper, steel and hardened steel—in a clean environment. Enhancing these mixed-use capabilities are the Mikron MILL S solutions' integrated Automation to drive your agility, productivity and return on investment.

Take your blisk production to a new level with Liechti's solutions

Profit from a single-point-of-contact blisk production solution provider when you turn to the turbine application expert: GF Machining Solutions' Liechti brand.



Liechti go-Mill 800



Liechti's 4P model



Blisk machining done to perfection with the Liechti go-Mill 800



Milling

With more than three decades of turbine application expertise, from process engineering and prototype production to process qualification, Liechti is uniquely qualified to help you keep pace with the current ramp-up in aerospace produc-

tion that is expected to continue through the year 2035.

From small batches to high-volume production, with Liechti solutions you defeat a vast range of blisk production challenges: thin, complex shapes; the need for single-setup accessibility; expenses related to long machining times requiring highly reliable machine tools; reducing tooling costs by consistently finding the "sweet spot" in machining conditions; and—especially in

critical leading and trailing edge zones—the ability to achieve the required surface quality.

With Liechti as your partner, those challenges are resolved and you are on your way to reaping the benefits of Liechti's 4P approach to greater productivity and profits. This 4P model—Plan, Performance, Partnership, Profit Increase—helps you attain the lowest cost per part and achieve profitability increases of more than 30 percent.

A prime example of Liechti's full scope of competence is its five-axis go-Mill 800 turnkey solution for production of cylindrical parts including blisks. Capable of machining parts up to 860 mm (33.8 in.) and 500 kg (1,100 lbs.), the go-Mill 800 employs 1 g (10 m/s²) acceleration and deceleration on each of its five axes to perfectly machine profiles. With its 15,000 rpm spindle speed, 120 Nm torque (S1), and a double-end-driven A axis, you get the power and performance you need and the

full confidence that your go-Mill 800 is backed by Liechti's proprietary TURBOSOFT plus computer-aided manufacturing (CAM) software and Liechti's ever-expanding airfoil manufacturing process knowledge.

To learn more about Liechti's solutions, visit: www.liechti.com

With new software, integrating Laser texturing into your process is a snap

Integrating GF Machining Solutions' AgieCharmilles Laser texturing solutions into your process is easier than ever with three game-changing software packages.



Laser

Laser texturing machine and accurately reproduce your textures, forms and shapes.

The software automatically generates the right texture at the right position, eliminating the tedious task of mapping the right position on the 3D shape, enabling you to easily achieve accurate geometric shapes.

3D Map software

GF Machining Solutions' one-of-a-kind 3D Map software makes it easy to import any 3D computer-aided design file into an AgieCharmilles



Dedicated software embedded in the AgieCharmilles LASER P 1200 U makes it easy to import designs for tire sidewalls.



The areas in red on this demo part could only be executed with 3D Map software.

Simplified tire mold production

Embedded in the AgieCharmilles LASER P 1200 U dedicated tire industry solution, this software takes the complexity out of importing designs for existing tire sidewalls, for example. Just make a projection of your .dxf file with the software and query the diameter of the cutter, and the soft-

ware simulates the engraving job with perfect accuracy. With this solution, you can continue your existing jobs and innovate your designs with greater simplicity.

New Laser software version 1.8.0 boosts your business

The latest version of GF Machining Solutions' software brings new

intelligence and efficiency to the Laser texturing process. With advanced patching generation, the software adapts the Laser patching strategy to the texture you want to reproduce on your AgieCharmilles Laser texturing machine. Improve the quality of your texturing jobs by integrating intelligence and efficiency into your process: The software intelligently analyzes your job and generates the optimal patching strategy without affecting your texture's quality.

Microlution's ultraprecise platforms for micromachining success

Reduce your cycle time and disposable tooling costs and improve your surface finish with GF Machining Solutions' compact, ultraprecise Microlution micromachining platforms.



Laser

As micro parts become ever smaller and more complex, Microlution goes beyond standard computer numerical control machining to help you create eco-

nomically and technically feasible precision parts.

Microlution's platforms coordinate high acceleration, exceptional stability, precise part handling, and motion control with integrated part characterization and measurement to deliver ultraprecise machining with unsurpassed accuracy, speed and quality.

ML-5 for ultrafast drilling, milling, cutting

The ML-5 five-axis ultrafast Laser platform is the perfect example of the performance Microlution brings to manufacturers: Drill, mill and cut with no heat-affected zone and get precision parts in seconds.

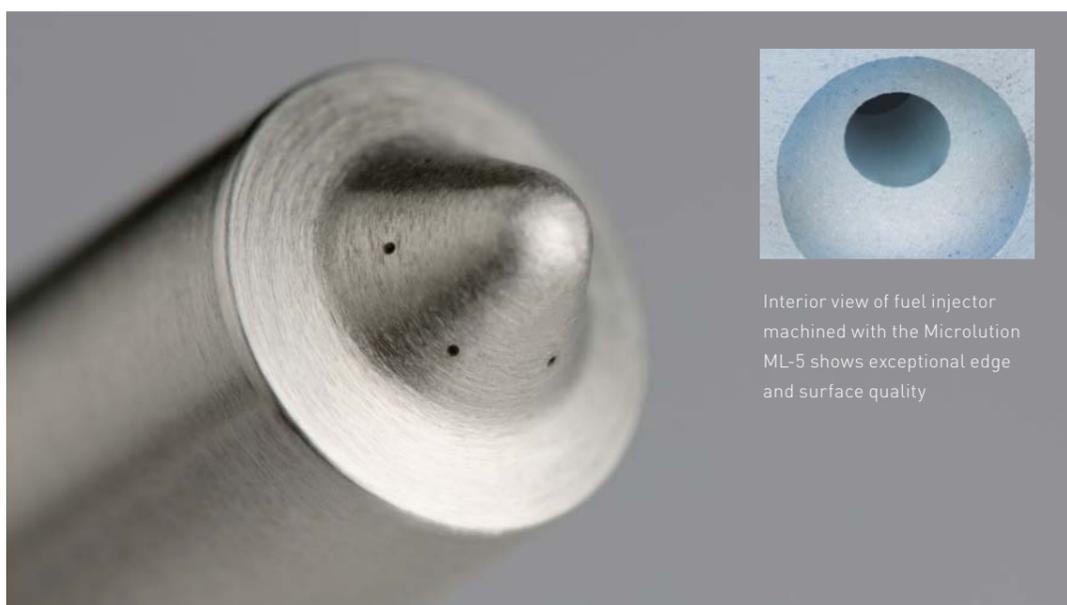
From more efficient automotive fuel injectors and complex, micro

precision watch parts to highly precise medical catheter tips and micro-crack-free holes for mobile devices' hardened glass displays, the ML-5 brings new designs and products to life.

With $\pm 1 \mu\text{m}$ positional accuracy and $\pm 0.5 \mu\text{m}$ repeatability, the platform is available in Laser and Laser/mechanical configurations, has up to five axes of motion, and supports multiple Laser types. It has a precision ground natural granite base; high-acceleration linear motors; Heidenhain glass scale encoders; granite-mounted,

ironless rails; a Laser tool sensor; in-line workpiece touch probe; and a confocal Laser probe.

Part of GF Machining Solutions, Microlution was established in 2005 and today offers a full line of compact micromachining platforms including mechanical milling and turning solutions and femtosecond Laser technology. Achieve faster, more accurate and higher quality micromachining results with Microlution's solutions to reduce cycle time, decrease disposable tooling costs and improve surface finish.



Interior view of fuel injector machined with the Microlution ML-5 shows exceptional edge and surface quality



Microlution ML-5

Discover complete AM solutions with seamless process chain integration

Experience streamlined integration of GF Machining Solutions' Additive Manufacturing (AM) technology into your process chain and take the difficulties out of post-processing steps.



AgieCharmilles AM S 290 Tooling



Additive Manufacturing

Say goodbye to the complexity of integrating AM into your process stream, thanks to GF Machining Solutions' ongoing collaboration with global Tooling, Automation and software leader System 3R, a technical unit of the GF Division.

From computer-aided design (CAD) to your final plastic parts, GF Machining Solutions positions you for profitability and productivity with AM technology in mold and die manufacturing.

Thanks to industrial 3D printing, mold and die manufacturers can build inserts with conformal channels, meaning that they are placed closer to the final molded part and respect the part's geometry. This breakthrough then aligns the ex-

change of temperature inside the mold and optimizes production in terms of time, cost and quality.

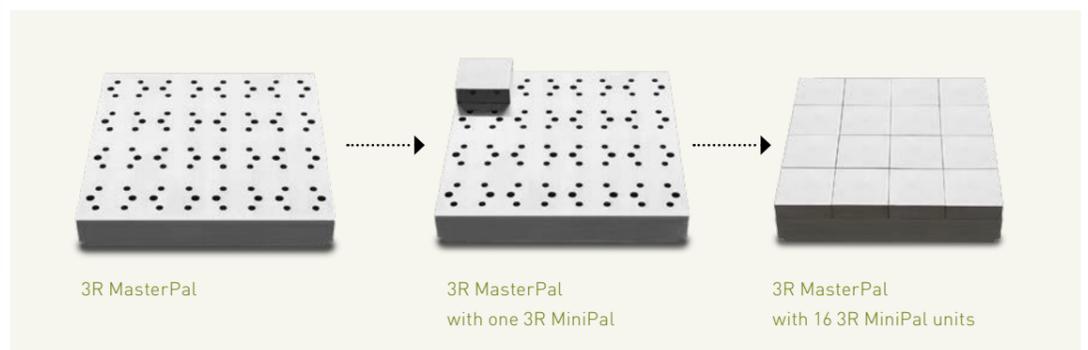
To ease integration of the AgieCharmilles AM S 290 Tooling into your processes, GF Machining Solutions and System 3R have developed a full range of Tooling solutions optimized especially for improved production and quality in AM production, so you achieve uncomplicated setup and maintain essential accuracy with AM.

Beginning with 3D Design, your AM job is prepared offline outside of the machine with the new 3R MasterPal and 3R MiniPal and transferred to the AM machine. Simply load the right size and amount of 3R MiniPal units onto a 3R MasterPal or use a 3R Direct-Base. Print your parts inside the machine—right onto the 3R MiniPal or 3R DirectBase.

Seamlessly move on to post-processing with Milling or Laser

texturing, thanks to 3R MiniPal being referenced on the System 3R Macro Reference, then separate the 3D part from the 3R MiniPal with a wire-cutting EDM machine or a saw.

Experience the added value and simplicity that GF Machining Solutions' ever-expanding AM expertise—including business support—delivers to ensure your productivity and quality with AM.



System 3R's new Nano Tooling solutions deliver highly repeatable accuracy

Achieve highly repeatable sub-micron accuracy with System 3R's new Nano Tooling solutions—already proven by leading milling and grinding original equipment manufacturers.



Tooling

Quick, precise clamping with MacroNano

Nano-precision machining demands nano-precision referencing of your workpieces and tools—no small challenge even with existing state-of-the-art solutions. And the challenge becomes even greater when you have to establish the references in the shortest possible time.

Quick and precise are the watchwords of System 3R's MacroNano high-precision palletized workpiece clamping system. It links your production chain through an ultra-precise coupling for both workpiece

and tool holding. You achieve consistent production of very accurate parts, thanks to the MacroNano system's extreme repeatability with sub-micron accuracy.

MacroNano has repeatable accuracy within 0.001 mm and a fixed index position of 4 by 90 degrees.



MacroNano chuck and pallet

Your high-precision machines are linked together in your production chain with uncompromising accuracy, and feedback to your machine for supplementary machining after inspection becomes a reality—and meaningful with a pallet system at least as accurate as your measuring machine.



MatrixNano chuck and pallet

MatrixNano for fast setup, precision, quality

As an interface with your manufacturing system, System 3R's MatrixNano pallet system features low built-in height, ultra-precise indexing, and a drawbar with a large through hole allowing tall and long workpieces to be sunk into the chuck for rigid, stable fixation.

Available in 110 and 142 mm diameters, the MatrixNano delivers repeatable accuracy within 0.001 mm and has fixed index positions of 4 by 90 degrees.

Customer Services' SMART wire brings new intelligence to your processes

Ramp up your serviceability, traceability and quality control with SMART wire for GF Machining Solutions' new AgieCharmilles CUT P wire-cutting EDM series.



Customer Services

tinuity, stock and process traceability, process optimization and part cost calculation.

Machine smarter with SMART wire

Just as the CUT P solutions are fully aligned with GF Machining Solutions' Industry 4.0 vision of high-performing, resource-efficient and fully predictive manufacturing, SMART wire from Customer Services brings new intelligence to your manufacturing processes. Embedded with radio frequency identification (RFID) chips, SMART wire represents a smart, connected solution to help you minimize human errors while ensuring consistent quality, process con-

Get access to the wire characteristics you need to support your wire selection, machining strategy and part cost calculations—as well as critical certifications, including Nadcap—with SMART wire. The RFID chip records a broad array of wire characteristics such as wire material, diameter, tensile strength, initial spool weight, remaining wire length, and validity date.

Exploit new traceability horizons, too, with SMART wire, and

improve your quality tracking. SMART wire collects your wire's product number, purchase order reference, production data, manufacturing date and expiration date.

With this technology's automatic wire detection, you minimize human errors and optimize your wire-cutting EDM process. With SMART wire's rewriteable memory, your wire spool status is continuously monitored and you are advised if the wire supply is insufficient to finish the job. Current wire length and first use date are recorded as well.

Discover the Limitless Possibilities that GF Machining Solutions' premium SMART wires bring to

the AgieCharmilles CUT P series and its dedicated technologies and take a significant step toward greater serviceability, traceability and quality control throughout your wire-cutting EDM process.

Machine smarter with Customer Services' SMART wire for GF Machining Solutions' new AgieCharmilles CUT P wire-cutting EDM series.



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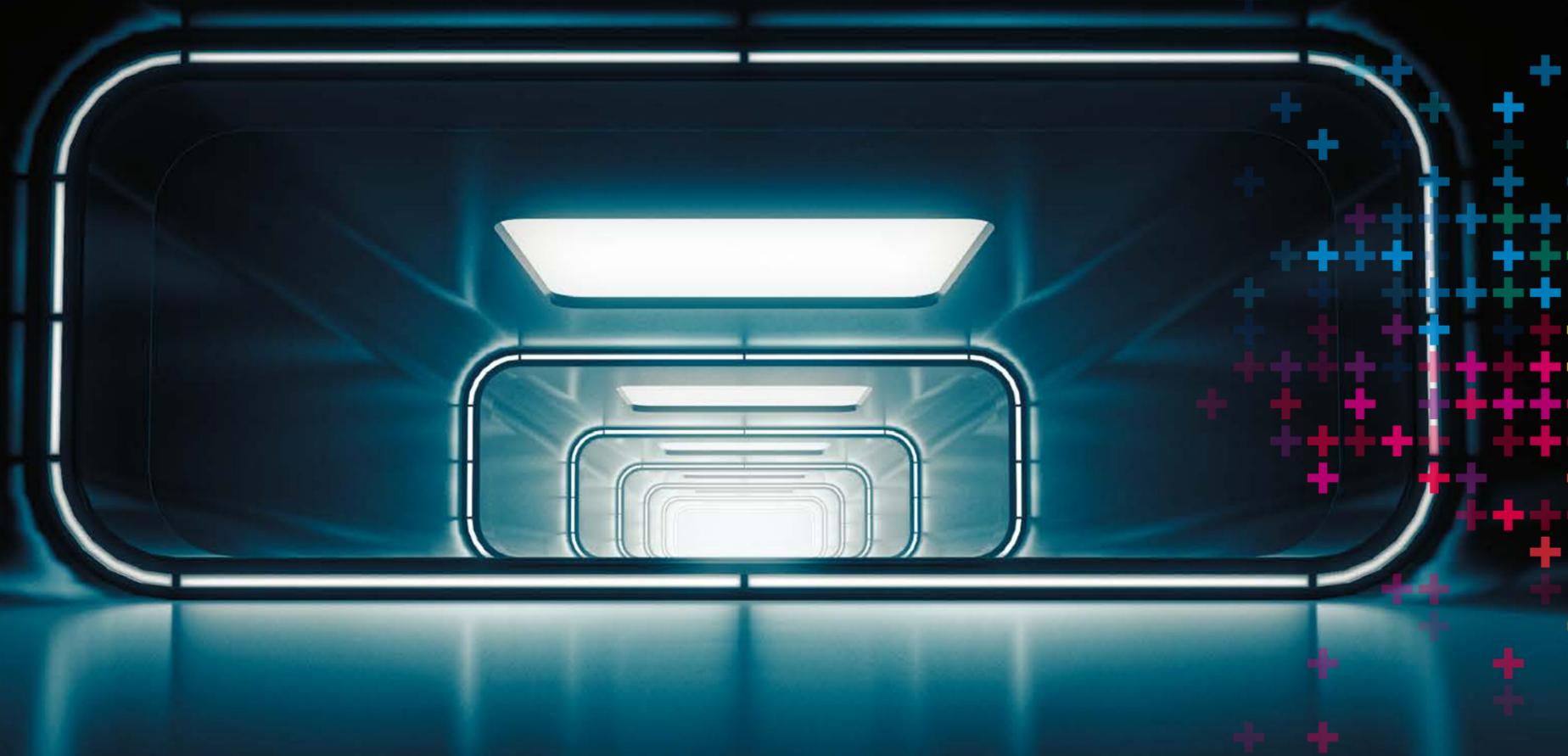
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Envision Your Future



GF Machining Solutions has continuously been driven by the passion to innovate and shape the future of global manufacturing. As pioneers in electrical discharge machining (EDM), high-speed Milling, five-axis machining and Tooling, we have set the highest standards for precision, efficiency and quality around the world. We inspire you by offering a broad range of complete machining solutions as well as a comprehensive portfolio of cross-technologies and intelligent ecosystems (Industry 4.0) designed to take your manufacturing process to the next level.

AgieCharmilles
Microlution
Mikron Mill
Liechti
Step-Tec
System 3R
