

SHAPE IT

A MAGAZINE FROM OSG | 2017 VOL. 2

Metal REMOVAL: There's a Robot for That

A Better, Safer and More Mobile Manufacturing

TECHNOLOGY

The New Standard
for Milling

CHINA

Shifting Gear
to Electric

GERMANY

Short Cut to
Productivity

SOUTHEAST ASIA

Bring Your Worn
Tools Back to Life

Tomorrow's Manufacturing

A Message from the President

As we enter into the second half of 2017, it is apparent that our world has become increasingly connected, compact and energy conscious. Industry 4.0 is beginning to take more firmly in place with concepts such as cloud computing and the Internet of things. A highly automated smart factory is no longer a notion of the future. The recent announcement of a potential 5G network capable of delivering extraordinary data speeds and connectivity further accelerates the next industrial revolution in manufacturing.

Today, software technology has evolved into a major component of manufacturing. In fact, it is beginning to dictate the direction of mechanical parts. The "connected car" in which automakers are able to monitor the status or parts and notify owners when repair is needed has already become a reality. Electric vehicles, which fits perfectly in line with the discussion of connectivity, efficiency and lightweight qualities, is also expected to take off at a greater pace moving into 2020. To continue to thrive, we must stay ahead of change – from providing innovative tooling solutions for lightweight materials with increased fuel efficiency, to adapting to the new trend of battery fueled electric vehicles.

I hope you enjoy reading through our latest edition of SHAPE IT and learning more about OSG's latest innovations and collaborations with machine builders in pursuit of a more efficient, sophisticated, safe and mobile manufacturing environment.



Noriko

Norio Ishikawa
President of OSG Corporation



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Metal REMOVAL:

There's a Robot for That

Intelligent Industrial Robots for Better, Safer and More Mobile Manufacturing

Etsushi Imaizumi, OSG Corporation Engineering Manager

In reference to industrial robotic technology used in manufacturing, automation and transport system may immediately come to mind. Industrial robots are automated, programmable and highly sophisticated. With rapid technological advances, industrial robots today are not only used for transport, pick and place, but can also weld, paint, assemble, pack, palletize, label, conduct inspection, and more.

Industrial robots used in the manufacturing sector are designed to help improve efficiency, safety

and quality of work. Since industrial robots are capable of movement on two or more axes, they can provide greater flexibility in terms of motion range and function in comparison to human personnel. In addition, industrial robots have limited downtime, safety concerns, and less floor space requirement than large computer numerical control (CNC) systems. Moreover, robotic systems can be programmed and reprogrammed to fulfill specific needs that are repeatable, making them a flexible yet reliable manufacturing solution.



INDUSTRY 4.0 and the Evolution of Automation

The manufacturing sector has recently entered a new era known as Industry 4.0, driven by cyber physical systems, the internet of things (IoT) and cloud computing. In Industry 4.0, automation has advanced one step further to not only replace human workers on the assembly lines, but to also provide connectivity to a large amount of data, problem-solving capability and other highly optimized intelligent support. Industrial robotic technology is a part of the driving force behind the evolution of automation and promotes the computerization of manufacturing. With the integration of big data and remote monitoring, manufacturing process can be efficiently evaluated and improved for better work quality and cost savings.



Fanuc's M-10iA is a six-axis multi-joint small payload handling intelligent robot. The small robot weighs 130 kg but provides 10 kg payload with the highest wrist moments and inertia in its class. It is designed to provide optimal solutions for machine tending, material handling, assembly, picking and packing, material removal, testing and sampling, and dispensing.

METAL-REMOVAL Robots

At the center stage of Industry 4.0, more is being expected from robotic systems, and the recent trend has geared toward a new specialty – cutting. Many industrial robots today can perform a wide variety of cutting for material removal applications, such as grinding, finishing and polishing, deburring, waterjet cutting, laser and plasma cutting, ultrasonic cutting, trimming and routing, just to name a few.

HOW IT WORKS Multi-Axis Robots

Multi-axis robots can be adapted for machining processes such as milling and drilling. Just like any type of automation, programming is required to help guide the robot along the area to be machined. To begin, a cutting tool has to be attached to the end of the robot with a high-speed routing spindle. Once the setup has been completed these robots can potentially create more quality parts per hour than CNC systems as they are able to change parts and tools more quickly and easily.

Material-removal robots, however, have their limitations. Rigidity, hardness of material and precision requirements are key factors in metal-cutting applications. Due to the construction of multi-axis robots, which are composed of a series of linked joints, they often lack the rigidity required for tight-tolerance machining. The lack of rigidity limits the amount of force the robot can exert on a part thus, up until recently, material-removal robots have only been able to process soft materials such as plastics.

APPLICATION OF METAL-REMOVAL ROBOTS in Aerospace Manufacturing



OSG's D-DAD is a diamond coated double angle drill designed to excel in composite materials with stable tool life.

In the past decade, great strides have been made in material-removal robotic technology. A number of industrial robot manufacturers have successfully developed sturdy serial-link robots capable of applying the required force for high-accuracy machining for materials such as carbon fiber reinforced polymer (CFRP).

In the past, aluminum alloy and stainless steel have been widely utilized in commercial aircraft applications due to their good casting characteristics. However, unlike aluminum alloy, CFRP does not oxidize. By replacing aluminum alloy with CFRP, parts will become more durable and aircraft fuel consumption can be significantly reduced. CFRP is a corrosion-resistant, stiff, and strong material composed of mixtures of fiber. Machining CFRP often involves a high degree of difficulty because of its multilayer property. Finding consistency is difficult due to the various types of CFRP (ex. cross directional, unidirectional, etc.) in

the market and the requirement of varying tolerances and delaminating issues. CFRP manufacturing requires a high degree of flexibility, and the latest industrial robots are able to fulfill such a requirement. As a result, the usage of metal-removal robots has significantly increased for the automated manufacturing process of wide-body commercial airliners.

In the construction of aircraft many parts are required to be machined by cutting tools in order to connect the various sections and components. To automate the manufacturing process, rails are installed within the aircraft body once the floor beams and frames have been assembled. Industrial robots are then placed on the rails to maneuver back and forth to work on fuselage panels including the sides and the ceiling with their exceptional motion range capability. For maximum efficiency, the robots often work in pairs handling different operations. With improved rigidity, precision and flexibility, industrial robots have become a cost-effective option for aerospace manufacturers to automate production.





COLLABORATION

Between Machine Builder and Cutting Tool Manufacturer

Fanuc Corporation, one of the world's largest manufacturers of industrial robots, is among the few that offer metal-removal robotic solutions that are capable of machining composites. Fanuc's core business domains include the manufacturing and sales of FA products such as CNC systems, industrial robots and small machining centers. It was the first private company to succeed in the development of NC's and servomechanism in Japan. Ever since this success in 1956, Fanuc has consistently pursued automation in factories. In terms of industrial robots, Fanuc offers a comprehensive lineup to cover a wide spectrum of operations such as loading and unloading of machine parts, welding, palletizing, painting, assembling, deburring, etc. Fanuc's industrial robots are equipped with powerful software that enables them to diagnose, to trouble-shoot, and to continue learning to improve productivity. Their products are well-known for reliability and ease of use.

Today, Fanuc has bases in 257 locations in 45 countries throughout the globe to offer solutions to minimize downtime in factories all over the world. This year, Fanuc announced the sales of the FIELD (Fanuc Intelligent Edge Link & Drive) system to further promote unmanned factory using the latest IoT and AI technologies.

At the 2016 Japan International Machine Tool Fair (JIMTOF), Fanuc collaborated with OSG Corporation to display their latest metal-removal robotic technology. A manufacturer called NSK Nakanishi was also instrumental in this collaboration in securing spindles for mounting the robot and the cutting tool. The tool used for cutting the composites was OSG's D-DAD diamond coated double angle drill. This combination has successfully demonstrated cutting results with low cutting resistance, which allowed the Fanuc robot to cut CFRP even with OSG standard cutting tool items with exceptional hole quality.

Rena Matsukawa from Fanuc's robot business division makes adjustments to the M-10iA at the stand of OSG before the opening of the 2016 Japan International Machine Tool Fair (JIMTOF) on November 17, 2016 at the Tokyo Big Sight, Japan.

The collaboration drew great interest from visitors at the exhibition. Many manufacturers have stopped by to ask questions regarding the technology. Despite the benefits metal-removal robots could bring, adaptation in Japan is slow due to the various constraints involved. Implementing new technology often is a challenge especially for small and midsize enterprises. Aside from the upfront equipment cost, job routine has to be altered. The transfer of knowledge must also take place from the old operation to the new process, which can be seen as an investment risk from a management standpoint. In order for small and midsize companies to execute the technology migration, the cost must be clearly justified on the basis of savings over time.



THE FUTURE OF METAL-REMOVAL ROBOTS

To further accelerate and promote Industry 4.0, government involvement may be required in the form of incentives such as rebates. From the standpoint of industrial robot technology, additional evolution is also required. Currently, no industrial robot has yet to be able to consistently and successfully machine aluminum and steels, which are common materials used in manufacturing due to their low cost and high tensile strength properties.

Due to steel's toughness, rigidity must be enhanced in the design of material-

removal robots in order to exert the required force while maintaining precision. Improvements in clamping technology, such as increasing the responsiveness and strength of the clamp, can overcome the nature of the robot's serial-link structure. In addition, software improvement can also help further enhance rigidity and accuracy. With enhanced analytic capability, the industrial robot will be able to evaluate processes to make required adjustment during cutting, such as reducing the cutting distance by moving closer to the workpiece to improve rigidity.

THE ROLE OF CUTTING TOOLS



In addition to the design of industrial robot and programming, cutting tools used for the metal-removal robots must also continue to evolve. Because serial-link robots tend to lack rigidity required for high precision cutting, the cutting tool must be sharp to minimize cutting resistance. Cutting tools play a vital role for high precision metal-removal robots. Sharpness in the cutting edge is required for low cutting resistance. At the same time, too much sharpness can cause the cutting edge to chip easily. The engineering team at OSG is continuously researching and testing new tool geometry that can achieve the ideal balance between sharpness and durability for metal-removal robots. In addition to tool geometry, coating of the cutting tool can also be a determinant in the machining of hard materials. Coating technology such as Nano coating can

help create a thin protector for the tool to prevent chipping without increasing thickness thus without reducing sharpness.

Paired with the right tooling, advanced robotic systems can offer manufacturers the ability to easily manage and optimize machining processes, reducing the need for expensive, large and specialized multi-axis CNC machines. Intelligent mass production is not far from the future. Once technology further matures, robotic systems designed for metal-cutting applications will be able to better support physical workers in their increasingly complex work with flexible solutions, revolutionizing the way of manufacturing. ✖



Shifting Gear to Electric

Growth of electric vehicles accelerates trend of smaller, more lightweight and efficient auto parts

Chunhui Xu, OSG Shanghai



Interest for electric vehicles (EVs) has surged significantly in the past couple of decades. In addition to lower long-term costs and the reduction of ecological footprint, many car buyers are drawn to the latest cutting-edge technology of EVs, which have greatly contributed to their rising popularity. With increasing market demand, a new wave of electric cars is expected to be released from major automakers around the globe. The promotion of EVs, however, is nothing short of challenge. Battery life, repair and replacement costs of EVs



are enough to put off many potential buyers. Moreover, the resale value of EVs, hybrids, plug-in hybrids are significantly less than traditional automobiles on the market, which also heavily influences a buyer's choice. Last but not least, charging stations are few in number in comparison to gas stations, making EVs an unrealistic choice for many. In order to aggressively promote cleaner and more energy efficiency transportation, government incentives are essential.



ENERGY VEHICLES in China

In China, the world's largest automotive market, the government is mandating more new energy vehicles to help reduce the severity of air pollution.

Battery electric cars, plug-in hybrids and fuel-cell cars all fall within the category of new energy vehicles. China is one of the world's top sellers of environment-friendly vehicles since 2015.

According to government plans, China aims to have at least one in every five cars sold in the country to be a new energy vehicle by 2025. To reach its target, Chinese policymakers are requiring automakers' sales of battery electric or plug-in hybrid to constitute approximately 8 percent of their total sales in the country by 2018, and plans to gradually increase the ratio

as time goes by. Furthermore, in order to accelerate growth in the sector, the Chinese government will continue to encourage research and development,

and invest in necessary infrastructures, such as charging stations and charging piles.

Energy Efficient Scroll Compressor

China's increasing demand for new

energy vehicles has become one of the driving forces behind the development of greater efficiency auto parts. The scroll compressor is among one of the components. A scroll compressor is a device used for compressing air. It is commonly used as an automobile supercharger and as a vacuum pump. The latest models of scroll compressors

are designed with lighter weight and fast speed capability to reduce engine load for maximum efficiency. They are also engineered to operate smoothly to reduce noise and vibration. Made primarily of aluminum, a scroll compressor is composed of an orbiting scroll and fixed scroll, which serve as a compression unit. Each of the scroll has end plates and wrapped scroll blades, and a unit that drives the orbiting scroll through the crankshaft. The orbiting scroll and fixed scroll are key components for the process of gas compression. In order for them to interact harmoniously, very tight tolerances are required, where the depth of tooth, the wall thickness and tooth type vortex line should be identical in size.

“China aims to have at least one in every five cars sold in the country to be a new energy vehicle by 2025.”

ACHIEVING STABILITY and Superior Surface Finish with Custom Tooling

OSG was recently approached by a manufacturer of orbiting scroll in China (whose name cannot be disclosed due to confidentiality reasons). The material of the workpiece is aluminum alloy (DL4032). The customer was seeking cutting tool solutions to further improve the stability of the machining process as well as the surface finish of their orbital scroll and fixed scroll. The workpiece has a height of 12.9 mm and a thickness of 3 mm. High accuracy is required for the part, with a permissible tolerance of ± 0.01 , depth parallelism of 0.02, perpendicularity of 0.02, roughness within Ra 0.8, and R-angle of 5.25 mm. The customer was using a Japanese brand machining center and a high-precision thermal expansion shank (HSKA50) for the processing.

The customer had requested a 6-flute, 10 mm dia. end mill, and asked the OSG engineering team to customize the rest of the tool specifications. Based on past experience, the diameter of the finishing machine tool accounts for approximately 70 percent of the minimum of R-angle. After a careful evaluation of the application, OSG proposed a custom tool with a cutting length of 15 mm, overall length of 70 mm, clamp length of 42 mm, and with coolant holes for internal coolant capability.

The parameter of the cutting condition was set at a cutting speed of 250 m/min, a feed per tooth of 0.0125 mm, an axial depth of cut of

0.05 mm, and a radial depth of cut of 0.05 mm. Using 10 percent coolant, with the customized end mill's coolant holes, the cooling effect was evident. Tested repeatedly, the custom end mill was able to demonstrate consistent performance and a superior surface finish between Ra 0.5 and Ra 0.6 that surpassed the customer's expectation and required tolerances.

The automotive industry has been evolving rapidly in recent years through new discovery of materials, technologies, and the rising concern to conserve energy. To accommodate more complex machining, custom tooling can offer an additional solution to manufacturers seeking maximum result. OSG will continue to use its experience, technical expertise and creativity to help manufacturers develop compact, lightweight and highly efficient products to contribute to the growth of energy vehicles and a more environmentally friendly transportation system. ✦

TAILORED APPLICATION SOLUTIONS

From OSG

OSG not only supplies powerful standard cutting tools for manufacturing, but also provides tailored application solutions to help clients facilitate better processing with higher efficiency and longer durability based on their specific needs. For many years, OSG has offered its cutting tool expertise and application solutions for scroll compressor manufacturers.



From left to right: OSG custom tools HSK solid PCD cutter and PCD reamer.



The New Standard for Milling

Next Generation AE-VMS Anti-Vibration Carbide End Mill

Ikuo Takikawa, OSG Corporation Applications Engineer (End Mill Development Division)

The AE-VMS anti-vibration carbide end mill is the latest addition to OSG's milling tool lineup. It is a next generation end mill series designed to attain an all new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications.

In the past, OSG has developed end mills based on specific application needs. As machining requirements evolved over time, the need for versatile milling solutions has become increasingly vital. As a result, the AE-VMS development project was introduced to create a new standard for milling solutions.

Enhancing processing efficiency was one of the key objectives of the AE-VMS development project, which could lead to various cost savings due to machining time reduction. An additional focus was to ensure high quality surface finish.

OSG has accumulated a tremendous amount of data over the years and has analyzed in detail the performance of existing products versus other competing products in the market. This data and customer feedback are the fuels to innovation such as the AE-VMS series.



INNOVATION

from Trial & Error

The hardest part of the development process was to add originality to the product. There were already a wide variety of high efficiency end mills in the market. It was a great challenge to create unique characteristics that can differentiate the new end mill from competing products. Consequently, the concept of the AE-VMS focused on the problem of burrs generated during metal processing. Because many conventional end mills have this problem, OSG's development team spent many hours seeking a new method to eliminate burrs.

Addressing a new challenge means a succession of failures. OSG's product development team looked for the cause of the existing problem, developed countermeasures, and solved them in a step-by-step manner. To patiently repeat this process is the work of product engineers. To succeed, each and every challenge has to be addressed honestly and earnestly.



The AE-VMS is the latest addition to OSG's milling tool lineup, designed to attain an all new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications.



Ikuo Takikawa, OSG Corporation Applications Engineer from the end mill development division, is in charge of the development of the AE-VMS anti-vibration carbide end mill.

REDUCTION OF Cutting Vibration & Burrs

As illustrated in figure 1, the AE-VMS' sharp positive rake angle geometry significantly reduces cutting force to minimize tool wear and potential damage to the workpiece even under aggressive cutting conditions. Cutting vibration is minimized with the AE-VMS' unequal spacing of teeth and variable-lead geometry (figure 2). Furthermore, its unique flute form helps facilitate trouble-free chip evacuation to enable stable and consistent performance. As depicted in figure 3, the AE-VMS is able to achieve stable performance even when the overhang length is $L/D=4$. With the AE-VMS' high tool rigidity, the occurrence of burrs can be suppressed to ensure high milling accuracy.

With the addition of OSG's original DUARISE coating, tool life can be enhanced by its excellent lubricity, superior friction-resistance and high oxidation temperature qualities. As illustrated in figure 4, the AE-VMS is able to consistently suppress cutting heat generation, resulting in stable surface roughness, less tool wear and longer tool life versus other competitor tools. Moreover, the DUARISE coating's multi-layer construction minimizes thermal cracks, allowing the AE-VMS to excel even in water-soluble oil.

The AE-VMS is designed to accommodate a wide range of milling operations including slotting, side milling, helical milling, contour milling and ramping in stainless steel, cast iron, carbon steel, alloy steel and hardened steel (up to 40 HRC). The cutting trial in figure 5 highlights the AE-VMS' capability to achieve superior surface finish with no vibration and minimal burrs even in stainless steel. Tested repeatedly to guarantee consistent performance and quality even in difficult-to-machine materials, the AE-VMS is the new standard for milling. ✖

Figure 1 10% Lower Cutting Force Versus the Competitors

Low cutting force is achieved with the AE-VMS' sharp positive rake angle geometry.

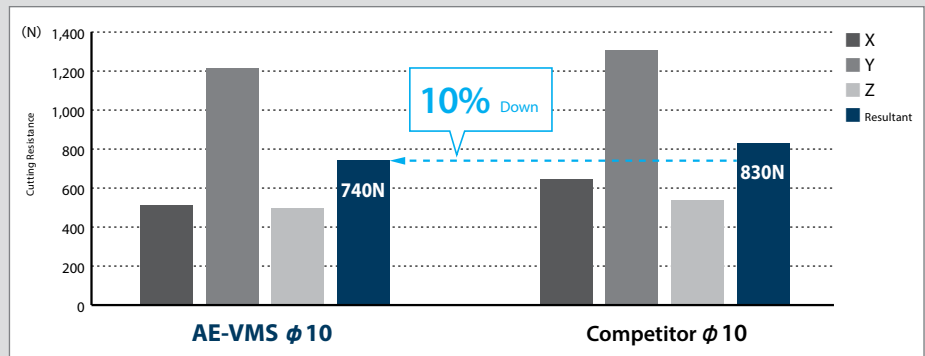


Figure 2 Unique Geometry for High Efficiency Milling

Unequal spacing of teeth and variable-lead geometry enables stable and high efficiency milling.

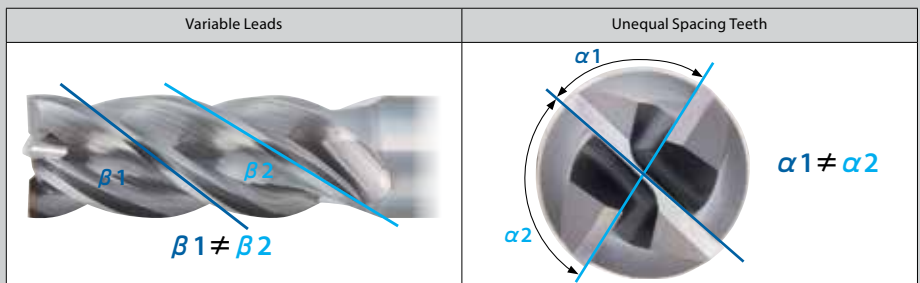


Figure 3 Stable Performance with an Overhang of $L/D=4$

The AE-VMS' unique flute form with high rigidity and excellent chip evacuation properties enables stable milling and the suppression of burrs.

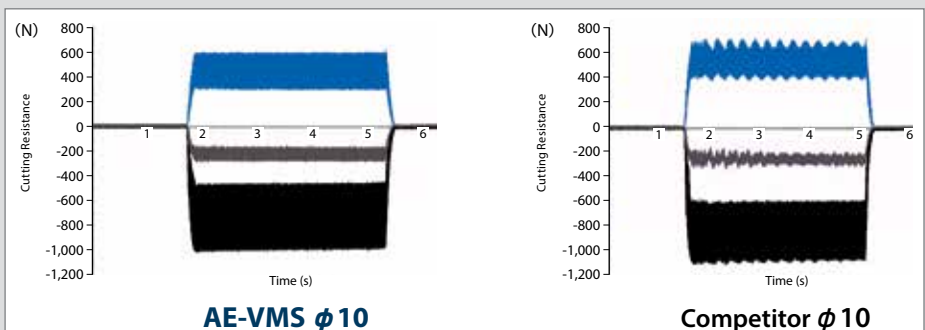




Figure 4

SUPPRESSED HEAT GENERATION

The AE-VMS is able to consistently suppress cutting heat generation, resulting in stable surface roughness, less tool wear and longer tool life.

Tool	AE-VMS Ø6
Work Material	SCM440
Cutting Speed	140m/min (7,500min ⁻¹)
Feed Rate	1,800mm/min (0.06mm/t)
Depth of Cut	ap=9mm • ae=1.2mm
Coolant	Air Blow
Machine	Vertical Machining Center

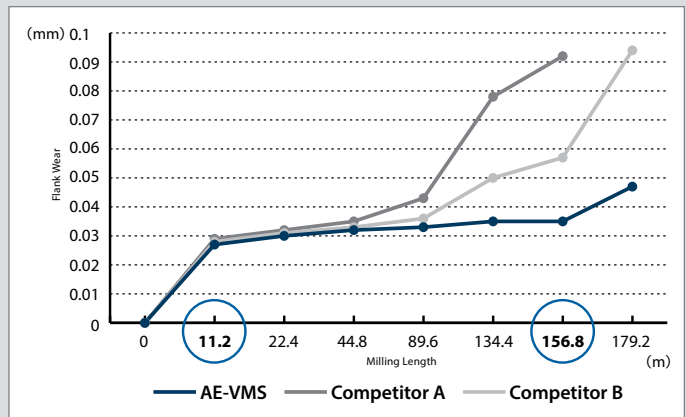


Figure 5

SUPERIOR SURFACE FINISH

In this cutting trial, the AE-VMS was able to demonstrate a superior surface finish with no vibration and minimal burrs.

Tool	AE-VMS Ø10	Competitor Ø6
Work Material	SUS316	
Cutting Speed	69m/min (2,200min ⁻¹)	
Feed Rate	350mm/min (0.04mm/t)	
Depth of Cut	ap=10mm	ap=5mm
Coolant	Water-Soluble	
Machine	Vertical Machining Center	
M.R.R.	35cm³/min	17.5cm³/min





Molds in 58 HRC made of a thermoset. By employing the PHX-LN-DBT long neck bull nose end mill, IKO Isidor Kurz Tool and Mold Making was able to complete the project in their graphite machining center in accordance to the desired quality and time requirement.

Short Cut to Productivity

3-Flute EXOPRO® PHX Bull Nose End Mill Eliminates Polishing Process with Enhanced Surface Quality

Magnus Hoyer, OSG Germany

It is a no-brainer that by employing the latest and greatest machinery, quality and efficiency can be easily achieved. However, not all businesses can afford the investment, or may be limited by the number of machines they can invest in due to various constraints. When IKO Isidor Kurz Werkzeug- und Formenbau (Tool and Mold Making) was left with a graphite machining center to fulfill a mold order involving work material in 58 HRC that would last for several years, they turned to OSG's PHX-LN-DBT for process improvement that would enable them to achieve the same result as other high performance machining centers.



The EXOPRO® PHX-LN-DBT is a long neck bull nose end mill series designed to significantly reduce machining time required for roughing while improving surface quality.

IKO Isidor Kurz Tool and Mold Making GmbH & Co. KG is a part of the Kurz Group, which was founded in 1946 by Isidor Kurz. Located in the Owingen district of Haigerloch, Germany, the company is a supplier and manufacturer of customized components and assemblies for the automotive, electronic, medical and consumer goods industries. In addition to the tool and mold making division, the Kurz Group also owns Kurz Kunststoffe GmbH and Kurz Plast Kft., which specialize in the production of sophisticated plastics components. Its tool and mold making

division currently employs just over 20 employees. Although small in number, IKO Isidor Kurz Tool and Mold Making takes pride in its products and maintains high quality standards. The company continuously invests in new technology and is always in sync with the manufacturing industry's changing requirements.

IKO Isidor Kurz Tool and Mold Making gained confidence in OSG's milling tools through attending one of its workshops on the WXS end mill series for nonferrous materials, mild steels

and hardened steels up to 50 HRC. The workshop drew interest of the management team at IKO Isidor Kurz Tool and Mold Making because OSG was able to successfully demonstrate the machining of hardened components on a graphite machining center.

Although graphite machining centers can offer great balance in terms of speed, accuracy and flexibility, its performance is inferior to 5-axis machining centers, especially for the work of deep cavity molds or tall core molds. To compensate, graphite machining centers often have to slow down feed rates to minimize chatter and prevent tool breakage. Achieving the desired quality of surface finish in hardened materials can also present a great challenge.

OSG's WXS end mills had helped IKO Isidor Kurz Tool and Mold Making increase tool life by a factor of four previously. With this tremendous success, IKO Isidor Kurz Tool and Mold Making decided to consult with their tool distributor and OSG regarding their latest project involving the machining of molds in 58 HRC made of a thermoset in which the component must be deformed by force. Due to the nature of the material the mold has to be polished in a very time consuming and costly manner after finishing. At the time, the polishing process required four weeks at an estimate of €3,000 per component. And thus, Klaus Winter, sales representative at the Erich Klingseisen KG, tooling distributor in Aldingen, was confronted with the request to eliminate this expense.

"More specifically, the objective was to reach an Ra value at the surface that reduces the polishing work of the entire contour," said Winter. "The request is understandable because it concerns a total of six molds and approximately €18,000."

After a careful evaluation of the application, the sales and engineering department at OSG proposed the PHX-LN-DBT 3-flute long neck bull nose

end mill. The PHX-LN-DBT is a long neck bull nose end mill series designed to significantly reduce machine time required for roughing while improving surface quality. Its highly rigid 0.75D short length of cut geometry enables low resistance machining. Without a back taper, the PHX-LN-DBT's peripheral cutting edge is able to achieve flat milling to improve accuracy in vertical wall milling. Moreover, the PHX-LN-DBT's strong helix angle ensures that the tool exhibits very low radial deviation to accommodate tight tolerance requirement. Depending on machining environment, the PHX-LN-DBT can completely eliminate the process of semi-roughing and semi-finishing, helping manufacturers drastically improve their bottom line.

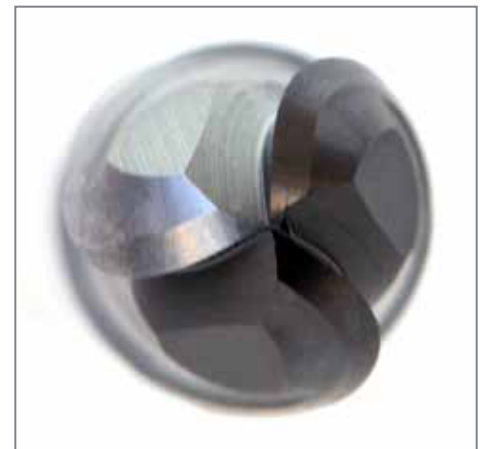
IKO Isidor Kurz Tool and Mold Making started off on the mold using a 2-flute cutter for the roughing process. A 2 mm diameter PHX-LN-DBT was then used to produce the mirror surface. The operation finished in a total run time of 22 hours, including six hours for finishing. The PHX-LN-DBT was used for a total of 18 hours, well above average for similar end mills.

"The tool was changed after 18 hours only for safety reasons because it could have lasted longer," said IKO Isidor Kurz Tool and Mold Making Operations Manager Gerd Kleinmann. "We reached Rz 1.3 μm or Ra 0.16 μm and have thus achieved our goal. Thanks to the PHX-LN-DBT's third cutting edge, we also achieved measurable time savings."

A 3-flute end mill with a diameter smaller than 1 mm is hardly available in the market. Thanks to its unique 3-flute geometry, the PHX-LN-DBT can serve as a finishing tool. The cutter not only offers increased surface quality and process reliability, it can also achieve the same cutting speeds or feeds per tooth while the feed rate can be increased by 30 percent when compared with a 2-flute tool.

Traditionally, machining the 58 HRC mold part on a graphite machine center

is anything but optimal. It was inevitable due to IKO Isidor Kurz Tool and Mold Making's circumstance. However, with a change of cutting tool, the burden of the operation was relieved. Contrary to general assertions that very good results can only be achieved with an optimal machining center, the PHX-LN-DBT demonstrates that certain weaknesses can be compensated easily and quickly. ✖



Thanks to its unique 3-flute geometry, the EXPRO® PHX-LN-DBT can serve as a finishing tool. Further, the PHX-LN-DBT's strong helix angle ensures that the tool exhibits very low radial deviation to accommodate tight tolerance requirement.





CUT ABOVE

A New Level of Productivity with PRC

Donna Gialo, OSG USA



From left, Micro Technology's Shop Foreman Ted Pierce, General Manager Charlie Wright, Jr., and Lead CNC Operator John Hargrove.

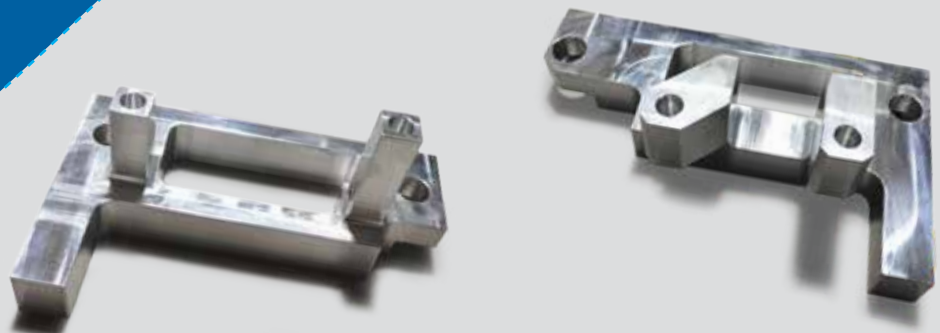
The U.S. auto sales rose for the seventh consecutive year in 2016. Autodata Corp. reported an auto sales of 17.55 million in 2016, 0.4 percent higher than 2015. Low gas prices, rising employment and low interest rates have contributed to consumer confidence in the past year, according to Reuters. The appetite for new technology – such as backup cameras and automatic emergency braking systems, have

also promoted greater demand for new vehicles. In order to keep up with the increasing needs, U.S. auto manufactures have been strict about meeting consumers' time constraints. Efficiency and productivity have become more essential than ever before for both auto manufacturers and auto parts manufacturers.

Micro Technology is an auto part manufacturer located in Tullahoma, Tennessee. After years of experience as a machinist, the owner, Charlie Wright Sr. started the company in 1987 with just three mills, three lathes, one radial arm drill and one band saw. Thirty years later, his son, Charlie Wright Jr., will inherit the company to continue to provide precision machining and fabrication services to the manufacturing industry.

Micro Technology's core service includes the manufacturing of parts that are used to mount to automotive engine blocks to be robotically transported through assembly lines. They produce various models and quantities annually. These parts are 2-part sets that are machined and then assembled, which require additional time before they can be shipped to the customers. While the soon to be owner, Wright Jr., focuses on quality and accuracy of his products, he also strives for improved efficiency and productivity. He was in search for ways to reduce machining time to meet strict time constraints of his customers, so he reached out to

Micro Technology manufactures various models of aluminum parts used to mount to automotive engine blocks to be robotically transported through assembly lines.



his tooling agents DGI Supply and OSG's district manager, Philip Woody.

Micro Technology uses a HAAS VF-3 vertical machining center with a CAT 40 taper tool holder. The part being machined is 6061 aluminum alloy and the tolerance requirement is +/- 0.002" to achieve the precise geometry and finish the company needs. Wright Jr. used to machine the parts with a competitor face mill that ran at 3,000 rpm, 120 ipm with 1.25" axial and 1.2" radial depth of cut. He wanted to improve productivity without sacrificing quality and accuracy. Upon a careful evaluation of the application, Woody recommended OSG's Phoenix PRC indexable radius cutter (EDP #7800404) with 12mm diameter aluminum grade inserts (EDP# 7811013).

OSG's Phoenix PRC radius cutter is a highly versatile series of button insert end mills and face mills for contour milling applications. The PRC features an insert rotation notch where the number of cutting edges per insert (4 or 8 edges) can be selected by changing the depth of cut. Chip ejection is improved with wide chip pocket geometry. Its large body relief further supports 3-dimensional machining.

The PRC ran at 5,780 rpm and 345 ipm, surpassing speeds and feeds of the competitor tool. Micro Technology was able to reduce the machining time by approximately 25 minutes per part, achieving a 50-minute reduction per set. In addition to the machining time, the company was able to improve the surface finish with OSG's PRC.

"This tool (the PRC) was extremely instrumental in achieving our required tolerances and meeting delivery deadlines of my customers," said Wright Jr.

Wright Jr. is excited for his new journey as an owner with reliable tooling to support his needs to reach even greater heights. ✨



OSG's Phoenix PRC radius cutter was employed to help Micro Technology improve machining efficiency and surface quality on the various models of aluminum parts that they manufacture.





NO CHIP BIRD NESTING

EXOPRO® XPF Form Tap Eliminates Operation Disruption & Safety Risk

Valdir Lima, OSG Sulamericana

When you think of high hazard industries, where people can easily be injured or killed in their work environment – what comes to mind first? According to the Bureau of Labor Statistics (BLS), construction, mining, transportation and manufacturing rank top in the list. The manufacturing industry in particular, often involves the handling of complex machinery, large and heavy parts, sharp blades, and the moving of components at high speeds, all of which contribute to the high risk of work injuries. According to the BLS, approximately 40 percent of workplace injuries in manufacturing

are associated with the contact of objects and is the number one cause of injuries. Overexertion ranks second and constitutes 24 percent of the total work injuries based on a 2011 survey with 114,327 cases of incidents.

At Valtra Inc., in addition to providing value-added services and solutions, the health and safety of its employees and customers are a top priority. Valtra, a worldwide brand of AGCO Corporation, is a leading manufacturer and service provider of agricultural tractors. Valtra tractors are sold in over 75 countries and are known for their reliability,

versatility, durability and Nordic roots. Valtra tractors are designed to withstand the harshest climates and deliver high performance even in the toughest working conditions.

Valtra manufactures 24,000 individually tailored tractors each year and employs approximately 2,100 employees worldwide. Valtra enjoys a growing reputation in South America and is serving the region from its Mogi das Cruzes, São Paulo state-of-the-art facility with approximate 140,832 square meters of production floor and 930 employees.

From left, OSG Sales Technician Valdir Lima, Valtra Applications Engineer Jeferson Barreto and Valtra Manufacturing Manager Eduardo Bezerra. Valtra is a manufacturer of tractors and agricultural machinery. It is a worldwide brand of AGCO Corporation.



In the production of fuel tanks in SAE 1020 steel, where holes are required to be threaded, Valtra was encountering tap breakage due to the formation of bird nesting, in which cut chips ejected during operation would wrap around the workpiece, quickly disrupting the tool path. These fuel tanks are made for tractors of small, medium and large sizes. Valtra has been producing these parts for more than 20 years. There are 35 blind holes at a depth of 34mm per workpiece with a tolerance requirement of 6HX.

Valtra was using a HSSE M16 DIN 376 TiCN coated spiral fluted tap with a 45-degree helix to thread the part with welding points near the threads. When the problem arises, the machine would have to be stopped, which delays production time and is costly to the company. Moreover, the material of the workpiece is malleable and the formation of the spiral chip was causing a safety risk to its employees as the problem requires manual removal of the tool and cut chips. When other tool management providers failed to improve the situation, Valtra's applications engineer Jeferson Barreto contacted OSG.

Instead of using a spiral fluted tap, OSG proposed the HSS-Co M16 DIN 376 S-XPF forming tap with V coating. Initially, Valtra was hesitant because all the competitors have already tried forming taps with no success. However, the XPF won confidence by demonstrating its ability to perfectly thread external hardened weld points and hardened materials. The XPF is uniquely engineered with a low-torque design to facilitate longer life at faster speeds. Its V coating also enables extreme wear resistance. Engineered to generate up to 50 percent less torque versus other forming taps, the XPF is capable of tapping materials up to 35 HRC and sizes up to M45 in diameter.

During the trial, both the competitor tap and the XPF were set at a cutting speed of 20m/min, 398 rpm, at a feed of 796 mm/min. Success was measured by tool



From left, OSG Sales Technician Valdir Lima and Valtra Applications Engineer Jeferson Barreto inspect the condition of the XPF forming tap used for threading fuel tanks in SAE 1020 steel.

wear and stability. The XPF completed 10 tanks in the first day of production, without wear marks or high torque problems. The test continued for about a year, with weekly follow-up procedures observing all aspects including torque, quality and tool life that were approved by Valtra's quality control division. The XPF finished the tests with the M16 and M12 sizes range with tool life surpassing the competitor record of 50 tanks to 350 tanks, which is seven times the tool life. The competitor tool also had to be removed frequently for chip removal; while the XPF maintained excellent thread quality throughout. In addition to the significant gain in tool life, the headache of tool breakage and bird nesting were completely eliminated.

"The technical support offered by OSG helped us discover a new effective solution in our process," said Valtra Applications Engineer Jeferson Barreto. "In addition to the cost benefit, the safety of our employees is a priority for AGCO, and this partnership has allowed us to improve and guarantee a more profitable and safe process." ✨



Top: Prior to the EXOPRO® XPF forming tap, Valtra was using a cut tap to thread their fuel tanks in SAE 1020 steel and was troubled by bird nesting problems.

Middle: After implementing the XPF forming tap Valtra was able to improve productivity as well as employee safety.

Bottom: The fuel tanks of Valtra's tractors require the threading of 35 blind holes per part at a depth of 34 mm in SAE 1020 steel.

Bring Your Worn Tools Back to Life

Precision Tool Reconditioning Services
in Southeast Asia

Victor Wong, OSG Asia



The primary benefit of tool reconditioning is obvious:
reduction in overall tooling costs.



Although many shops regrind their own drills, few shops have given thought to regrinding high performance drills and end mills, even though substantial cost savings can be obtained. These efforts not only save customers thousands of dollars each year, but are also environmentally friendly and sustainable.

As one of the world leaders in metalworking cutting tools, OSG has the unique ability to rejuvenate used tools to like-new condition. The OSG Reconditioning Division in Southeast Asia has the capability to regrind and recoat carbide drills, end mills, HSS drills, reamers and taps. We can also apply modifications and create custom tooling on request.

Reconditioning Solutions for Other Manufacturers' Tooling
Utilizing know-how cultivated over the years, OSG can restore other manufacturers' tooling to print. To begin, contact your nearest OSG sales representative to set up an evaluation appointment. OSG's representative will evaluate each of your applications before sending the tools off for reconditioning. ✖



OSG Tool Reconditioning & Coating Service Centers in Southeast Asia

OSG currently has four tool reconditioning facilities in southeast Asia, two of which offer coating services.

Vietnam

3/F, 561 Kim Ma Street,
Ba Dinh District Hanoi, Vietnam

Tel: (84) 4-37672857

Fax: (84) 4-3762856

Regrind Services: drills, end mills, reamers and PCD tools

Coating Services: FX, TiN, AlCrn

Malaysia

S-11-07 Level 11 First Subang, Jalan SS15/4G,
Subang Jaya, 47500, Malaysia

Tel: (60) 3-5611-7415

Fax: (60) 3-5611-7496

Regrind Services: standard and special forming tools

Indonesia

Ruko Podium, Blok A23 & A25, Jl.Mataram, Lippo Cikarang,
Bekasi, Jawa Barat 17550, Indonesia

Tel: (62) 21-2940-6625

Fax: (62) 21-2940-6420

Regrind Services: drills, end mills, reamers and taps

Coating Services: WXL, WDL

Thailand

128 Moo 9, Wellgrow Industrial Estate, Bangna-trad Road,
Tambol Bangwua, Amphur, Bangpakong, Chachoengsao,
24180, Thailand

Tel: (66) 38-989-035

Fax: (66) 38-989-154

Regrind Services: drills, end mills and dies

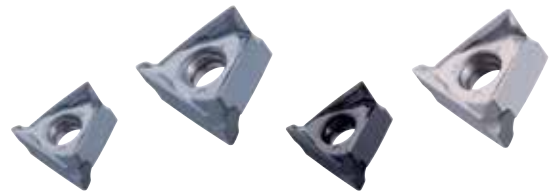
For a full listing of OSG tool reconditioning facilities worldwide, please visit www.osg.co.jp/en.

OSG PHOENIX® PSTW

6-Corner Shoulder Cutter Series

The OSG Phoenix PSTW is a 6-corner shoulder cutter series designed for high efficiency heavy milling. The cutter features a high rigidity and positive rake angle geometry with strong chattering resistance to enable effective processing of long overhang length applications. The PSTW employs six double-sided 6-corner (90°) inserts with a maximum 12mm depth of cut and chip pocket uniquely designed for heavy machining. The insert's economical 3-corner per side specification and flat cutting edge geometry allow this series to achieve excellent surface finish and maximum efficiency.

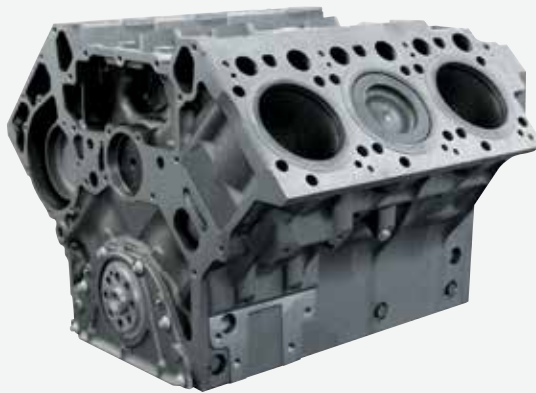
Four application-based inserts are available to accommodate a variety of machining needs, such as low-resistance machining, general steel milling, intermitted machining, cast iron machining and the machining of super-alloy and other difficult-to-machine materials. ✖



EXOTAP® A-Tap® (Carbide)

High Performance Carbide Tap Series for Cast Iron and Aluminum Alloy

Developed in line with the core concept of the A-Tap series with superior chip evacuation capability, the carbide edition of the A-Tap is designed to excel in cast iron and aluminum alloy threading applications. This series' oil hole specification is enlarged to enable 1.3 times the coolant flow versus other conventional products for improved chip evacuation in high-speed processing. The carbide A-Tap is made of ultra-fine grain carbide with high rigidity to prevent tool breakage and is applied with the FX coating to increase wear resistance. This series is available in spiral flute and straight flute with internal coolant capability. ✖



EXOPRO® AERO-DAD

High-Helix, Double-Angle Drill for Composite Materials

The AERO-DAD is a diamond-coated, high-helix, double-angle drill. The combination of sharpness, low-resistance design and outstanding diamond coating technology offers excellent exit hole quality and stable tool life in CFRP drilling applications. OSG's ultra-fine diamond coating has a maximum diamond grain size diameter of 2µm. This strictly controlled diameter allows the coating to be super smooth and extremely sharp, which is ideal for preventing delamination in CFRP. ✖



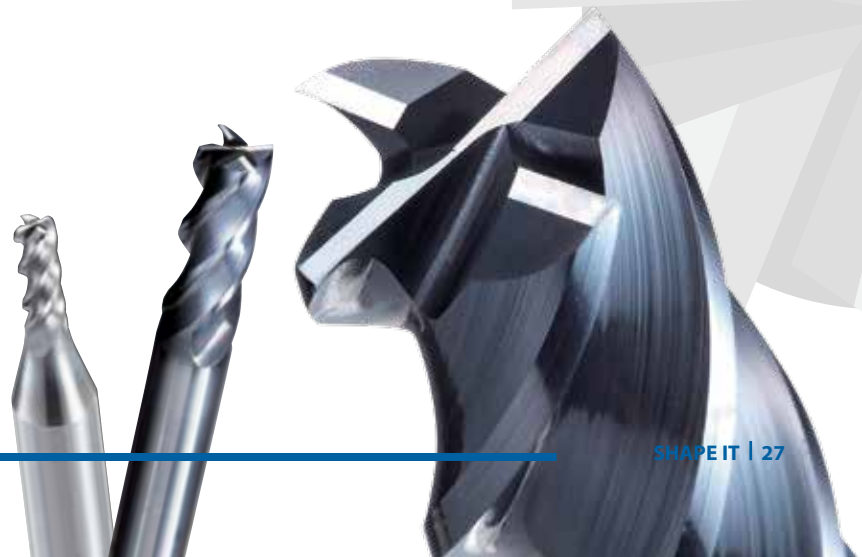
AE-VMS

Next Generation Anti-Vibration Carbide End Mill

The AE-VMS is one of OSG's latest innovations designed to attain an all new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications, including slotting, side milling, helical milling, contour milling and ramping in stainless steel, cast iron, carbon steel, alloy steel and hardened steel (up to 40 HRC).

The AE-VMS' sharp positive rake angle geometry significantly reduces cutting force to minimize tool wear and potential damage to the workpiece even under aggressive cutting conditions. Cutting vibration is minimized with the AE-VMS' unequal spacing of teeth and variable-lead geometry. Furthermore, its unique flute form helps facilitate trouble-free chip evacuation to enable stable and consistent performance. With

the addition of OSG's original DUARISE coating, tool life can be enhanced by its excellent lubricity, superior friction-resistance and high oxidation temperature qualities. The AE-VMS is available in both square and radius styles. ✖





Top: From left, OSG Managing Director Bobby Osawa and Somta Tools Managing Director Allan Conolly prepare for the ribbon cutting ceremony.

Left: Somta employees celebrate the new partnership by holding a luncheon and ribbon cutting ceremony.

OSG Invests in Somta Tools in South Africa

Africa's Largest Manufacturer of Round Cutting Tools

Earlier this year OSG acquired a majority stake holding in Somta Tools, Africa's largest manufacturer of round cutting tools. With the new investment, OSG now has a presence on every continent and will be able to directly serve the African market. Somta Tools in return will gain access to OSG's immense technologies and expertise to further improve manufacturing process, technical capabilities and quality of tooling, providing greater values to its customers.

About SOMTA Tools

Established in 1954, Somta Tools is a manufacturer and supplier of drills, reamers, end mills, bore cutters, threading tools, toolbits, custom tools and surface coatings. Its production facility in Pietermaritzburg manufactures 7,000 standard items and 3,000 made-to-order items to serve local markets and export to markets in over 70 countries worldwide. Somta Tools currently employs over 400 employees operating from offices and manufacturing facilities laid out over 3 hectares. The company is driven by a culture of service excellence and holds high quality standard supported by an ISO 9002 certification achieved in 1991 and ISO 9001 achieved in 2003 and 2008.



An aerial view of Somta Tools' facility in Pietermaritzburg. Somta Tools currently employs over 400 employees operating from offices and manufacturing facilities laid out over 3 hectares.



SOMTA TOOLS (OSG Group Company)

290-294 Moses Mabhida (Edendale) Road
Pietermaritzburg, KwaZulu-Natal, 3201

Tel: +27 33 355 6600
www.somta.co.za



IN MEMORIAM



Teruhide "Terry" Osawa
1938 - 2016

Academics:

B.S. in Economics from
Waseda University

Career:

- 1961: Joined OSG Grinding Co., Ltd.
- 1968: Opened new subsidiary in USA and became President of OSG Tap & Die, Inc. (OSG USA)
- 1970: Began manufacturing and sales of HSS end mills
- 1977: Became President of OSG MFG. Company (now OSG Corporation)
- 1980: Began manufacturing and sales of carbide end mills
- 1984: Began manufacturing and sales of drills
- 1992: Became President of OSG Corporation
- 2007: Became President and CEO of OSG Corporation

Teruhide "Terry" Osawa made OSG grow into the global company we know today, under the principle of 'Global Presence.' Throughout his tenure at OSG, Terry had been instrumental in the global expansion of the company. Terry established OSG's very first subsidiary in the United States in 1968. Since then, the company has built a production, sales and technical support network spanning 33 countries, creating a global network capable of meeting the needs of customers worldwide.

Many of Terry's policies were innovative and at times unexpected especially in the early days of the cutting tool industry.

Nonetheless, these unique 'Osawa values' have eventually taken root in OSG, became the 'OSG values' and a part of the corporate culture. Terry emphasized greatly on the importance of communication within the workplace. Throughout his career, Terry always interacted with people with a smile, and this became the OSG corporate culture. In inheriting what is left of the company after the loss of our Chairman, we will continue to contribute to the advancement of the manufacturing industry and society through innovative technology and superior quality products. This is what we can give back to him in his memory.

President and CEO of OSG Corporation Teruhide Osawa passed away on September 20, 2016, at the age of 78. A farewell ceremony was held at the OSG Academy in Toyokawa, Aichi, Japan on November 1, 2016. Approximately 2,000 guests attended the ceremony.



OSG Around the World

SHEENA LI

Employee Interview



OSG Corporation was founded in 1938, more than 78 years ago. Today OSG holds the No. 1 position in the Japanese cutting tool market as well as a top-ranking position globally, with a production, sales and technical network spanning 33 countries. Our commitment to innovation, services, total solutions and out-of-the-box thinking has contributed to our immense success today. However, without our employees, none of it would be possible. We truly believe that our employees are one of the greatest assets of the company. In this section, we will introduce our team members from around the world.

Sheena Li

Company Location:

Taiwan

Position:

International Trading
Specialist

Joined OSG:

2011

Motto:

*"Life is too short to waste,
yet too long to compromise."*

Left: Sheena celebrates her birthday at the OSG Taiho sales headquarters in Kaohsiung.

Tell Us About Your Work & Experience at OSG:

I majored in Business Administration at the National Sun Yet-Sen University from 2007 to 2010. After graduation, I taught children English at a language school for a short period of time until joining OSG in March 2011. The cutting tool industry was completely foreign to me in the beginning. However, thanks to the support of my colleagues I have gained a great deal of passion and knowledge in this industry over the years. Work at OSG is now more than just a job, but rather a career with goals to be fulfilled for life.

At OSG Taiho I am in charge of markets in India, the United States, Canada and Russia, taking care of customer inquiries, orders, shipments, and all other relevant

tasks. From time to time I would travel overseas for exhibitions, market development and customer after-sales services. Customer communication is at the heart of the OSG brand. My role at OSG is to be the key link between our customers and our internal departments – to ensure that customer needs are heard and fulfilled.



Sheena and her team from Taiwan meet with colleagues at OSG India to discuss market development.

What is unique about the Taiwan division at OSG?

Our employees are what makes OSG Taiho so unique. We have the most sincere and energetic attitude toward our customers and suppliers; within the company the relationship between supervisors, subordinates and colleagues is always harmonious. Conflicts do arise from time to time, but outside the office we are more like a big family. At OSG Taiho there are many company sponsored events that give us opportunities to bond and to communicate, which helps make us a stronger team.



Above: Sheena makes a stop at the OSG India office. From time to time she would travel overseas for exhibitions, market development and customer after-sales services.

Left: Sheena (center back row) and her colleagues from OSG Taiho pose for a photograph at a shopping center in Kaohsiung.

Left: On her day off Sheena enjoys spending time reading at the local coffee shop.



How do you spend time on your day off?

When I am not working, I enjoy spending some quiet time reading at the local coffee shop, or take up a spontaneous trip with friends. I also enjoy hiking, trying out new restaurants and attending exhibitions and lectures in the area.

What is your favorite OSG tool?

Nut taps are my favorite OSG tools. OSG Taiho specializes in the production of nut taps and we have the largest market share in Taiwan. I also feel that nut taps say a lot about the essence of OSG Taiho. Although nut taps do not require the most advanced manufacturing technique, they are manufactured according to the standard of OSG that guarantees consistent tool life and performance, which is critical for helping our customers reach their manufacturing goals.



OSG high performance nut taps for steels and stainless steels.



shaping your dreams

AE-VMS

The New Standard for Milling

Engineered to attain an all new level of milling efficiency coupled with superb finish quality suitable for a variety of milling applications and materials, including hardened steel up to 40 HRC.



Scan for details.

