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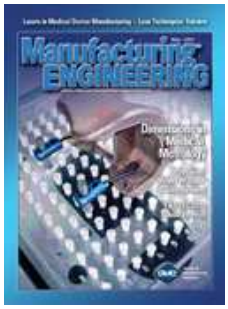

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Shop Solutions

Tooling Supplier Advances Shop's Processes

For small-to-medium job shops, constant process improvement can prove to be an exhausting and time-consuming endeavor. Equipment manufacturers are constantly innovating, and thousands of new products arrive every year, each promising increased productivity and better performance. Increasingly, smaller manufacturers are calling for suppliers to take on a more prominent role in this area. Allied Technologies International Inc. (Tualatin, OR), a manufacturer of high-precision components, has adopted this strategy, and, since its inception, worked closely with tooling manufacturer Sandvik Coromant Co. (Fair Lawn, NJ) to optimize its machining processes.

Founded in 1993, Allied Technologies resulted from the desire of two fab-shop employees, Bob Porter and Tom Jackson, to have greater control over their own success. Messrs. Porter and Jackson established Allied Technologies in a small rented space that contained only 1500 ft^2 (139 m^2), of which 600 ft^2 (56 m^2) was office space. Initially the men envisioned the shop as providing fabrication, machining, and tube-bending operations, but they quickly discovered an aptitude for high-precision machining that would come to define the shop's capabilities.

Today, Allied Technologies serves a variety of customers and industries. The largest segments of its business involve producing components for the hydraulic valve, communications, and aerospace industries. The company takes on jobs ranging in scope from a single prototype to lot sizes up to 25,000 parts.

When the shop purchased its first machine, it decided upon a new Miyano turning center that had previously been equipped with Sandvik Coromant tools. "When we purchased the Miyano, the local Sandvik Coromant rep contacted us to see if he could provide assistance in helping us tool the machine up for our operations," says Porter. "We had him in and were happy with how everything was set up, so it was the start of what would become a long-term partnership."

Over the years, Allied Technologies has contacted the tooling supplier whenever it has run up against a particularly challenging application. In early 2009, such an occasion arose with the production of a small L-shaped component manufactured for a customer in the hydraulic-valve industry.

"We were having a pretty serious issue with tool life," says Eric Porter, floor manager at Allied Technologies and Bob Porter's son. "We had just invested in a Hanwha XD20H Swissstyle turning center and weren't getting the performance we knew the machine could deliver."

Measuring 0.5 x 0.5 x 0.25" (12.7 x 12.7 x 6.35 mm), the L-shaped part was being cut from 303 stainless. Allied Technologies was using a 0.5" (12.7-mm) end mill with a diameter formed by three tangentially-held inserts. Running at 3500 rpm with a feed rate of 15.4 ipm (391 mm/min), the tool was only producing about 400 components before requiring the inserts be changed. Each insert was held by its own individual screw, so it would take approximately 4 min for every change. With the job running in lots of 4000–6000, a significant amount of time had to be set aside for tool changes.

"The part was being produced by cutting a notch out of 0.25 x 0.5" [6.35 x 12.7-mm] bar stock," says Greg Pope, Allied Technologies' local Sandvik Coromant rep. "Looking at the issues they were facing, I felt that the new CoroMill 316 could provide a real benefit in reducing toolchange and cycle times, along with offering increased tool life."

Bob Porter, Bryant Jackson, and Eric Porter all play vital roles in ensuring Allied Technologies maintains its reputation as a high quality provider of precision components.

The CoroMill 316 features an interface between an exchangeable cutting-tool top and shank. This allows the cutting head to be changed without removing the tool shank from the machine or having to undergo another presetting of the cutting edge. As expected, toolchange times dropped immediately, from 4 min to approximately 30 sec.

The four-flute, 0.5" CoroMill 316 achieved higher tool life. On its first run, the tool produced over 3000 parts, and optimization of the cutting data pushed tool life to 4500 parts. To get maximum performance from the tool, spindle speed was reduced to 3000 rpm, while the feed rate was increased to 26.4 ipm (670.6 mm). Depth of cut and working engagement were left at the same levels as with the previous tool.

Allied Technologies has found success by specializing in the production of high-precision components across a variety of industries.

In addition to improving tool life and toolchange times, the CoroMill 316 was able to shrink cutting time for the process from 29.4 to 16.8 sec, a reduction of approximately 42%. Combined with other improvements in efficiency, the switch to the CoroMill 316 eliminated 164 hr of annual production time, resulting in a substantial cost savings.

"Our customers place a lot of value on our ability to integrate new technologies to improve quality, cut costs, and reduce throughput time," says Eric Porter. "Working closely with our suppliers is a key part of our strategy for delivering the best performance to the companies we serve. In a typical year, we might have Sandvik Coromant come in a dozen times to review and help us improve our processes, and their efforts really help us be the best company we can be."

While the economy has been a challenge for nearly all manufacturers during the past year, Allied Technologies has weathered the downturn very well. The company expanded its facility this year, using a

5000 ft^2 (464 m^2) addition to bring its total floor space to 11,000 ft^2 (1022 m^2). By relying on the expertise of its suppliers when possible, Allied Technologies continues to experience substantial success in growing and satisfying its customer base.

For more information from Sandvik Coromant, please visit www.coromant.sandvik.com/us, or phone 201.794.5000.

Air Gaging Ensures Performance

By using air gages from Stotz USA LLC (Freeport, IL) to validate spindle-interface components, Advanced Machine & Engineering (AME; Rockford, IL) is able to maintain quality at the highest levels.

AME is a provider of high-quality machine-tool spindle-interface components. As part of the Goellner Inc. Group, AME enjoys a reputation for manufacturing high-quality power drawbars, spindle shafts, guide bushings, locknuts, hydraulic sleeves, and expansion gibs, among other components. AME components include its own branded products and those of its brother companies, such as OTT Jakob, Spieth and Tschudin & Heid, as well as its "other brother" Hennig, itself a builder of in chip-conveyor and machine-protection systems.

Stotz is well-known for air-gaging technology, products, and quality gaging system integration.

HSK 125 spindle shaft ID taper check. Photo courtesy AME's Bill Edmundson

The Stotz customer base consists of leading manufacturers and suppliers in the machine tool, automotive, aerospace, and medical industries, says company President Chris Koehn.

"Air gaging is the only technology we've found that's accurate enough to check the machine tooling and especially the spindle tapers we produce here," Greg Hobbs, AME service manager, explains.

"In the past, we would use hard gages, and we still use them, but only for certain OD checks. We'd blue up the tapers, insert them, give them a good twist and do our inspections. There was way too much inconsistency. Today, with sophisticated HSK tooling, this method is too hit-or-miss to be reliable. Air gaging provides dead stops on the test stand, and the documentation is unbeatable for validation on the straightness, surface finish, and taper angles. Plus, the Stotz system allows us to upload all the data on every part, so we have our favorite word—documentation—for every part we produce."

Hobbs also notes the user-friendliness of the Stotz air column. When the program is first input into the column for a part in the AME grinding department, for example, the Stotz column essentially becomes a PLC, providing hard data via the Ethernet connections to the host database. In this manner, every parameter of every part is documented and recorded. In a classic example of the law of unintended consequences, this process is not only used on the parts run, it's also used for calibrating the AME machines, in a predictive maintenance function.

At AME, various testing of machined spindle interfaces and other components is performed both at the machines in the grinding department, in a temperature-controlled 72° environment, and in the company's totally envir onment-controlled, in-house testing department. Director of Quality, Brad Patterson, observes that the "sophistication of the Stotz air column is unmatched in the industry. We get all the data required, and we get it in exactly the fashion needed to support our customers. [We get] repeatable results and elimination of error, every time. Plus, the setup is much faster than on our laser mics, which can't be used for ID measurement."

The typical Stotz air column employed by AME is the Model MSG, with four pneumatic channels or ten LVDT channels operating simultaneously. Features include pneumatic length measuring, user specific programming up to 18 programs per column, full statistical analysis, and full data transfer capability within the host network. All information is fed into the AME host computer by serial number, so any job can be quickly retrieved, while historical records on any part produced can be easily called up for evaluation, deviation claims, or to dovetail with a customer's internal quality protocols.

Front row: HSK 40 grind quill; back row: ANSI B 5.50 40 taper balance plug. Photo courtesy AME's Bill Edmundson

Typically, the finished product will rest for 24 hr of soaking, allowing the diameters to normalize, AME's Grinding Supervisor Sam Schubert explains. Though statistically predictable for most metal materials, thermal expansion can cause off-normal readings to occur. For checking certain bearing journals or spindle shafts, snap gages are set to accommodate size measurements down to the 0.000020" (0.00051-mm) range. The acceptable diameter tolerances for most AME products measured are in the 0.0001-0.0002" (0.003-0.005-mm) range.

Among the many products finished in this grinding department are CAT/ISO 40 taper spindles, HSK test arbors, HSK grind quills, and HSK steep-taper milling tools, among others. Often, older and worn spindle shafts are reverse-engineered by AME for retrofits and remanufacturing. Even in these cases, air gaging is used to evaluate the finish process on the ID taper.

Sam Schubert expands on the use of Stotz air gaging at AME: "The documentation we can produce from the air-gaging procedure is like a birth certificate on every unit we make. All our spindle shafts for customers, for example, can be viewed as a series of genetically identical twins to each other and we're providing the documentation of their DNA." As evidence of their commitment to this technology, Schubert notes that AME is now purchasing air-gaging fixtures for all new customer applications.

For more information about Stotz USA LLC, go to www.stotz-usa.com, or phone 815.297.1805; about Advanced Machine & Engineering, go to www.ame.com, or phone 815.962.6076.

Direct Digital Manufacturing Takes Flight

The Trainer Development Flight (TDF) facility, based at Sheppard Air Force Base (Wichita Falls, TX), designs, develops, and manufactures trainers and training aids for the US Air Force and all branches of the Department of Defense (DoD) as required. These items are used in training environments, including avionics, weapons and fuel systems, medical readiness, HVAC, and telecommunications systems.

The trainers and training aids may be either original products or replicas of existing ones, depending on the specific training need. Some devices are not required to be working units, so it usually isn't cost-efficient to purchase the actual item. For most training applications, it's more economical to train students on replicas, instead of the (often extremely expensive) equipment itself.

The TDF uses direct digital manufacturing to fabricate a wide majority of its training products. It employs four Fortus fused deposition modeling (FDM) additive-fabrication machines from Stratasys (Eden Prairie, MN) in a centralized location with AFSO 21 (Lean) processes incorporated into the overall process.

Before adding direct-digital manufacturing to its processes, the TDF used conventional manufacturing methods. Conventional manufacturing typically requires longer lead times, because there are often multiple steps, like machining, lathe work, welding, sheetmetal bending, and cutting. A similar difficulty occurs when producing tooling to mold a part.

"Because most of our projects are either one-off or very low volume, conventional methods become very expensive," explains Mitchell Weatherly, chief of the TDF. "Only about 10% of our work is for prototypes and 90% is production." Before settling on FDM, the TDF considered a number of other additive processes. "With FDM, the investment is upfront, not ongoing. The parts are durable, and they have the high level of detail we require," says Weatherly. "In addition, the process is environmentally safe and 100% green with zero waste."

Antenna and other components are manufactured by a Fortus FDM machine.

The TDF is responsible for designing and manufacturing an exact replica of an unmanned aerial vehicle (UAV) or "drone" for training repair technicians. It has built a variety of internal and external components using its FDM machines. The components included most of the body components as well as several cowlings, propellers, and antennas. TDF also purchased a number of real UAV components from the OEM.

Just for producing the UAV's large antenna, using the FDM machines did the job in about one-tenth the time it would normally have taken with conventional methods, and it delivered an ROI of more than

$12,000. The savings go beyond time, though. For the antenna, it would have taken an outsourced machine shop up to 20 days to produce the part, whereas it took only two days using FDM—but with only 15 to 20 min of labor. For the entire UAV project, there was a total time saving of more than two years in some areas. The project, along with other trainer savings, has yielded an impressive $800,000 cost avoidance over the last four years.

With direct-digital manufacturing, the TDF can produce batches of components with the FDM process.

"Major advantages to the FDM system include its speed over other processes or alternative build methods, the versatility of FDM versus injection molding, and the ability to run multiple parts simultaneously through the system," says Weatherly. Benefits include ease of maintenance, as well as the availability to use multiple materials for a variety of purposes.

"For four of our first FDM machines, we projected ROI in four years, but it took only 18 months. For our second FDM machine purchase, we saw ROI in only 9 months," Weatherly says. "You will never get away from conventional methods and highly skilled technicians, but you can give them the proper tools and new technology that can make their job easier and more competitive. Since 2004, when we purchased our first of four machines, the FDM process has saved the government over $3.8 million to date, with an expected 10 to 15-year savings of over $15 million," Weatherly concludes.

It isn't surprising that the TDF was awarded the 2008 Air Force Chief of Staff Team Excellence Award for its use of FDM technology and other advanced production methods.

For more information about Fortus 3D Production Systems, visit www.stratasys.com or phone 888.480.3548.

The Americanization of German Auto Supply

Smith's Machine (Cottondale, AL) is a 30-person shop, founded by Woody Smith in 1974, and currently supplies precision-machined parts for the Mercedes Benz US International (MBUSI) facility in Tuscaloosa County. Today, Smith's is run by Woody's sons Robert and Tim Smith.

Part of this story originates with a joint venture that began in 2000 between Smith's Machine and two German companies, Eberspaecher Formenbau and Hummel Formen, both of Stuttgart, Germany. Through contacts made during that joint-venture process, as well as Smith's long-standing commitment to buying the best machinery and equipment available, Smith's Machine became familiar with machine tools from DMG America Inc. (Itasca, IL), now DMG/Mori Seiki USA (Hoffman Estates, IL) for its primary machining operation.

Today, more than a dozen DMG machines operate in workcell environments to produce CNC-machined bar stock and castings for the automotive and other markets, including indirect sales to MBUSI. In addition, according to Vice President Tim Smith, the shop supplies other automotive and tire manufacturers, OEMs in the HVAC compressor, agricultural machinery, propane valve, stainless pipe fitting, marine diesel engine, and underground mining industries.

At the heart of the shop's operation are specialized workcells for dedicated long runs, comprising DMG Twin mill/turn centers fed by robotic parts handlers. All machine motions are controlled by Siemens Sinumerik 840D CNCs for twinspindle, twin-turret bar feed, four-axis turning, and four-axis milling on castings. The CNCs incorporate the manufacturer's ShopMill and Shop-Turn software for graphical programming, DIN/ISO programming, full machining simulation, machine setup, and tool management. As for the twin-spindle machines, Smith's uses the MF Programmer software especially designed by DMG for its Twin product for real simulation and the full cycle utilization that the Siemens 840D offers.

"The HMI on these machines offers us a virtually unlimited amount of options in the cycles and control of the work planes," Tim Smith comments. "This enables us to run nearly all the advanced features on the machine-tool control itself. For our production-run machine cells, this is very beneficial, because we're able to keep the number of lines of code to a minimum using these features, as opposed to making standard ISO code from a CAM system."

Operators and programmers at Smith's can revise programs while running and implement changes on the fly. "The standardization of the control and layout are taking effect in our shop now. The similar architecture between the controls, even on different generations of machines, helps us greatly in the cross-training of our staff," Tim Smith notes. Training from both the machine tool builder (DMG) and CNC supplier (Siemens) were effective in bringing Smith personnel up to speed on all aspects, from application engineering assistance to service issues and part refurbishment.

The full PC with hard drive onboard, enables Smith's engineers to store all programs on the machines, and to utilize routing back-up via a PC and Cisco wireless network.

"An excellent example at Smith's of how the Siemens Sinumerik 840D control has been applied is on the DMG Twin

machines," says Smith. "Offset tables can be generated and stored locally on the machine, while the use of RG variables makes the setup simple and fast. In each group of programs, we have one program of user-defined RG variables that carries all our setup information, such as stock size, part projection, transfer information, load/unload cycles, and other relevant automation factors. With just these two items, we can pull up the program and offsets, and change our collets/jaws, and bar feeder. Then, we're ready to go without any further setting of workshifts or master offsets. We simply set up and run."

Representative automotive parts produced at Smith's Machine include a tow bushing, valve block, spare tire arm, stainless spinnerette, steering knuckle, propane valve, and several marine diesel turbocharger parts supplied to the Mercedes facility in Tuscaloosa County and other OEMs.

Through the use of the supplied ShopMill and ShopTurn software, additional programs are created offline where training also occurs. Real-time, plain-language commands and highresolution 3-D graphical simulation are highlights of these software suites, along with short online setups for the end users, resulting from simple operator prompts for determining workpiece zero points and tool lengths.

Smith further notes that the DMG production cells and Siemens controls offer his company flexibility, allowing it to seek additional large production runs from the automotive sector and other OEMs in its customer base.. These robotic workcells will provide us longer equipment utilization due to the current speeds and available options," Smith observes.

"Overall, these cells have not only made us more competitive in automotive, but they have helped us remain so. Automotive is one of our most lean manufacturing market segments, so we see our future in multifunction machine tools and greater use of robots," he adds.

Smith's Machine has added a five-axis DMG 80U machining center to be able to reduce the number of operations in production parts, as well as being able to enter markets for more complex parts like those required for defense and aerospace applications.

At Smith's Machine, DMG Twin machines with Siemens Sinumerik 840D CNCs are fed by the robot that loads and unloads the turning center and the four-axis milling machine, and rotates the parts through a queuing station before engraving and placing the part on the engraver.

Smith's Machine produces most parts from low-carbon steel, including 1018 and 12L14, 1045, and 1144. In addition, it runs 303 and 316L stainless, as well. Castings machined are mostly Class 30 grey iron and ductile iron, 60-45-12 and 80-55-06. A Zeiss CMM is employed in-house for quality checks, and Smith's Machine uses a network of local partners to plate, chrome, paint, and heat-treat parts.

In addition to the main production workcells, Smith's also operates a job shop that specializes in serving its local market with jigs, fixtures, and spare parts. Smith's Machine is ISO9001:2001 certified.

For more information about DMG America, go to www.dmgamerica.com or phone 630.227.3904; for information on Smith's Machine, go to www.smithsmachine.com, or phone 205.553.7623; to learn more about Siemens Energy & Automation, contact SiemensMTBUMarCom.sea@siemens.com, go to www.SiemensCNC.com, or phone: 847.640.1595.