

Carl Zeiss CMM

GUIDES ANDREW TOOL WITH COMPLEX MARS ROVER PROJECT

When Andrew Tool got the call to quote on a MSL (Mars Science Laboratory) project, they were determined to succeed by taking advantage of their expertise. At Andrew Tool, CMMs have been an integral part of their manufacturing processes for years, but they had never faced a project with such intricate measurements, tight tolerances, heat treatments and a very short time frame requirement. Carl Zeiss had proven to be a great resource at Superior Tool (Andrew's sister company).

"Our PRISMO CMM at Superior Tool is the backbone of our quality department, and my goal was to replicate and build on this capability at Andrew," says Bruce Hanson, president and CEO. This goal and initial project discussions with the MSL top-tier contractor pointed Andrew Tool toward a Zeiss CMM as the best option.

Andrew Tool is a unique machine shop with more than 30 years of experience handling five-axis milling, EDM, grinding and more. Their success is dependent upon fostering good relationships between the tool designer or engineer and the machinist.

"They need each other, and our employees understand that it's a team effort that links us to our customers," Hanson says. The majority of Andrew Tool's customers are found in the aerospace, defense, medical and micro electronic industries, all having parts that often require extremely tight tolerances.



Andrew Tool is utilizing the Zeiss ACCURA with VAST technology for the Mars rover Curiosity (courtesy of Carl Zeiss).

This new, complex project from MSL required Andrew Tool to manufacture actuators (gearboxes) for the next Mars rover Curiosity. This new rover will weigh more than 10,000 lbs., five times the weight of the current rovers, and carry more than ten times the weight in scientific instruments compared to the current Spirit or Opportunity rovers.

Therefore, the propulsion system's power and torque will be more robust, and the unit's wheels considerably larger than previous designs. NASA engineers believe these changes will help prevent the problem that Spirit is encountering now: it's stuck in a sand pile. There were many parameters that Andrew Tool had to adhere to in order to help NASA make their new actuator design a success. Many of the parts had very deep pockets (almost a 20:1 ratio), and small radii added to the challenge, along with extremely tight tolerances, many of which are tied to different gear pitch diameters. The parts are very labor intensive with thousands of points of data measured on individual parts. The VascoMax material used for the actuator parts changes size slightly during heat treatment and, as a result, many of the part

features were machined and inspected to process dimensions that allowed for this size change if the feature was not going to be final finished post heat treat. Additionally, position tolerances of .0002", geometric control of .00008" and size control within .0001", even on relatively large (5" range) dimensions added to the challenge. All of these factors, coupled with a demanding 18-month timeline and AS9100 certification requirements, made it critical that Andrew Tool bolster its CMM capabilities for precision and speed.

Andrew Tool decided to purchase the Zeiss ACCURA with the VAST XT gold active scanning sensor. The Zeiss ACCURA was an affordable solution with the range they needed while the VAST technology and automatic stylus rack system increased flexibility and productivity when determining size, form and position. The VAST XT gold is suitable for the complex and heavy stylus configurations required in measuring MSL's actuators.

Of course with any new machine being added to the production process, there's always a learning curve. The first surprise they had was seeing

how seemingly benign parameter setting changes could dramatically affect measurement results. The discipline of always verifying critical measurements with another method was crucial to the learning curve. Brent Helgeson, metrology applications manager at Concept Machine, was very responsive in efficiently diagnosing the correlation problems, enabling Andrew to quickly get up to speed with their new CMM. Additionally, probing strategy for some of the features and proper alignment sequences to achieve correct results were developed and refined to achieve consistency.

“The Zeiss ACCURA helped us orchestrate the project by providing timely, accurate and understandable in-process reporting. It can’t be overstated how critical good inspection is for process development and setup,” says Bryant Broderick, quality control engineer at Andrew Tool. The project included 14 different part numbers with quantities ranging from four to 12 plus setup parts. Throughout all of the

different processes including milling, gear cutting, heat treatment and stabilization, each part was successfully measured up to 60 times by the Zeiss CMM to ensure accuracy every step of the way. The temperature compensation feature was especially helpful because they were able to check parts

right off the machine tool and relay the results to the toolmaker instead of having to wait for the part temperature to stabilize before measurement. With a coefficient of expansion of five and one half millionths of an inch per degree, a few degrees could mean the

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difference between pass or fail. “We were amazed by how effortless the ACCURA made this whole process.”

The robust reporting capability in CALYPSO is a great asset for the AS9100 certification process required by NASA. This certification involved

a lot of time on the program management side of things ensuring there was documentation for all of the critical paths of each part throughout the whole manufacturing process. All of this information was contained in a spreadsheet with all of the serialized

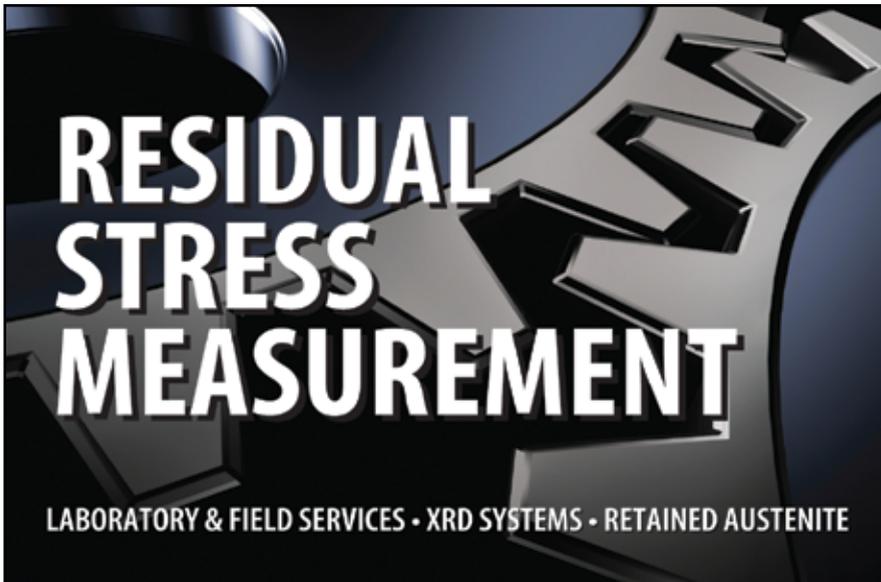
parts to clarify where each part was at any point. The CALYPSO software easily documented the information electronically each time the part was measured.

“Verbal information of part details means nothing; documented data is everything,” states Don Felix, director of sales and marketing. “We couldn’t have been successful without Carl Zeiss. The benefits Zeiss brings have been enormous, and we see positive results every time we use the CMM.” Ongoing training continues to drive Andrew toward the goal of using the ACCURA to its full capacity.

Andrew Tool even acquired a new customer after another NASA supplier saw several of the MSL actuator parts. They were so impressed with the precision and complexity of the parts that they were instantly sold on Andrew Tool’s capabilities. This supplier also required AS9100 certification and fortunately, Andrew Tool was well on their way to attaining this certification and ready to take on this new opportunity with enhanced confidence in data from their Zeiss CMM.

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Zoller and Ingersoll

PARTNER FOR MEASURING HOB CUTTERS



With growing markets in aerospace and energy technologies, measuring hob cutters used in gear cutting is becoming an essential requirement for workpieces and machine tools. Zoller, a provider of solutions for tool pre-setters, measuring and inspection machines and tool management software, has developed a new partnership with Ingersoll/Germany for shop floor checking of hob cutters by a combined hardware and software approach. "Ingersoll's experience enabled the Zoller software engineers to optimize the measuring process for hobs," says Robert Auer, export sales manager at Zoller. "Due to this partnership Zoller

now offers a measuring program for hob cutters which ensures an accurate and fast measurement combined with unrivaled user friendliness."

Its base is a Zoller Venturion 600 or 800 with a CNC driven tilting optic carrier with *Pilot 3.0* software featuring photo-realistic user dialog.

Programming boils down to nothing but entering the nominal parameters as indicated in the corresponding graphic. According to these nominal values, the measuring program is automatically generated by the *Pilot 3.0* software. Positioning and determining individual

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measuring points on the cutting edges is carried out automatically and—more importantly—independent from the operator. Even superimposed or distorted edge images as they occur with the helical pitch pose no problem as Zoller Venturion optic carriers are

automatically and precisely rotated by numeric control if necessary.

Another advantage of this measuring approach is scanning the entire effective outline of all edges: This is of eminent importance for hob cutters with carbide inserts as the contour

in the work piece is produced by an entire range of different inserts. Only by scanning the contours of individual inserts and merging them into a total contour can errors be avoided, as they occur in the transmission zone, insert tolerances, imprecise mounting or excessive tolerances concerning insert positions.

When combining a Zoller Venturion with hob cutters by Ingersoll, users get a hands-on system to test tools quickly and with micron precision before using them on the machining equipment. As opposed to most tactile-based measuring machines in this area, measuring results do not vary according to which operator happens to be on duty. Zoller systems are tailored to the demands as posed by hob cutters and offer additional value as they may be used for measuring and presetting all types of other tools as well: reamers, mills and milling heads. The result of this partnership between Ingersoll and Zoller shows how users can profit when industries join forces for their mutual benefit.

“In today’s market it is important to not look just at individual components but at processes instead,” Auer says. “The combined hardware and software approach ensures an integrated, transparent manufacturing process from tool manufacturing to quality control, machining, process control and regrinding.”

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Sunnen's SV-1005 series vertical CNC honing system with integrated air gaging system provides closed-loop control of tool size, along with downloadable SPC data. Matched with Sunnen's super abrasive MMT tool, the air-gage-equipped machine can automatically control hole size to accuracies of 0.25 μm (0.00001") without operator intervention, working in a bore size range of 3–65 mm (0.120–2.56") diameter. It is suitable for automated, high-Cpk production of small engines, hydraulic valves/bodies, fuel injectors, gears, compressor parts, turbocharger housings and gun barrels in medium and high volumes.

According to Sunnen, by combining the new air gaging system with the machine's patent-pending tool-feed control, the SV-1005 eliminates the need for an experienced honing operator to tweak the process. The new air gaging system controls bore diameter and geometry by taking post-process measurements of the parts while they

are still fixtured on the machine's rotary table. Feedback from the air gage provides the highest possible accuracy for tool-feed control.

The SV-1005 matches an ultra-precise tool feed system with CNC control to allow any CNC-experienced machinist to master honing quickly.

Setup is simple with a three-axis hand wheel for fine tuning the tool feed and the servo-controlled stroke system and rotary-table. The control includes several features that put honing expertise at the fingertips of novices, such as a switchable autocorrect feature for bore

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shape. Using measurements from the air-gage system, it allows the operator to select from a library of "problem" bore images (taper, barrel, etc.) to match to the part on the machine. The servo-controlled stroke system ensures a consistent crosshatch pattern and can dwell in any part of the bore, end-to-

end, selectively removing stock for ultra-precise straightness and roundness.

The vertical design of the SV-1005 conserves shop floor space, requiring just 2,400 x 2,300 x 2,700 mm WxDxH (95 x 91 x 107 in.). A cast polymer base and cast-iron column

provide enhance vibration damping for precision honing, while removable stainless steel side doors facilitate integration with automatic part loading systems. The high-torque, belt-driven spindle is rated at 7.5 kW (10 hp) to cover a wide range of sizing and finishing work.

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Forest City Gear

PURCHASES TAKISAWA LATHE



Forest City Gear has purchased a Takisawa TT-200G, a fully-automated turning center with twin-spindle, twin-turret and twin-CNC operation, for its in-house blanking department. By the acquisition of this machine, according to a company spokesman, the production in the blanking department has radically improved, as the machine combines full automation with twin-sided, simultaneous machining.

With a 16-pallet capacity, this Takisawa 8" chuck-type machine boasts a feed rate of 8 m/min and features a standard spindle and turret plus a second C-axis spindle and turret with milling function. In addition, a bar loader, workpiece stacker, turn-over unit, chip conveyor, air blower, tabulating counter and other equipment are onboard for fully automatic mode operation of the machine.

As a strictly custom gearmaker, Forest City Gear made the decision recently to develop an in-house blanking department, thereby improving its turnaround time on most jobs, according to company president, Wendy Young. "We were reliant on a number of outside suppliers and, while our volume overall is quite substantial, we were often slow to receive some small, project-specific blanks for production. Many of our jobs are short-run, highly specialized precision gears, and that means we place a premium on being very efficient in our time-to-first-prototype. The Takisawa is already making a big impact on our blanking operation here."

Tommy Kalt, who runs the blanking department at Forest City Gear, concurs. "We're achieving a 27-second cycle of continuous turning, and the fully automatic mode means a big boost in production for our department. Because we do so many jobs that require relatively few blanks, our overall speed was hampered, due to excessive downtime for set-ups. That situation is diminished to a great degree with the Takisawa machine. Having this capability allows us to reduce our lot sizes on high-volume blanket orders and increases our ability to prototype."

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PRODUCT NEWS

The new series features a standard boring range of 7.87–13.39" diameter for ISO40/HSK-A63 tapers, and 7.87–24.41" diameter for ISO50/HSK-A100 and larger tapers. Special components allow the system to extend up to 118" diameter. The mounting flanges feature Kaiser's new CKN modular con-

nection with a three-screw interface, developed for high torque transmission with lightweight tools. The system supports spindle speeds of up to 6,600 SFM thanks to safe and secure "pinned to fit" lightweight aluminum mounting components. The high strength aluminum components are hard coated to



protect against wear and corrosion, and all assemblies deliver high pressure coolant through the tools to cutting edges.

"The 318 series features aluminum extension slides that allow for diameter and length setting adjustments without a tool pre-setter," says Jack Burley, Big Kaiser vice president of sales and engineering. "The simplicity of this system virtually eliminates operator error during assembly and promotes safety during operation."

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Luren Precision Co., Ltd. recently released a vertical type CNC gear profile grinding machine. The LFG-8040, which can form grind spur and helical gears up to 800 mm (31.7") in outside diameter and maximum module of M20 (1.27 DP), incorporates an eight-axis CNC controller with close-loop servo control system, direct drive motor and personal computer. A Windows-based user-oriented smart interface developed by Luren is used to operate the LFG-8040. The operator can easily key in gear data, modify gear profile and specify the grinding steps. No NC programming is needed because the grinding program will be generated automatically. Involute profile can be checked easily as desired. K-chart points can be set and adjusted freely by rolling arc, rolling angle or radius on the base circle. Lead modification can be carried out easily as well. Operators can also set up the grinding procedure based on their own data or experience. On-board gear measurement, automatic stock dividing and rotary dressing are also included in the standard machine.

For more information:
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1320 Tower Road
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Milwaukee Machine Works

PURCHASES
HEXAGON CMM

Hexagon Metrology, Inc. recently announced that precision component

manufacturer Milwaukee Machine Works has purchased a Leitz PMM-G ultra-accurate coordinate measuring machine (CMM). The Leitz measuring machine has a supersized measuring capacity of three meters wide by four meters long, and two and a half meters high, tailor made for the large

scale machined components that are a Milwaukee Machine Works specialty. The PMM-G is a gantry configuration machine that allows large scale parts up to 30,000 pounds to be easily moved inside for precision measurement. It also boasts the highest accuracy specifications for its size, enabling ultra

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precision measurements to be made for case, cover and housing parts for the wind, off-highway and mining industries which comprise MMW's typical customer base.

"This new machine is a huge enhancement to our capabilities," said Mike Manna, general manager

of Milwaukee Machine Works. "We are known for tackling the toughest, highest precision, turning and machining jobs in the business—jobs that other shops just don't have the capability or expertise to handle. Now we will have a measuring machine with the size, capacity and accuracy to



handle the very largest parts we are capable of making—single parts that are the size of small cars." Milwaukee Machine Works has always been a good customer of Hexagon Metrology, and represents the best of what American manufacturing is capable of," said Jack Rosignal, vice president of sales for Hexagon Metrology, Inc. "We are pleased that the first PMM-G Coordinate Measuring Machine to be installed in America is going to a company like Milwaukee Machine Works, that has the commitment to precision manufacturing and the highest quality standards."

The new Leitz PMM-G is scheduled to come on line in Milwaukee Machine Works' ISO 9001:2008-certified facility by the second quarter of 2011.

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