

IMTS 2006: Manufacturing Technology On The Rise



Barbara Donohue

In September, more than 90,000 visitors experienced new technologies in equipment both large and small at the largest US machining/metalforming trade show, held in alternate years in Chicago. By **Barbara Donohue**.

September 6 through 13, the International Manufacturing Technology Show (IMTS) in Chicago, Illinois, USA, welcomed 91,985 business owners, engineers, machinists and others involved in manufacturing cross the globe to experience the newest in machining and other manufacturing technologies. Sponsored by the Association for Manufacturing Technology (AMT), IMTS runs every two years, on even-numbered years, at McCormick Place convention centre on the shore of Lake Michigan.

Demonstrating everything from massive machining centres to tiny tools for micromachining, 1229 exhibitors from 40 countries filled over 1.1 million sq ft of display space in four halls, with areas designated for specific technologies, such as metal cutting, grinding, EDM, workholding, software, machine components, quality assurance, and metal forming and fabricating. The next IMTS, in 2008, will feature more show space, as McCormick Place will have added another building, and a shorter, six-day schedule, September 8 - 13.

Total attendance this year was up about seven percent from 2004, and international registration increased by 15 percent since the last show. Visitors came from 70 different countries, of which, ten countries each contributed at least one percent of the total attendance: Canada, Mexico, Japan, Korea,

China, Germany, Brazil, the United Kingdom, Italy, and France. The International area of the show hosted machine tool trade associations from about 20 different countries on four continents Asia, Australia, Europe, and South America.

During the first three days of IMTS, the Society of Manufacturing Engineers (SME) offered a Competitive Manufacturers Conference. About 250 people learned about how to make their businesses more successful through lean manufacturing, realistic cost estimating, product lifecycle management, supply chain management, and new manufacturing technologies. Author and speaker Doug Hall, known as "America's number one idea guru", delivered the keynote address, "Jump Start Your Brain To Be More Competitive Globally."

Industry On The Way Up

Recent US sales have been growing, but are still well below the industry's high in the late 90s, according to US machine tool (metal cutting and metal forming) consumption data from the Association for Manufacturing Technology and the American Machine Tool Distributors' Association. The peak figure, in 1997 was US\$5.6 billion.

During an interview at IMTS with the magazine, Pat McGibbon, vice president for strategic information and research at the Association for Manufacturing Technology, McLean, Virginia, reflected on market changes in recent years.

After the peak, US manufacturing technology "began a precipitous fall. It started out because of Y2K. . . . Then it was accentuated by the Asian financial crisis," he said, as well as the terrorist attack on September 11, 2001. "The industry got very competitive, and demand fell, not only here in the United States, but around the world. So it was a global downturn in the production equipment business. And from [its peak] through 2003,

the US market fell by more than 60 percent. We were at an all-time low. In real terms, it would appear that we have not experienced as low a period in our industry domestically since the 1931 depression."

However, since hitting a low of US\$2.1 billion in 2003, growth has been strong. In 2005, machine tool consumption was up nearly 50 percent over the 2003 numbers. However, it still was 45 percent less than the peak. Even with "what looks to be a 20 to 25 percent increase in 2006," said McGibbon, "we'll still end up this year at only 67 percent of what we were at the peak."

Looking ahead

What does the future hold? "In '07, [we're] looking out for things to be positive again, but at a much slower pace of growth," said McGibbon.

"And the outlook for '08 is questionable at best right now. . . . It could go either way," he said. "The key point is the oil shock. When we had this same type of situation back in the '70s, it took a heavy toll on consumer spending. [Also,] interest rates continue to creep upward. Every quarter point is . . . taking hundreds of dollars out of a family's monthly budget . . . that they would normally spend on the new front-loading washing machine, or the new hybrid [car], or the new plasma TV - all things made with machine tools, manufacturing technology."

"The [higher] interest rate . . . typically slows down new housing starts [as well]. The beauty about new houses is that each one of them needs three TVs, a washer and dryer, and two cars in the garage. Slower housing starts

means less demand for those things, too. That's the main reason we look at '08 with some questions," McGibbon said.

On the positive side, McGibbon sees changes in the automotive and other industries that provide growth for the US manufacturing technology industry. For example, GEMA, the Global Engine Manufacturing Alliance, a joint venture of DaimlerChrysler, Hyundai, and Mitsubishi Motors, has built a new plant in Michigan.

"People are learning that shipping things around the world is becoming very, very expensive," McGibbon said, "not only because of oil prices, but because space on ships is getting tighter as world trade grows. . . . So people are seeing that the strategy of building locally for a local market is smarter. For example, Hyundai, just a fledgling in the automobile industry in the United States, has put a significant new plant in [Alabama]," and is planning another, as well as being part of GEMA.

Pumping Up Innovation: Ex One

The biggest buzz at the show was about a new business, the Ex One company, which was founded in March of last year by Lawrence Rhoades, former president, CEO, and principal owner of Extrude Hone Corporation, which was sold to Kennametal last year.



Ex One rapid casting machine creating a sand mould by 3-D printing.

The new company, based in Irwin, Pennsylvania, develops and commercialises breakthrough manufacturing processes. In its show booth, Ex One demonstrated three-dimensional “printing” in metal to create intricate parts, or in sand to create moulds and cores for casting; micro-ECM (electro-chemical machining); and dual-pulse laser machining.



Example of a sand mould built by an Ex One rapid casting machine.

David Burns, president and chief operating officer of Ex One, conducted a tour around the booth. One system, the imagen, created copings (bases) for dental crowns by printing in 3-D with gold powder. With this technology, eventually, dentists could scan the patient’s tooth, and build the crown right in the office, Burns said.

Another, much larger system, was “printing” a sand mould. Three-dimensional printing in sand and metal both work the same way. An ink-jet-style print head lays down

a layer of binder. Next, the build medium, whether powdered metal or sand, is adhered to the binder to a precise thickness. Then the process repeats, layer after layer, until the whole part is built. The powdered metal parts are then sintered. The sand moulds are ready to use when they come off the machine.

The point of making moulds for casting, Burns said, “is it’s fast, you can put in features you can’t put in conventionally, and you can get thinner wall sections. We do a lot of work with the racing industry. . . . We get a file on Friday; on Tuesday you’re ready to pour.”

The SuperPulse laser machining system removes very small amounts of material at a time, very quickly, from a very precise location using thousands of laser pulses per second.



Cooling holes in a turbine blade, an example of laser machining by the Super Pulse technology from Ex One.

Suitable for such applications as creating tiny cooling holes in turbine blades, this laser machining system incorporates a protective technology that prevents the laser from cutting too deeply.

The microECM machine is finding application in the manufacture of very small motors, such as those used in small disc drives. One hundred of the machines are already in use in Southeast Asia, Burns said.

As part of showcasing innovative technologies, Ex One

also sponsored the Emerging Technology Centre at the show, next to the Ex One booth, where university researchers discussed and displayed technology that may find its way to the factory floor in the next few years. Experts and researchers presented their work in a theatre space within the centre. Topics included dynamic spindle measurement, control of thermal effects in machine tools, technology transfer, and applying nanotechnology to manufacturing.

Mechanical & Thermal Improvements

AMT vice president for technology Paul Warndorf, saw a trend throughout the show toward design for mechanical robustness and thermal control, both necessary to

another trend he observed, the move toward higher accuracy.

“There are a lot of newly designed machines, taking advantage of computer analysis – finite element analysis – making a better machine, [a better] platform,” he said. “[Manufacturers] are paying a lot of attention to structure and thermal expansion in the design. This gives them a point from which to move forward.”

“They had to do this,” Warndorf said, “as there will be a movement toward accuracy. The commodity

market overseas will be putting a lot of pressure on them for speed and accuracy.”

Warndorf said he expected to see a lot of micromachining at the next IMTS in two years. And in that technology, accuracy becomes even more important and challenging to maintain, so what the manufacturers have learned about mechanical and thermal stability will serve them well.

Multiple Functions

Though there doesn't seem to be a uniform terminology for them yet, multi-function machines appeared in several manufacturers' booths this year.

improvements. A box-in-box design lends rigidity to the structure. The trademarked DCG (Driven at the Center of Gravity) technology helps keep components of the machine in correct alignment. Symmetrical placement of the motor helps prevent uneven thermal expansion, and cooling for the ball screw and motor jacket also provide thermal stability.

The GMX 250 S *linear* turning/milling centre, one of four GMX S *linear* units from DMG, features a 12,000 rpm milling/turning spindle, a linear drive in the z axis, and a disk magazine for 36 tools. It offers parallel machining on the main and counter spindles or four-

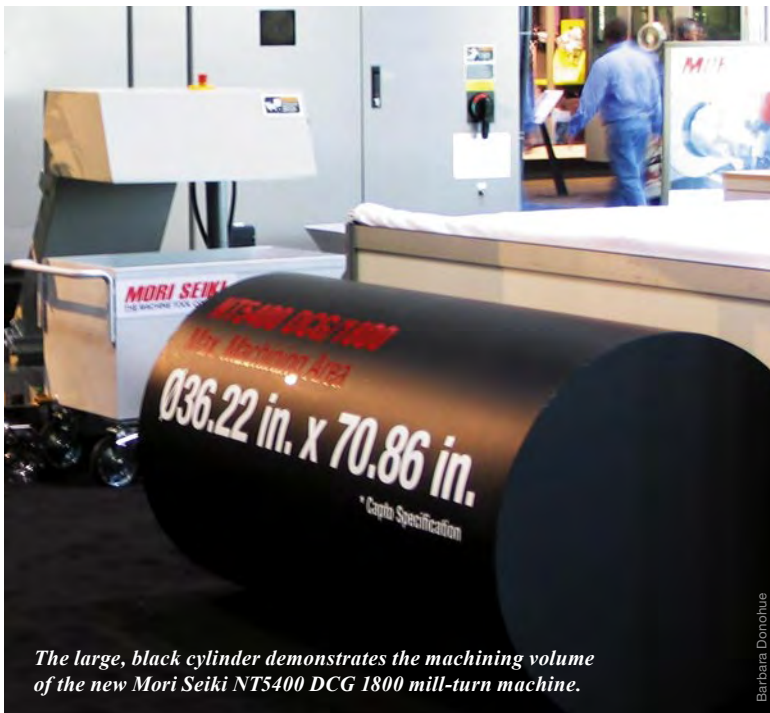
horizontal machining centre, the a51. Adding grinding wheels, or special grinding tools with a single layer of abrasive on a steel core, to the tool collection, is only part of the process of adding grinding ability. The machine needs to dress conventional grinding wheels. Chip/swarf separation needs to deal with the long chips from drilling, smaller chips from milling, and the very small fragments and abrasive grains from grinding. The upside? Parts can be completely machined and ground in a single setup, or perhaps two.

New Generation Of Transfer Machines

Mikron presented the NRG-50, a new, high-performance 12-station rotary transfer machine that can perform as many as three operations at each station, from top, bottom, and side. The NRG-50 handles part sizes up to 50 x 50 x 50 mm, or turned parts up to 35 mm diameter x 70 mm. Completely CNC, it can perform up to 30 operations simultaneously. Modular tooling performs milling, drilling, reaming, thread cutting, contour milling, and other operations. Optional rotary/indexable clamping platforms enable turning operations, as well, and parts can be turned with cutters opposite each other, for high concentricity. With CNC clamping, six-sided machining is possible. Table rotation and index time is less than one second, and the automatic tool changer goes chip-to-chip in 2.5 seconds.

The whole unit is thermally stabilised; in the machining area, temperature is controlled with cooled cutting oil. For mechanical stability and to prevent vibration, the NRG-50 has a massive concrete base.

The Mikron booth showed a computer animation of the machining of a complex part. This animation was produced as a demonstration for a potential customer of how the NRG-50 could machine a specific part, according to Carl Walters, Mikron regional sales manager.



The large, black cylinder demonstrates the machining volume of the new Mori Seiki NT5400 DCG 1800 mill-turn machine.

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Mori Seiki's mill-turn centres combine complete turning capability with the functions of a machining centre. The new NT5400 DCG/1800S has a maximum turning length of 1800 mm, a maximum tool spindle speed of 8,000 rpm, and a tool-to-tool change time of one second. The NT5400 DCG/1800S is one of many Mori Seiki units that feature structural/mechanical/thermal

axis machining on the left or right spindle. The 250 *linear* features a maximum machining diameter of 645 mm; maximum machining length, with tailstock, 1186 mm; maximum bar diameter 66 mm, or optionally 89 mm.

Other manufacturers feature enhanced capabilities for more conventional machines. Makino, for example, offers grinding on a

He said an NRG-50 system would sell for around US\$2 million, and retooling the system might cost in the neighbourhood of US\$200,000.

Focusing On Small Shops

Hurco USA focuses on job shops with one to 25 employees, said marketing manager Rick Ritter. Though it is a US company, 70 percent of Hurco's sales are outside North America, he said, currently about six percent in Asia, where sales are growing at the rate of 35 percent per year.

New Hurco machine offerings included TMM8, an eight-inch (203 mm) slant-bed lathe with live tooling, adding milling capability; VMX60, an extension of the VMX line of machining centres to 1500 mm x-axis travel; and VMX42SR, five-axis machining centre with a swivel head

programming" for CNC machines, according to Ritter. The software's ease of use has helped make sales offshore, he said. The new program offers features such as the ability to edit any program while another is running, combining NC and conversational commands in the same program, a tool and material library, and the ability to edit a part at the machine, and automatically update the CAD file.

Conversing With The Machine

Conversational programming was a theme throughout the show, and so were powerful new software capabilities. Besides Hurco, many other tool manufacturers touted the features of their new or updated software. And the software companies did the same.

D simulations to help the operator detect interferences, and its Voice Advisor speaks aloud to alert the operator when there is a machine alarm.

Mori Seiki's latest version of its control, MAPPS III, is intended to make setup for five-axis machines a smooth and simple process. MAPPS III includes a real-time interference check function that operates in both manual and automatic modes.

FeatureCam software is out in a new version 2007 from Delcam. Now fully 3-D, it graphically shows the tool path and the resulting surface, which the user can edit and "clean up" on screen. Versions are available for turning, milling, and wire EDM.

Gibbs and Associates, developer of GibbsCam CNC programming software introduced a GibbsCAM Machine Simulation option to validate the tool motion of turning, mill/turn, and multi-task machine tools.

Surfware showed its new SurfCAM Velocity II package, designed to reduce cutting time with a toolpath generator that takes into account the angle of tool engagement to minimise tool load.

Cutting Edge

Many innovations showed up in the cutting tool area, from simple mechanical improvements to sophisticated coating chemistry.

In the Iscar booth, the Jet Cut system offers a coolant passage right through the cutter insert providing coolant directly to the cutting region. Designed for parting and grooving on stainless steel and high temperature alloys, the localised coolant delivery can increase tool life significantly, and improve surface finish.

Seco Tools, formerly Seco-Carboly, announced DurAtomic, a new coating technology for tool inserts, called in company literature, "The World's first atomically modified coating." Michael Parker, director of marketing and product development, explained. The company's research



A student machinist runs a Hurco machine using the new WinMax software.

and a horizontal rotary table. The VMX42SR occupies only about half the floor space of a conventional five-axis machine offering the same X, Y, and Z travel (1067 x 610 x 610 mm).

Big news at Hurco was the introduction of the new version of machine control software, WinMax, a replacement for the previous program, UltiMax. Hurco was a pioneer in developing "conversational

Mazak's new version of Mazatrol Matrix CNC runs on a twin-CPU computer to process the huge amounts of data required to control a precision simultaneous five-axis machine, such as the Integrex e-650H S II. Besides the basics, the system also includes such features as servo control technology that helps minimise vibration. For safety, the program runs visual 3-

staff discovered that when a conventional aluminium oxide coating is applied, the molecules stack up on the surface in vertical columns. The researchers devised a way to improve the structure of the material so it is more wear resistant.



The Jet Cut parting insert from Iscar provides coolant directly to the cutting area through an internal passage.

The result is a combination of long life and cutting capability. Parker said that testing had shown the new coating to allow increase in feeds and speeds of 200 percent and more on steel, stainless steel, and Inconel. Parker said the coating would be able to take on metal-removing tasks that previously required grinding.

Toolmaking In PCD

A new system for using wire EDM to profile Polycrystalline Diamond (PCD) plates on cutting tools uses a build-in probing system, special software, and a customised EDM system to produce precision forms, edges, and relief angles. The system, shown by Methods EDM, a division of Methods Machine Tools, in cooperation with the German software maker,

GTR, uses a Fanuc α 0/iIC wire EDM machine with a five-axis simultaneous control.

The tool with PCD plates brazed on, is mounted in the EDM machine. The measuring probe locates the plates with respect to the tool, and feeds this information to the software. The software then generates the cutting path, compensating for any errors in alignment of the plates. It also corrects the relief angle. After machining, "the part is then ready to use, sharp, and correct in shape. No grinding or polishing is necessary," said Steve Bond, national sales manager for Methods EDM.

Though the diamond material is non-conductive, Bond explained, the binder is conductive. This type of processing for PCD has become possible "as manufacturers have provided finer and finer-grained PCD, and a power supply is available that will work with the PCD/binder combination." The system costs about half the price of the grinders usually used to process PCD-tipped tools, Bond said.

Tigers & Battling Robots

Attendance at IMTS wasn't all work. Besides tending to the

serious business of machining, metalworking, and manufacturing, visitors to the show could take a break for some entertainment. At the Walter USA booth, performing tigers drew admiring crowds, and highlighted the company's black and gold Tiger-tec line of cutting tools.

In another part of the building, visitors could watch homemade, remote-controlled robots push, cut, flip, and hammer on each other in one-on-one competition inside a 150-square-meter protective enclosure. Students build the machines under the guidance of participating teachers and mentors from industry as part of the BattleBotsIQ educational program, which is based on the popular "BattleBots" television program shown in the US. The National Tooling and Machining Association [US] was a founding sponsor of the BattleBotsIQ program.

An informal, unscientific survey of exhibitors revealed a consensus that it was a good show. They were pleased with the attendance. The aisles were often full, but seldom uncomfortably crowded. Visitors showed a lot of interest in new technology, and a good number were ready to buy. **MEN**



Performing tigers in the Walter USA booth drew attention to the company's Tiger-tec cutting tools.

Oscar Enzlig, courtesy of IMTS