What's Special about Specs? ■ China Needs to Play Fair!

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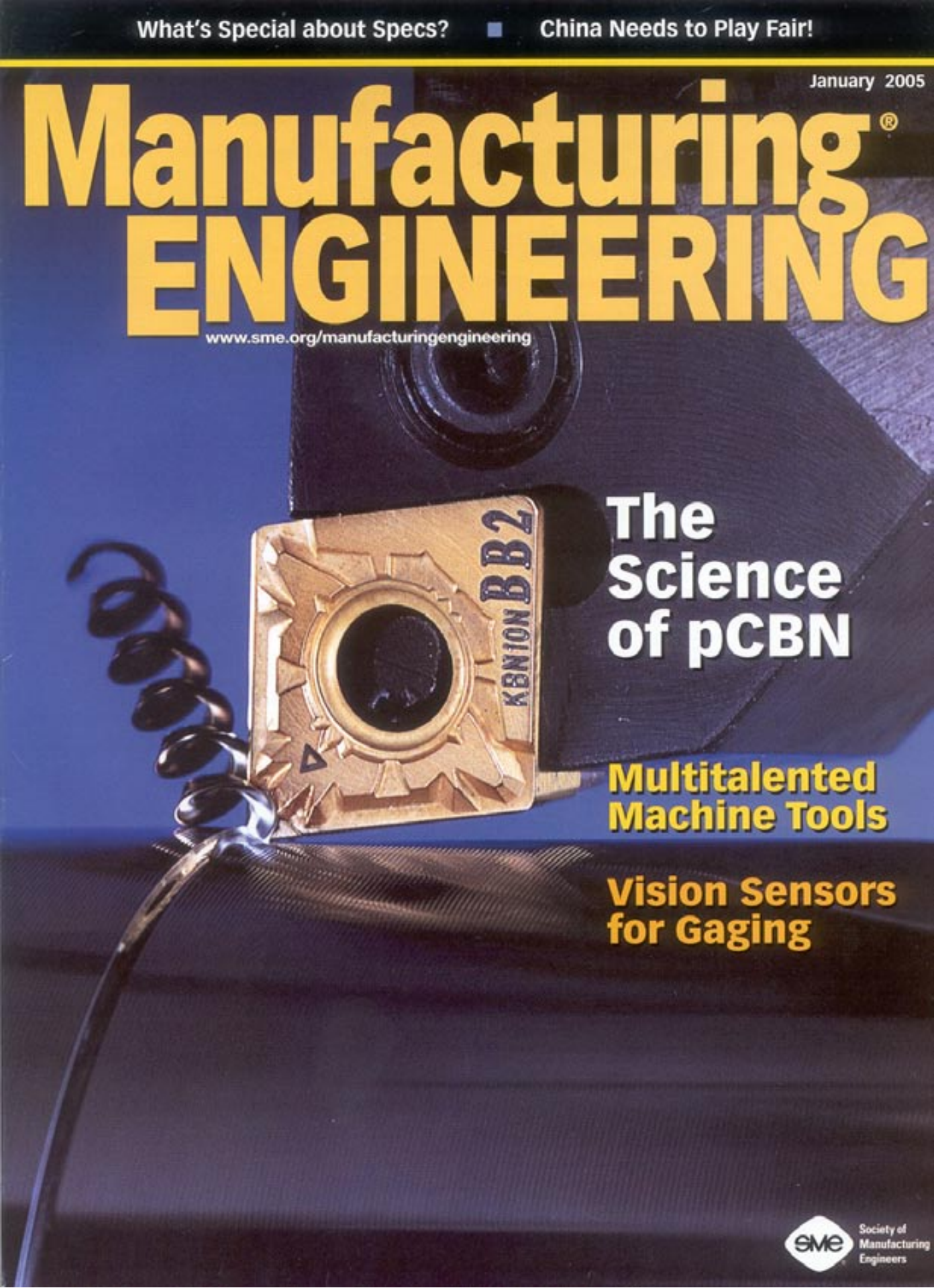

The Science of pCBN

Multitalented Machine Tools

Vision Sensors for Gaging

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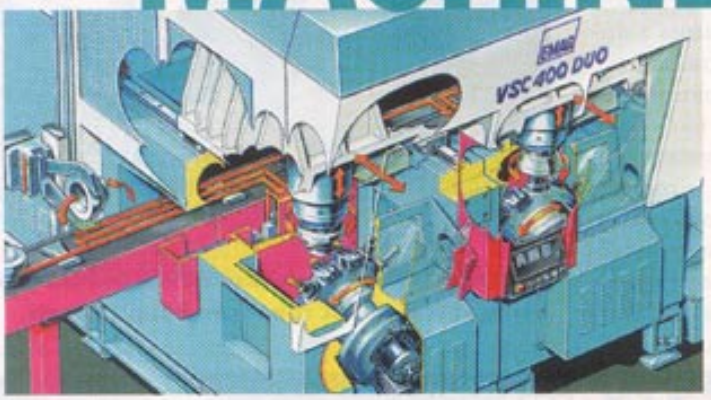
Multitalented MACHINE TOOLS



They do everything but make the coffee

Robert B. Aronson
Senior Editor

Multiple modules provide a variety of machining processes in this Emag machine.

The path to survival in the face of overseas competition favors those companies that can provide added value to a product. That means more precise, complex products. At the same time small companies are looking for greater product diversity, but without major investment. And this has favored the development of multifunction machine tools.

Here are some of the pluses:

- Fewer, sometimes single, setups.
- Complex parts don't have to be made on several machines.
- Minimized part handling.
- Fewer machines—don't need as much costly floor space.

Machine tool manufacturers have approached this expanding market in two ways. The most obvious is to be able to do more than one process. Machines are now available that offer a combination of milling, drilling, tapping, turning, grinding, welding, and balancing.

The other less obvious way to be more versatile is to make the machine more productive by improving or accelerating part handling, chiefly through the addition of robots or part-handling mechanisms within a single machine or cell.

Another factor promoting interest in multifunction machine tools is the trend of major auto and aerospace manufacturers to minimize their own manufacturing, and instead require suppliers to deliver ready-to-assemble modules. Analysts see large companies faced with warranty issues and aging equipment getting away from high-volume precision work. Some high-volume jobs are now being broken into smaller lots and given to a number of suppliers.

Here are a few examples:

(See Following Page)

Multifunction Is Not Just Machining

Walter Schnecker, PhD
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Many multipurpose CNC machines meet the challenges of machining, but fall flat in addressing the other two thirds of the equation: setup and secondary operations

Setup is frequently cited by manufacturers as a primary source of inefficiency and frustration. Users often have to call upon their own ingenuity and resources to develop fixturing and workholding solutions. This usually results in limited success with the problems created by the "solution." For example, when spray glue is used to hold the workpiece, a secondary operation is required to clean the machine when the job is completed.

The final phase of machining is a sore spot for many manufacturers. Most parts that come off a machining center must be deburred, degreased, or both. Sometimes another operation is even added in order to improve the surface quality of a given part. In the end, the labor and equipment required for these tasks impact the manufacturer's time-to-market and profitability.

At Datron Dynamics we're tasked with delivering a homogenous solution for the entire process—from setup and machining to secondary operations.

With regard to workholding, our company's focus has been on "modular" designs that leverage the large work area of our machines by allowing for multiple setups, or workstations. One station may accommodate a manual pallet changer, another could have a vacuum table, and a third could have a pneumatic clamping system. Together they inherently provide flexibility, but a single station also provides the manufacturer with agility to adapt to job changes. Our small pallets actually register with a boss-in-cavity system to the machine bed to provide location repeatability. So if a user is in the middle of a batch and an unexpected rush project comes in, one pallet is easily removed and replaced with the new job. When the rush job is complete, the first pallet is returned to its place and the operator can pick up from where he left off. The integrated vacuum tables, on the other hand, were developed in response to the "spray glue" fixturing method mentioned earlier. Plastic foils as thin as 0.001" (0.03 mm) or large aluminum sheets up to 0.250" (6.4 mm) can be swiftly secured to the bed of a machining system. A low cost gas-permeable substrate serves as a sacrificial vacuum diffuser, allowing the cutter to machine through the workpiece without cutting into the table.

Careful setup can still be thwarted by variance in individual blanks. To simplify workpiece setup, "smart features" like 3D probes have been developed to locate parts in the *X*, *Y*, and *Z* coordinates. This includes finding centers of holes and bosses, as well as pre-measuring blanks before the machining process starts. Intuitive machining programs adjust themselves to the particular workpiece on the machining bed in order to maintain consistency regardless of workpiece irregularity.

As for the machining phase, many CNC manufacturers have answered the call by developing multipurpose machines that perform several functions or operations. Datron machines can mill, drill cut, rout and engrave. But, if you frequently use tooling larger than 0.250" (6.4 mm) we're just not a good fit for you. CNC providers that focus on large tools really shouldn't tout the ability to run microtooling because it cannot be done efficiently without breaking tools with their heavy, high-force, low-RPM spindles.

Time-consuming secondary operations face most CNC designers. There are degreasing agents and numerous methods for deburring on the market. But these operations require additional expenditures for materials and equipment. Datron is geared toward high-speed machining with microtooling, which inherently produces better surface finishes and reduces burring. A 60,000-rpm spindle speed reduces the chip load to less than 0.005" (0.127 mm). Such a low chip load significantly reduces the forces between the tool and the material. High-speed/low-force machining develops less heat, reduces tool deflection, and allows machining of thinner-walled workpieces. This results in better surface quality, cooler machining, easier workholding, and better accuracy.

Microtooling needs a lubricating agent with a lower viscosity than water because the coolant needs to make it to the cutting edge of the tool at the high spindle speeds involved. Emulsion-based (oil) coolants have a higher viscosity than water, and thus are less effective as a lubricant for high-speed machining with micro-tooling. Ethanol doesn't need to be disposed of or recycled, because it simply evaporates. The low evaporation point of ethanol makes it a very efficient cooling and lubricating agent for high-speed machining operations. Since it's a natural chemical, there's no negative environmental impact, no waste, no cleanup, and therefore no cost. In addition, ethanol as a coolant does not leave any residue on the machined parts, thus eliminating the costly secondary operation of degreasing the parts.