

Message Received

Big Data Expands Process Capabilities for Multi-Axis Machining

Matthew Jaster, Senior Editor

Shop floor conversations are becoming so one-sided.

Instead of some witty banter or charming political debates, the manufacturing floor is getting less personable and more productive. Years ago, you'd find four or five operators sandwiched between two workstations. It's become increasingly common to find one or two individuals responsible for several pieces of equipment during a shift. The direction this is going appears that the machines will be doing most of the talking while the operators simply listen to what they have to say. We have big data to thank for this.

Big data (machine tool data in this context) can provide everything from sensor readings, machine behavior and

security threats to machine analytics, troubleshooting and part production. The possibilities for big data (in the industrial sector) are mind boggling and constantly in-flux. The process of collecting and distributing shop floor data (in real time) has changed significantly since MTConnect was first introduced in December 2008 as an open communication standard between shop floor equipment and software applications.

What began as a simple machine tool monitoring operation has significantly flourished in the metalworking industry providing new technologies in areas like mobility, tool management, metrology, automation and controls. Today, a manufacturer can connect its equipment

to examine machine processes, cutting tools and inspection capabilities via data reporting and analysis that keeps getting faster, more efficient and more reliable. Here are few examples of companies utilizing the Industrial Internet of Things (IIoT) to enhance machine tool technology in 2017:

Okuma Focuses on Customization

The Okuma OSP controls are designed to integrate the latest software and hardware technology on the market. Okuma designs OSP controls for all of its machine tools and the control architecture allows the company to easily collect data tags no matter what machine is being polled.



The Mazak SmartBox connects machines and devices for the collection and distribution of shop floor data.

Photo courtesy of Mazak.

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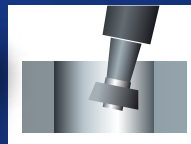
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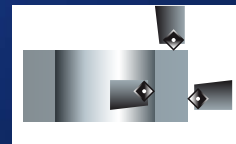
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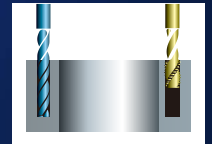
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“That being said, we’ve taken steps to make the process of data collection and transfer easier than ever before. On OSP-P series controls (100, 200, 300), you can download the MTConnect *Agent & Adapter* application for free from our app store (<https://www.myokuma.com/mtconnect-agent-adapter>),” said Brad Klippstein, controls product specialist at Okuma.

Other builders are charging for the MTConnect software interface. Okuma will soon be embedding the MTConnect

Agent & Adapter software onto the control, saving customers the extra step of downloading the app and installing it onto the machine. MTConnect allows users to access the machine’s conditions and status then converts that data into a data stream that can be read by a PC or device application.

“We understand that end-user productivity strategies are endless, so we’ve made the process even easier to accomplish for customers wanting to take that route of data collection and analysis. The

process is easy, and free, for our customers to accomplish,” Klippstein said.

Many of Okuma’s latest machine tool advancements play on the idea of the factory of the future and the benefits of utilizing data collection on the shop floor. These include numerous time-saving strategies such as new widgets and apps that make it easier to gather the required information at the control or from a connected network.

Okuma’s built-in ECO functionality can be used to conserve energy that isn’t needed from the machine tools. This now comes standard on new machines with the OSP suite platform. “This function automatically shuts off non-essential pumps, motors, conveyors and other equipment after the machining process to save energy and maintenance costs,” Klippstein said.

The Tool Life Management feature (which is standard on Okuma controls) is another well-received update on the company’s machine tools. “You can track insert life and tell the machine how to handle situations when the tool life runs out. This saves time and money when you eliminate operator intervention and automate the consumable insert change process,” said Klippstein.

Regarding gear manufacturing (a subject near and dear to our hearts), Okuma

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Okuma has come up with more efficient ways to manufacture gears with its hobbing and skiving functions. Photo courtesy of Okuma.

has come up with more efficient ways to manufacture gears with its hobbing and skiving functions for lathes as well as mills. Okuma offers a gear machining package along with the GUI interface for easy program input. The menu guide the user through the process in an intuitive application that runs on the OSP control. Designing hobbing and skiving programs is made easy with this new Okuma function.

On the metrology side, Okuma continues to improve its capabilities. "As metrology advancements continue to improve, we will need the flexibility to change tool paths and wear offsets in creative manners. The quality and accuracy of parts will be improved if this process can be made relatively easy and fed back to the machine tool," Klippstein added.

All of the OSP controls support application interfaces, according to Klippstein. "Okuma, our distributors, vendors, partners, and customers all have the ability to write custom applications and add them to our OSP interface. Anyone with savvy programming skills can write an app. We offer free dashboards in our app store like MTConnect Mobile Display for connecting your equipment to your smart phone or tablet. You could also download the

Machine Alert app and get emails or text messages whenever your Okuma machine is in an alarm state. It tells you what happened and when, and provides a screenshot of the control."

The company's showroom called the Aerospace Center of Excellence (Charlotte, North Carolina) focuses on 5-axis capabilities. "We are always demoing features such as 5-axis auto tuning, dynamic tool load control, cryogenics, tool center point control, and other

concepts that can aid in simultaneous 5-axis machining. We've posted blogs and whitepapers on certain applications such as cryogenics and turn-Cut. We try to showcase these machines and processes as much as possible," Klippstein said.

Customer and distributor feedback is imperative to Okuma's success. "We continue to improve the look/feel/functionality of our control by directly communicating with our software engineers at Okuma Japan," Klippstein said. "They



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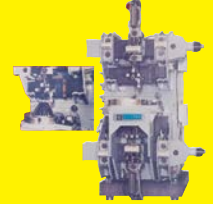
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Mazak Manages Big Data with the SmartBox

Manufacturing engineers continue to approach Neil Derosiers, application engineer and developer at Mazak, with a series of “But can it do this? ...” type of questions regarding the company’s Smartbox.

“One engineer after another,” he said in a recent phone interview. “The first guy will ask if the technology is capable of performing a specific task and then it will be followed by a completely different request. The answer to these questions, however rarely changes. Yes it can probably do that.”

Using MTConnect, the Mazak SmartBox connects machines and devices in order to capture a variety of monitoring, security and analytical capabilities. It was developed with Cisco, and will be a key strategy as Mazak moves its manufacturing base toward the digital factory of the future.

As shop floor monitoring and analytics grow in importance, Derosiers says it’s vital to not only consider what the Smartbox can accomplish on the shop floor today, but how it can accommodate new technologies and solutions in the future.

“How do we create some kind of launch platform that allows us to have a unique connection that meets shop floor requirements today, but also make it as future-proof as possible so when new technology is introduced five to ten years down the road, it can handle it? This is essentially what the SmartBox is.”

The ongoing list of IIoT capabilities including vibration, temperature, positioning, and inspection analysis is evolving in multi-axis machining. Mazak’s SmartBox is an effective way to securely manage data like this.

With this product, Mazak has put the security of its machine network in the hands of the people that should be in charge of it, the I.T. department. “We needed I.T. to take the edge of the network from the office to the factory floor and provide the same kind of security

and analytics but separate it,” Derosiers said.

In short, the SmartBox is a condensed, “three-layer managed switch” similar to what is typically found in a computer room. In manufacturing, the Smartbox can protect up to 10 machine tools on a single box. The user can even isolate groups or cells and allow only the data he or she wants to go through the system.

For example, let’s say you get a virus on a machine in the network from a USB jump drive. Not only does that machine tool get infected but every other machine on the network is potentially at risk. “The last thing you want to happen is someone comes into the shop with a laptop (and malware) and takes down your entire network,” Derosiers said. “So we’re doing more than just data acquisition, we’re isolating machines not just from the office, but from each other.”

This technology is a spinoff of Mazak’s iSmart Factory, the complete digital integration of its Kentucky plant with state-



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of-the-art equipment, automation and IIoT capabilities. In fact, Derosiers says that the SmartBox is now a part of the daily tours that take place at the facility.

“We’re talking about all of this highly-critical information and analytics moving around the shop floor and whether or not our customers feel they have a secure, trouble-free network that connects it all. It’s really a risk assessment, and something every manufacturer should pay close attention to moving forward.”

DMG MORI CELOS Platform Creates New Opportunities

The drive for Industry 4.0 is causing a paradigm shift in the machine tool industry that has never been seen since the advent of CNC. Jeff Wallace, general manager, 5-axis Center of Excellence at DMG MORI USA, says that the push for getting machines “online and accessible” is being pushed by customers and the quest for real-time information during the manufacturing process is critical.

“DMG MORI’s CELOS control platform is allowing us to develop our next generation of machines incorporating many of the i4.0 requirements. In fact, many of our existing machining platforms already incorporate many of the i4.0 technologies,” Wallace said.

Almost all DMG MORI machines are being offered with its CELOS control platform, and the company has the ability to incorporate its machines into almost any MRP and/or ERP system infrastructure, either existing or in the

future.

“Our machine platforms are being designed with “intelligent” systems to self-diagnose problems, either mechanical or the cutting processes, and notify the shop manager or the maintenance engineers of existing or potential problems. Armed with this information we are helping the customers avoid costly problems before they arise,” Wallace added.

With the ability to monitor the machining process, Wallace said the



The Mazak SmartBox can manage machine tool analytics including vibration, temperature, positioning and inspection analysis. Photo courtesy of Mazak.

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company can give engineering teams critical information for the production of their components. With the ability to evaluate the quality of the gear geometry on the machine, they can make dynamic adjustments and produce quality components every time.

Enhanced metrology is one area that is greatly improving for machining centers. Wallace said that the ability for closed-loop-feedback during the manufacturing process allows the machines to compensate for cutting conditions that are out of the “normal” range or compensate for tool wear. Systems like high-speed 5-axis scanning, blue light or laser systems make on-machine metrology easier to justify.

According to Wallace, the great debate has always been, “Should you use your machine as a CMM?” “With the speed of the new systems and the machines ability to make closed-loop adjustments, the need for the machine to check the part is critical to the success of i4.0 and much easier for the customer to realize.”

Another area of improvement is the evolving technology of human-machine



The CELOS control platform allows the development of DMG MORI's next generation of machines incorporating many of the Industry 4.0 requirements. Image courtesy of DMG MORI.

interfaces (HMI). “As we have seen over the past decade, the HMI (smart phone technology, for example) has moved to a predominately touch based system and humans are re-teaching themselves to take advantage of the new HMI. For the most part, the technology exists to make a very sophisticated HMI, but the (re)

training of the human and the paradigm shift is a significant challenge.”

This comes down to breaking bad habits and bad behavior that has been learned in the past 50 years in manufacturing. Wallace said that the new generation of machinists and manufacturing engineers are growing up with the new

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HMIs, so their adoption of the new technology is much faster. "It's the legacy that we have to deal with and incorporate," he added.

And where will some of these new innovations show-up in terms of gear manufacturing? DMG MORI's Mill Turn series is an interesting platform for gear milling today. The company's CTX, NTX and DMU series incorporate milling functionality as well as turning capability.


"Our *gearMILLING* software and our technology cycles with advanced HMIs make gear production much easier than the old gear table based "black-box" machines of the past," Wallace said. "These are quickly going the way of the whale oil industry as customer's demand multi-tasking platforms that can produce more than just gears."

And remote monitoring is becoming more the norm across manufacturing industries. Working with several metrology companies, DMG MORI is developing remote monitoring apps to evaluate the data as the parts come off the machine or monitor during the manufacturing process.

"Another "app" gives us the ability to monitor and adjust high pressure coolant systems in real-time, allowing the user to control their process much closer. The possibilities are limitless; it will be the customer who drives the need for the technology," Wallace said.

DMG MORI plans to cultivate this technology not just with help from its customer base, but also through partnerships with the National Institute for Metalworking Skills (NIMS) and with the control manufacturers.

This gives the company the ability to design systems that work with today's engineers and operators, but also allows the design of new systems that will work in the future.

"We have the ability to work with the schools so they can prepare the training courses for the next generation of users," Wallace added. "This way, we all win." 

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