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The Factory Floor Gets Smart

By Stephanie Neil

There is an ocean of information flowing through your manufacturing facility. But the data sits snagged within the ebb and flow of production, unable to reach the surface of the enterprise. You—the plant manager, or IT manager, or CEO—have been fishing for ways to hook into that valuable information swimming in the manufacturing abyss, because it could change the way your business operates. It is the missing link you need to tie customer demands directly to the actual production cycles, in real time.

Getting to all that information has been hard to do. Homegrown approaches aggregate but don't disseminate data. And while any old manufacturing execution system (MES) or data historian could pass a boatload of information into an enterprise resource planning (ERP) system, that doesn't solve anything. You need the right information—quality, not quantity.

Help is coming. If you haven't noticed, a slow evolution is happening. The build-out of Ethernet IP industrial networks, flexible control architectures, and layers of data-collection applications are spawning a new breed of software analysis and integration tools that will change the view from the top by providing new visibility right to the depths of that bottom layer.

The change agent behind this evolution is manufacturing intelligence systems—a distinct category from business intelligence systems. "The distinction we see is that [manufacturing intelligence uses] real-time event data," notes Bill Swanton, vice president of research at AMR Research Inc. (Boston, MA). "The business intelligence world tends to deal with pure transactional information, whereas enterprise manufacturing intelligence takes real-time events and correlates that to other data to show the transaction in context."

These systems can take many different forms. Traditionally, a data historian has done a good job of analyzing data from the perspective of time and sequence of events. More recently, moving into this space is middleware and operational equipment efficiency (OEE) applications, and even neural network technology—a set of mathematical instructions that "learn" the process to produce a predictive model. Each of these tools sits on top of existing control architectures with the intention of squeezing more value out of legacy systems. "All of these products have a role. What they are doing is pulling data together from a variety of sources, processing it, and creating a transaction for ERP. They are feeding the beast," says Swanton.

These manufacturing intelligence tools are companion components for the intelligent control and network infrastructure of the plant. Many companies, including Executive Manufacturing Technologies Inc. (EMT; London, Ontario, Canada) and Lighthammer Software Development Corp. (Exton, PA), categorize their products as universal data collection and connectivity tools. But they are much more than that. "These are tools to explore data and discover why there are inefficiencies in a line," says Robert Lendvai, vice president of marketing at EMT. "It is empowering the team with [new] visibility...allowing them to build a better product with less resources and less time."

EMT's VisualPlant version 4.0, released this past September, is based on [Microsoft Corp.](#)'s .NET architecture. This architecture supports new reporting capabilities based on XML that allows customization, filtering, and new formatting options. It also includes the ability to summarize, archive, and purge data down to the item level based on a specified set of rules, customized alarms, and an enterprise administration feature for multi-plant implementations. This release also includes third-party plug-in modules. One is a gateway that collects and feeds real-time data from the plant into business systems like ERP and computerized maintenance management systems (CMMS), and the other is a statistical process control module. Toyota Motor Manufacturing Kentucky Inc. (TMMK; Georgetown, KY) recently bought the VisualPlant solution in order to gather and analyze production information across multiple sites globally (see business case study, page 26). But the flexibility of the model is advantageous at the local level, as well. "The demands on the plant change on a weekly basis," says Lendvai, "requiring constant changes to software code. VisualPlant is point and click, drag and drop."

Similarly, EMT competitors like IndX Software Corp. (Aliso Viejo, CA) and Lighthammer offer Web-based collection and analysis tools, making the software solutions easy to deploy and easy to use. "People have been able to do this [in the past], but it required complex programming mainly in the days before the Internet," says AMR's Swanton. "What's happening now is that a couple of things are coming together. There is better configurable software for putting together a chain of events in order to understand the data and draw inferences from it. That's the main value."

Indeed, these tools actually deliver results. Glen Lawson, production manager at SpaceKraft, a Weyerhaeuser Company (Federal Way, WA), was looking for a way to identify the specific quality problems with machinery at its containerboard plant in Salem, Oregon. In order to identify where constraints were, he used a tool from [Rockwell Automation](#) (Milwaukee, WI) called PlantMetrics.

"The information PlantMetrics gives you helps you understand how well you are utilizing assets," says Lawson, pointing out that you can't fix a problem until you understand it. That's where PlantMetrics changed his view of the plant. "It gathers data, sorts it in a way that we can understand our business, and builds reports in the way we want." But more than that, Lawson was handed the right data, he says. "And as a result, we are able to make better business decisions on how to utilize capital dollars."

The PlantMetrics software allows for the configuration of data for OEE measurement and event tracking, including a reporting front end. That data is collected in a database using Rockwell's RSSql transaction engine to pull data out of the control layer. "The whole idea is to be able to capture meaningful data from the control system, store, and analyze that data for people to act on," says Todd Smith, PlantMetrics product manager at Rockwell Automation.

There are also emerging technologies that can be used in conjunction with data collection applications to produce a more accurately controlled process. For instance, Pavilion Technologies Inc. (Austin, TX) offers a neural net-based technique that runs on a standard PC, but works on top of a distributed control system (DCS) or programmable logic controller (PLC) connected via drivers and the standard Ethernet TCP/IP protocol. It views the data that has already been collected off of the plant floor and applies a mathematical model that learns the process and cleans out the data that may distort it, thus eliminating the variation inherent within the control process. "The bottom line is to produce an obedient plant," notes Ian Steele, Pavilion's vice president of strategic development. "Once the software understands the process, it can build new relationships based on that model."

Another modeling technology, not based on neural net architectures, comes from Aegis Analytical Corp. (Lafayette, CO), a private company funded by the pharmaceutical and biotech companies for which its product suite, called Discoverant, is designed. Discoverant pools information from the islands of systems that populate the plant floor such as quality, laboratory information management systems (LIMS) and other lab information systems, SCADA, and even ERP. But more than just retrieving the data, it finds relationships.

"We see if we can understand what is interacting with what to produce a certain outcome," says Dr. Justin Neway, Aegis' chief science officer. "For example, say you are making a tablet and halfway through you see the process is not producing the same profile of the final product, but batches haven't failed yet. You have to look into the process data and see if you can understand what is different from when you were getting a successful [batch] versus one that is out of control." Neway calls this "data-intensive decision-making". It is very different, he says, from what has been known as decision support, which typically relies upon the data residing in one data warehouse.

redicting how a process will react is an important element in efficiency, as SpaceKraft's Lawson knows. But it's the ability to interpret and take advantage of that new information that now weighs heavy on his mind. Lawson's latest initiative is to find a way to systematically gather data across the entire corporation, and funnel that information—the right information—between the plant and enterprise systems.

The vendors in this space understand Lawson's dilemma. For its part, Lighthammer recently formed an alliance with webMethods Inc. (Fairfax, VA), which has an enterprise integration platform. A new adapter between Lighthammer's Illuminator manufacturing intelligence tool and webMethods will instantly offer a way to move the appropriate plant data into hundreds of different enterprise systems that webMethods currently works with.

Another middleware solution, from a company called Starthis Inc. (Rosemont, IL), sits at the enterprise level in a Java 2 Enterprise Edition (J2EE) application server. Using an IP address to tap into devices on the industrial network, it is a way for the information technology (IT) department to monitor and act upon what is going on in the manufacturing facility without overstepping IT's boundary and making changes.

Starthis took the "top down" approach in an effort to alleviate the most obvious pain point. "Manufacturers have enormous headaches dealing with the diversity of systems," says David Naylor, CEO of Starthis. "They are trying to find ways of dealing with different facilities in a more uniform manner."

But the company is rapidly expanding its offering to address headaches of plant managers, as well. Starthis recently received a grant from the National Institute of Standards and Technology (NIST; Gaithersburg, MD). The money will be put toward the development of a tool set for plant engineers to quickly reconfigure their control systems to react to the changing needs of customers or suppliers.

Regardless of the approach, the idea is on target: find the right data, hook it, reel it up to the surface of the enterprise, and make way for a new business model that is guaranteed to succeed. "In the beginning, I never realized the wealth of information out on the floor," says SpaceKraft's Lawson. "Now that we are starting to gather it and slice it and dice it I can see the kind of quality [data] we have." MA

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