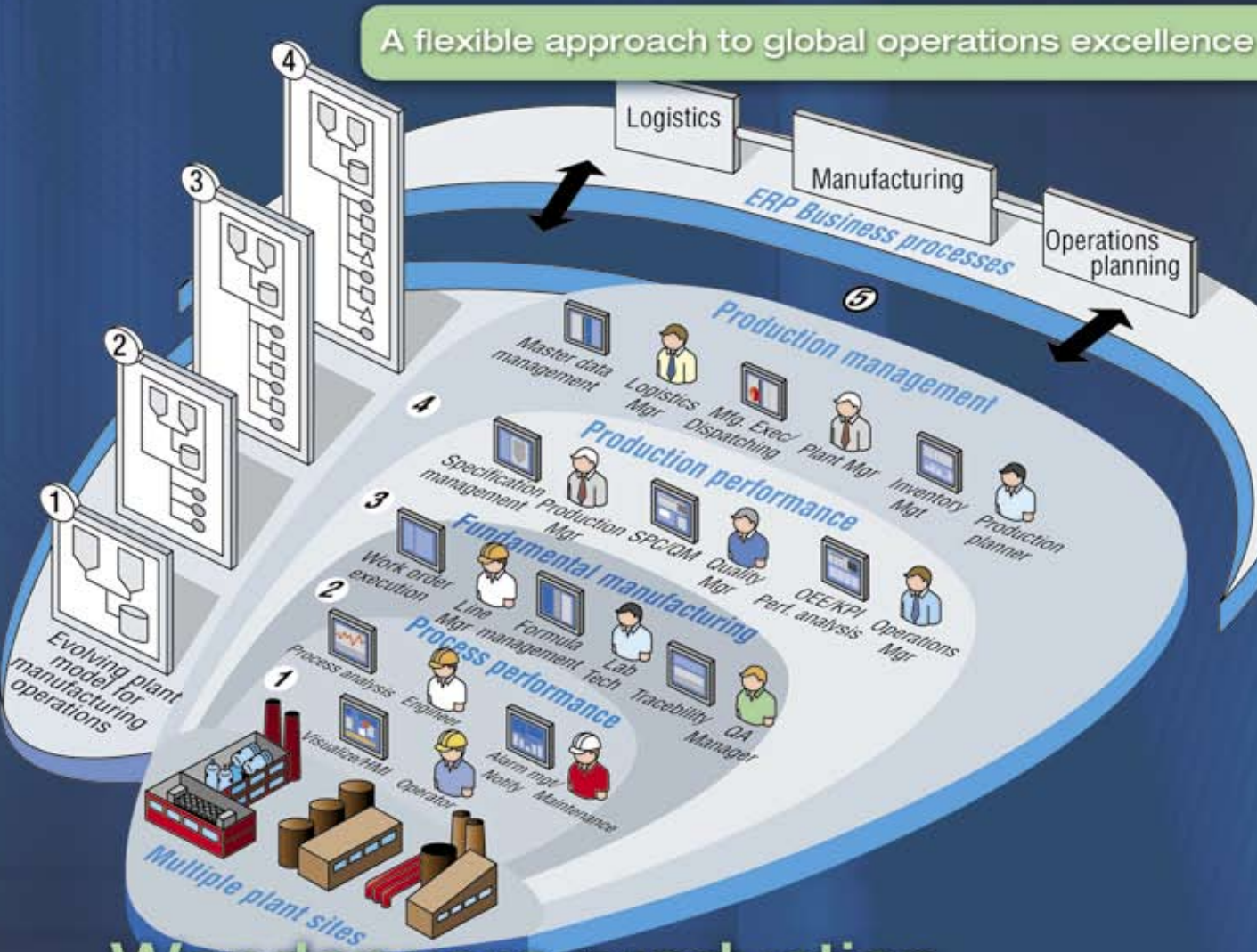


Manufacturing Business Technology

IT FOR MANUFACTURING EXECUTIVES

A flexible approach to global operations excellence



Wonderware production and performance management software solutions

- Connect plant floors with the enterprise
- Scalable production execution and performance practice joined
- Functional modules for batch, tracking, quality, and more
- Microsoft technology infrastructure-based

What IT professionals should know about manufacturing

An industry standards-based software framework provides global operations management that transcends limits of MES model

Of all the industries where information technology (IT) has transformed how work gets done—from banking to health care to utilities—manufacturing is unique.

In manufacturing, IT's sizeable productivity benefits can be expressed clearly in terms of, for example, reduced inventory or improved throughput. On the other hand, manufacturing plant-floor processes—some governed by the need for deterministic, millisecond response rates—

use of technologies common across industries. Today, even special-purpose computers are built using industry-standard hardware and operating systems.

This is so much the case that it's been said Microsoft's presence on plant floors today is as pervasive as it is on the desktop.

Most recently, a new generation of industry standards—for Internet, Web services, and service-oriented architecture (SOA)—is delivering heightened levels of systems integration, process flexibility, and inter-enterprise collaboration. IT professionals in manufacturing need to understand that these very same standards are being applied to plant-floor challenges.

These standards are the means by which:

- Plant floors and the business enterprise establish bidirectional communication;
- Operations are managed—not as isolated units of production and silos of information—but rather as the nexus of a web of real-time information, allowing optimized production based on known demand and secure supply; and
- Enterprises with production capacity located the world over will achieve the quality implied in the term *global operations management*.



“Globalization and enterprise system maturation have led to a new approach to production and performance management.”

—Mike Bradley, president, Wonderware business unit of Invensys

have a special vocabulary and their own proprietary technologies, such as programmable controllers (PLC).

But while proprietary solutions once ruled the roost, needed efficiencies led manufacturers to make greater

use of technologies common across industries. Today, even special-purpose computers are built using industry-standard hardware and operating systems.

This is so much the case that it's been said Microsoft's presence on plant floors today is as pervasive as it is on the desktop.

Most recently, a new generation of industry standards—for Internet, Web services, and service-oriented architecture (SOA)—is delivering heightened levels of systems integration, process flexibility, and inter-enterprise collaboration. IT professionals in manufacturing need to understand that these very same standards are being applied to plant-floor challenges.

These standards are the means by which:

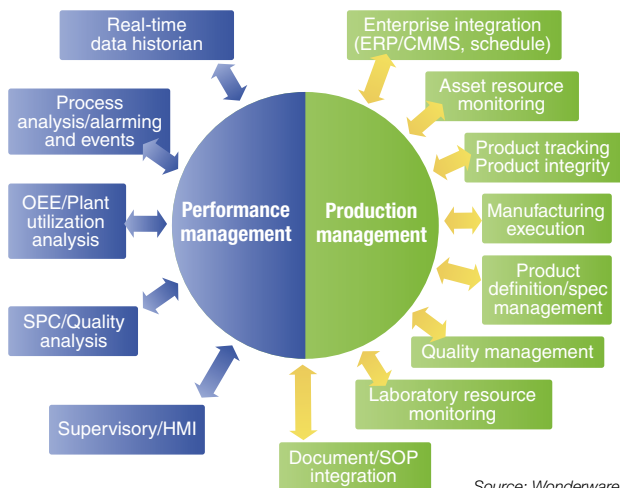
- Plant floors and the business enterprise establish bidirectional communication;
- Operations are managed—not as isolated units of production and silos of information—but rather as the nexus of a web of real-time information, allowing optimized production based on known demand and secure supply; and
- Enterprises with production capacity located the world over will achieve the quality implied in the term *global operations management*.

“Globalization and enterprise system maturation have led to a new approach to production and performance management,” says Mike Bradley, president of the Lake Forest, Calif.-based **Wonderware** business unit of Invensys. “The goal is for a company to be able to truly say what it's capable of producing, and what its ability to put product on store shelves is. As part of those efforts, a company identifies best practices aimed at process optimization, and puts structures in place that allow manufacturing flexibility at a reasonable cost.”

Wonderware® Production and Performance Management Software Solutions comprise an integrated software offering built on the open and scalable Archestra® industrial automation and information software architecture. Wonderware Software Solutions facilitate global operations management based on sustainable integration of plant-floor, enterprise, and supply chain systems.

“What we have,” says Bradley, “is production execution and performance practices joined in a single scalable system, including a robust manufacturing

A single model for plant-floor information management



By combining production and performance management in a single data model, duplication of data is eliminated, and efforts aimed at global operations management are synchronized.

system platform, and functional modules for such things as batch operations, work-in-process tracking, and quality management—chosen by the user based on the scope of the engagement.”

The system platform provides common application services, including the distributed applications processing and deployment services in the Wonderware Industrial Application Server; high-performance record-keeping in the IndustrialSQL Server™ historian; and performance content integration with enterprise Web portals via SuiteVoyager™ Web content software.

“Yet despite the technology innovation involved,” says Bradley, “this is a solutions-based approach with pre-defined and reusable application templates that address specific problems.”

Even today, 14 brand-name manufacturers in the consumer goods, aerospace, electronics, and other industries are engaged in global rollouts of Wonderware Software Solutions, involving 356 production plants, and with individual rollouts encompassing as many as 50 plants.

IT professionals thus have an opportunity to make a real contribution to their companies’ success based on the latest proven IT advances and recognized industry standards.

Yet to have such a positive impact, it’s important to first understand: a) how the nature of production is evolving due to globalization; b) the emerging IT infrastructure that supports legacy-system investments in the face of rapidly changing manufacturing industries; and c) the power of a unified production and performance solution that delivers consistent, real-time visibility into manufacturing operations, including orders, material, equipment, and production for use by all manufacturing disciplines.

Global operations management

Given explosive growth in emerging consumer markets, and in the productive capacity of developing global regions—as well as consolidation of regional and midsize manufacturers by means of mergers & acquisitions—the manufacture of brand-name goods has become a truly global endeavor. And for both cost and branding purposes, managers must ensure the same high quality regardless of where product is made.

Even midsize companies, squeezed by competition from low-cost labor regions, must deliver heightened service levels to important customers, and face the same pressures to improve operations. Thus, global operations management begins by aligning production with strategic business objectives, whether within a single-plant or multi-plant enterprise, and then extending out to customers, suppliers, and other business partners.

Bob Mick, VP of emerging technologies at Dedham, Mass.-based **ARC Advisory Group**, says a fundamen-

tal change is taking place in the way supply chains operate. Sharing forecasts on product usage is giving way to the exchange of data on actual usage—which requires the supplier to take responsibility for replenishment.

Two fundamental information flows in manufacturing

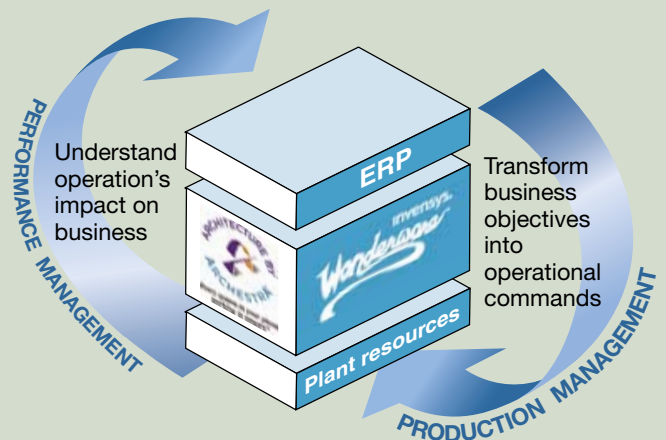
Wonderware Production and Performance Management Software solutions help manufacturers 1) transform business objectives into operational commands; and 2) understand how operations impact the business.

The production management information flow proceeds from the business system to the plant floor, transforming production schedules into operational commands within physical resources, including the following:

- Downloading and execution of the production schedule;
- Master data management for manufacturing operations such as recipes, bills of material, and quality specifications;
- Local dispatching of production work orders to lines and machines according to available capacity;
- Tracking and analysis of work-in-process and plant inventory; and
- Downloading equipment set points and coordinating sequence of operational activities.

The performance management information flow proceeds from manufacturing resources to the business system and sends combinations of this real-time information to users across the enterprise, including the following:

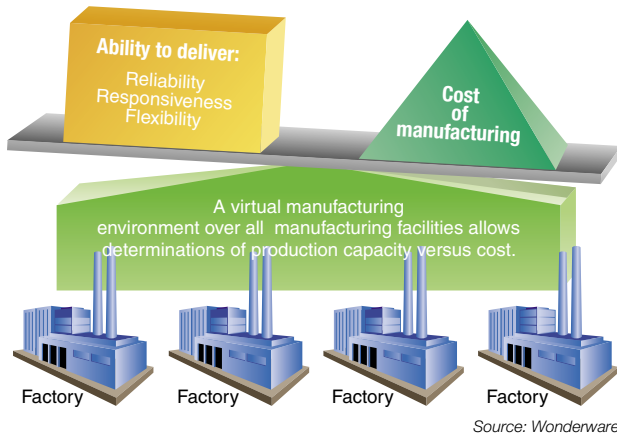
- Real-time data collection;
- Alerts, process analysis, traceability, and genealogy;
- Operational key performance indicators (KPI); and
- Equipment availability and use.



Source: Wonderware

What a performance management solution should do

Manufacturing decisions based on ability to maintain supply/market share versus cost to manufacturer



All manufacturers must balance the need for flexibility as a means to greater responsiveness versus the costs involved. Wonderware Software Solutions systematically reduce the costs of achieving needed flexibility.

“In a truly lean supply chain,” says Mick, “there’s no room for forecast error. Luckily, manufacturers today can benefit from mature technology at affordable prices, enabling them to implement a range of strategies based on information networks and networked individuals.”

One key element in this dynamic is the maturity of today’s enterprise systems. A single instance of enterprise resources planning (ERP) today can be applied to an entire global enterprise, even taking into account needed regional differentiation. And in older ERP installations, use of middleware to achieve integration of heterogeneous systems means it’s easier to aggregate information from diverse plants to compare operations.

This newfound capability—combined with the need for continuous business improvement—has led to increased interest in key performance indicators (KPI) as agreed-upon parameters for management use. According to Boston-based **AberdeenGroup**, users are looking to a new generation of manufacturing execution and intelligence systems—combinations of business process models and rules, workflow technology, Web services, SOA, libraries of component applications, and industry standards—to manage production and to collect, aggregate, and contextualize performance data for display in custom reports or dashboards.

The beauty of Wonderware’s approach is that it combines, within a single framework, solutions for both:

- Production management: the ability to identify and execute operations changes required by evolving business objectives and market demand.

- Performance management: the ability to monitor and understand how operations impact business goals and finance (See sidebar, *Two fundamental flows in manufacturing*).

A good example

Wonderware’s approach offers a highly scalable infrastructure and architecture for production and performance management that enables low-risk deployment of increased application functionality, one step at a time.

“Wonderware differentiates itself,” says Tim Sowell, a Wonderware VP, “by using technology to match both the scope and scale needed in a particular manufacturing industry and company. Users starting with a single application module easily extend and expand functional scope, evolving the original application with new modules at their own pace—from basic manufacturing execution and performance analysis to supply chain coordination and optimization.”

Scalability, from a single production line to a multisite manufacturing enterprise, follows from having a common data model as a single source of agreed-upon information that can be used for many different purposes.

Bocholt, Belgium-based **Brouwerij Martens** is the third largest brewery in a country that boasts more than 400 of them. More than 80 percent of Martens’ business targets the private-label beer market, a highly competitive, volatile environment characterized by low margins, high volumes, and constantly changing requirements.

“We need actual and real-time reflections of operational results,” says Paul Bloemen, IT manager. “This means we need systems that model our fully integrated value chain, from the trucks supplying malt to the brewery to the trucks delivering finished product to the customer.”

Besides addressing immediate needs, Bloemen wanted Wonderware to lay the groundwork for a new way of operating that would help it stay ahead of competitors. To do so, Martens needed the following:

- A seamless, unified IT infrastructure incorporating both business and production systems, and based on an open architecture;
- Improved recipe management, and full lot tracking and tracing for regulatory and other purposes; and
- Expandability, flexibility, and user-friendliness.

Integrated to ERP and supply chain systems, Wonderware’s Production and Performance Software Solution at Martens comprises critical functionalities, including batching, tracking, monitoring downtime, and quality control.

System platform & functional modules

At the heart of the system platform is Industrial Application Server, the core application development and deployment component for Wonderware Software Solutions, and a unified environment for harmonizing plant history, security, visualization, device communication, and applications integration.

“Wonderware’s Industrial Application Server is flexible and extensible, and can cope with diverse systems,” says Bloemen. “We can extend it to other areas of the brewery like fermentation/filtration, and the filling and packaging lines, and also implement our standards over there.”

Industrial Application Server simplifies development, deployment, maintenance, and administration of distributed automation applications. At Martens, the full range of production and performance tools includes Wonderware Enterprise Integration Application, InBatch™, InTouch®, InControl®, and IndustrialSQL Server historian.

The historian, an extension of Microsoft® SQL Server, is a second “core element” of Wonderware’s system platform. It combines the power and flexibility of a relational database with the speed and compression of a real-time system—serving as a high-performance, real-time and historical database for supervisory control or time-oriented factory data. The historian and associated analysis tools give decision makers immediate access to detailed plant information that leads to performance improvement.

At Martens, the result is more critical production information for consumed raw materials, produced beer, and quality characteristics. “All this information is communicated automatically to the ERP level,” says Bloemen, “which means we also have easy access to complete, accurate, real-time information for inventory management, lot tracing and tracking, and production costing.”

Not incidentally, adds Bloemen, “We raised the output of the brew house by 2.5 percent, meaning one to two extra brews a week.”

The power of portals

A third core element of Wonderware’s system platform is SuiteVoyager software.

Built on Microsoft SharePoint Services technology, SuiteVoyager brings together all production and performance information pertinent to the plant in a single portal environment for Web-based access, and one that integrates easily with other portal systems, including mySAP Portal and Microsoft SharePoint. In its latest version, plant information can be shared with existing manufacturing enterprise Web sites, facilitating access to both the business and plant in a single view.

As a plant-information content server, SuiteVoyager

software opens up to a broader set of interested parties the pursuit of global operations management, allowing collaboration based on real-time, consolidated manufacturing performance and business information that leads

An industrial-strength approach to plant-floor security

IT professionals must concern themselves with the security risks that follow from increased complexity of manufacturing IT systems. Wonderware sees five primary elements to the security ecosystem, as follows:

- Comprehensive security-model definition;
- Group- and role-based security;
- Data-level security enforcement;
- The defined security model; and
- Secured writes and verified writes.

Operating system-based security for Wonderware products ensures there is one means of authentication across the board, allowing their use even within complex network environments having multiple security zones, firewalls, and VPN access points. Industrial Application Server’s security model is enforced at the data level with full traceability of run-time changes, and with a client-independent access layer on top of automation hardware. Security can be defined down to the object-attribute level.

The Industrial Application Server also promotes engineering reuse through application objects that represent physical equipment or logical constructs, containing all associated configuration elements, including I/O definitions, logic and scripting, history configuration, and security and access controls. In contrast, traditional I/O tag-based approaches segment configuration information into different databases, requiring multiple editors and multiple security schemes. Application object security resides within the definition found in Industrial Application Server. When a security or other definition is changed, it need only be done once.

The Industrial Application Server’s approach to security is appropriate for applications impacted by FDA 21 CFR Part 11 requirements. Secured Write operations require an operator’s permission. The destination object verifies the credentials. Only then is the Write performed, logged, and reported back to the operator station. For Verified Write, a user reenters the password, and the definition object verifies the credentials and performs the Write.

Other key security features of ArcestrA technology include the following:

- Protocol security (Message Exchange/MX), a secure implementation of TCP/IP sockets;
- Device integration objects (DI Objects) that encapsulate OPC® (DCOM-based) servers and other protocol-based servers to integrate with the ArcestrA architecture’s data-level security; and
- Networkwide security as a result of the architecture’s global namespace.

to better decision-making and increased productivity and profitability.

Other elements of Wonderware Software Solutions include the following:

- Rich *process analysis tools* for trending, troubleshooting, and reporting maximize the value of data stored in IndustrialSQL Server historian.

- Modules for *equipment operations* increase consistency and reliability of operational activities, and capture and distribute complete “as-built” records of what was produced, including traceability across multiple production processes.

- Modules for *equipment performance* identify hidden production capacity and overall equipment effectiveness (OEE) by pinpointing causes of equipment downtime or slowdowns.

- Modules for *manufacturing quality* prevent—rather than correct—potential production losses by proactively monitoring real-time process and product variations, using a complete set of statistical process control (SPC) capabilities.

- Modules for *manufacturing execution* enforce production rules based on accurate tracking and control of work-in-process, inventory, resource use, and conformance to specifications.

Finally, Wonderware is the only vendor offering production and performance management capabilities built and integrated using a single, open, and scalable software environment—the ArchrA industrial automation and information software architecture. Built on Microsoft .NET XML/Web services and Windows Server technologies, ArchrA technology facilitates the rapid assembly of reusable applications, as opposed to laborious engineering and time-consuming recoding for what are essentially iterative applications.

As recently indicated by **AMR Research**, ArchrA “provides a model-based architecture that extends beyond autonomous local manufacturing to facilitate construction, deployment, configuration management,

and maintenance of operational excellence systems that can span highly distributed production assets and legacy software.”

The Wonderware Enterprise Integration Application goes beyond basic connectivity and adds transactional integration capabilities—including sending and receiving messages, data mapping, and transformations—while controlling the sequence of operations as required to keep applications interconnected and up-to-date. Key is the ability to manage the information required to prioritize, dispatch, and sequence work orders with sufficient details for correct operational execution.

With full support for industry standards such as ISA S95 and B2MML, Enterprise Integration Application leverages Microsoft BizTalk Server to seamlessly integrate with dozens of manufacturing, automation, and ERP systems—virtually out of the box, with built-in integration templates. This integration with ERP and supply chain management systems is the means to notify the wider world about plant-floor activities and needs.

The result, says Kevin Tock, Wonderware VP of MES and Production and Performance Management, is to transform the art of the possible. Imagine a situation where an enterprise system posts a requirement to the manufacturing execution system. The required action can’t take place, however, because a resource is unavailable due to equipment breakdown.

Instead of the requirement just queuing pending management action, the production planner is alerted for immediate action and the maintenance system is sent a “fix-it” message—entirely without human intervention. “And you don’t have to wait two hours to find there’s a problem,” says Tock.

Rapid rollout

The concept of global operations management has come to the fore due to brand-name manufacturers that require a firm grip on production and quality in plants found all over the world. Those that choose Wonderware

Since 1987, a commitment to Microsoft technology

Wonderware has a long-standing alliance with Microsoft, enjoying Gold Certified Partner status in the Microsoft Partner Program. Companies that obtain this level of certification have a successful record of developing and marketing software based on Microsoft technologies, which Wonderware has done since 1987. Today, says Chris Colyer, Microsoft industry director for process manufacturing, Microsoft technologies dovetail with Wonderware solutions to help manufacturers in three key areas.

- **Integration:** linking enterprise business systems to manufacturing systems through Microsoft products such as BizTalk Server and

Windows Communication Foundation.

- **Collaboration:** delivering role-based information to individuals within the organization, providing them with the data they need through Microsoft SharePoint Portal Server and related technologies.

- **Analytics:** transforming data into actionable information, with products such as SQL Server 2005.

“With Wonderware, Microsoft has a strong relationship with a strong partner—and as Wonderware’s focus extends beyond how manufacturers do things, to how they manage them, that partnership can only become stronger,” concludes Colyer.

Production and Performance Software Solutions as the means to accomplish multisite global operations excellence enjoy a distinct advantage in that the common architecture and the layer of abstraction it brings make it easy to duplicate initial implementations in increasingly rapid cycles.

Wonderware Software Solutions also are optimized for rapid rollout by employing reusable software templates and accelerated implementation methodologies to deliver benefits in the fastest possible time frame.

"Without reusability, it's impossible to roll out to a large number of plants," says Bradley. "Even doing 10 plants a year, with 50 plants worldwide, it could take five years to complete the rollout. That's simply not fast enough."

Get the project moving with a core set of capabilities, recommends Bradley, and then go back and fine-tune the earlier plants once the lessons from implementing the first several have been learned. "With our integrated architecture, going backward is as simple as going forward," he adds.

For fastest results, Wonderware also recommends bringing together expertise from the corporate IT and manufacturing IT functions as early as possible in the implementation.

"There's a huge gap between the language the corporate IT people speak, and the language the automation people speak," says Tock. "We can help the two groups work through a common terminology, define what really matters, what adds value—and what doesn't."

Concluding remarks

Global operations management is a concept that Wonderware Software Solutions actualizes to deliver business benefit based on having the means to synthesize real-time information drawn from plant, enterprise, and supply chain systems. Combined with production and performance applications, manufacturing analytics, and business intelligence, manufacturers can sustain improvement programs, compare performance across plants, extend capacity use, and have the necessary information for good investment decisions.

Wonderware, a pioneer in bringing Microsoft technology to the plant floor, also is the leader in helping companies achieve global operations management and the greater productivity benefits that follow from it.

Wonderware is a business unit of U.K.-based Invensys, and is the world's leading supplier of industrial automation and information software. Its software products and solutions are based on the ArcestrA architecture from Invensys. Other Invensys brands include APV, Avantis, Eurotherm, Foxboro, Triconex, and SimSci-Esscor. For fiscal year 2004-2005, Invensys

reported sales of approximately \$4.4 billion.

To learn more about exciting opportunities to achieve global operations excellence based on proven IT standards, visit <http://www.wonderware.com/products/ppm>. ■

Powered by the world's leading enterprise vendor

SAP is committed to a thriving ecosystem of partners—and Wonderware, as a strategic manufacturing partner of SAP, is very much a key part of that ecosystem, says Russell Fadel, VP of application solution management for manufacturing, SAP.

Wonderware and SAP complement each other in several key areas, says Fadel.

First is "standards-based transactional integration." Wonderware "Powered by SAP NetWeaver[®] certification—"one of the highest levels of certification possible for a partner to achieve," explains Fadel, delivers seamless out-of-the-box interfacing between the execution and automation layers in a manufacturing company, and the enterprise master data that is SAP's domain.

Where short lead times and demanding levels of responsiveness leave little wiggle room, Wonderware and SAP work together to provide manufacturers with a single version of the truth, adds Fadel. "Master data at the enterprise level is synchronized with what's happening on the factory floor."

Wonderware and SAP jointly ensure manufacturers have access to a comprehensive manufacturing intelligence solution, rich in analytics and opportunities to profit from new manufacturing insight.

"We look to Wonderware to provide the manufacturing intelligence functionality that our customers require," says Fadel. "We may deliver the overall framework, but some of the metrics are populated by data captured by Wonderware applications."

Wonderware is a Strategic Manufacturing Partner of SAP, having achieved "Powered by SAP NetWeaver" certification based on two plant-to-business integration solutions. The first certified solution for process performance analysis links plant-floor information with the SAP manufacturing intelligence dashboards of the mySAP™ ERP solution. The second solution, for order processing, is part of the SAP certification program for ISA 95-based manufacturing interoperability.

Achieving "Powered by SAP NetWeaver" certification status is a further step for Wonderware in aligning with SAP's vision for adaptive manufacturing. Wonderware is committed to evolving its manufacturing production and performance management solutions to leverage the SAP xApp™ Manufacturing Integration and Intelligence (SAPxMI) packaged composite application. Wonderware is implementing these new software and integration solutions on its ArcestrA technology and underlying Microsoft technologies. This continuing evolution will increase the business value Wonderware can bring to manufacturers looking for increased agility and performance.