



### Smooth operators

How DuPont and others use plant historians for quality and other plant performance goals

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Salvatore Grasso, a Six Sigma Black Belt in **DuPont's** Engineering Control Instrument Group at the company's world headquarters in Wilmington, Del., says DuPont follows a "product-by-process" philosophy. What this means in practice, says Grasso, is that the giant manufacturer of chemicals, fiber, resins, and other science-based products takes process data and translates it into product quality information in near-real time.

"This gives us confidence that we are producing high-quality products since we focus on stringent control of the process," says Grasso.

Product-by-process requires a big dose of procedural discipline, but plant historian software also supports the concept. Monitoring critical variables such as temperature, pressure, viscosity, and flow—and pulling data from multiple plant-level instruments and analyzers—DuPont's plant data historian systems alert operators when selected process variables go beyond tolerances.

DuPont uses data historian software from Cambridge, Mass.-based **Aspen Technology**, also known as AspenTech. With about 200 AspenTech data historians deployed throughout its facilities worldwide, DuPont uses the historians to aggregate data from more than one million process variables.

"AspenTech's plant historian tools are tremendous Six Sigma enablers for us in predicting or immediately detecting when processes behave outside traditionally acceptable operating values," says Grasso. Having a means of detecting those deviations, adds Grasso, also helps keep plant execution on-track.

The trend in the plant historian market today comes down to a shift in the use of data historians from mere aggregators of process data to foundations for decision-making. Dr. J. Patrick Kennedy, founder and president of **OSisoft**, a San Leandro, Calif.-based vendor whose PI System is one of the world's most widely used solutions for plant information management, says historians should actually be thought of as part of an "intelligent plant infrastructure." Says

Kennedy, “The United States has more than 90 percent of the world’s intellectual property. To compete worldwide, our manufacturing facilities must have intelligent plant infrastructures to help them run as productively and efficiently as possible.”

While it’s debatable whether plant historian usage has truly made this leap into broader decision support, experts say there is no question that manufacturers need effective information repositories at the plant level. “Manufacturers need two levels of data aggregation: process-level data to analyze manufacturing processes and efficiencies, and business-level aggregation,” says Kevin Prouty, a research director at Boston-based analyst firm **AMR Research**.

### **Staying on goal**

With Dupont’s use of plant historians, aggregated data is passed up to supervisory-type systems, where quality management and advanced control applications respond to actual process events, and real-time process and quality information. “When the information is fed up to our information management systems, we might be looking for material consumptions and productions, or real-time yields, or real-time quality in terms of numbers of excursions, or the number of times a process variable exceeds a process limit over an interval,” says Grasso. “We employ what we call ‘lost production opportunity’ tests, where we identify whenever a batch operation takes more than its standard or demonstrated goal of execution.”

Data is then classified into acceptable or non-acceptable categories, and when a certain level of unacceptable performance is exceeded, analysis teams initiate remediation events.

DuPont uses a multiple-repository approach in a distributed architecture. Real-time, uncompressed data is stored for relatively short intervals; compressed data is stored on-line for between one and five years. Aggregated production performance information is stored at the enterprise level for up to five years.

AspenTech developed a “converged guidelines” solution for process information management that sits on top of the historian and translates data into product-specific information. “It converts real-time information into a real-time quality vector for a particular product,” says David Elley, product manager for information management at AspenTech.

Information from historian tools allows DuPont personnel to compare demonstrated process to the ideal model of performance, and then to discover root causes for unacceptable performance. Grasso says the overall goal is to be able to use “common tools applied in a common way with fairly broad application so our information is accessible to our engineering and plant operations community.”

### **Decision platform**

**Millennium Chemicals**, with world headquarters in Hunt Valley, Md., uses OSIsoft’s PI System plant historian and information management package to aggregate plant data into performance models that calculate metrics and deviations from thresholds. “We aggregate historical data over time into real-time information through score cards so plant managers have the tools for decision-making with a snapshot of how well their plants are operating in terms of production, quality, and key metrics,” says Steven Sarnecki, global director of process controls for Millennium.

To date, 10 of Millennium’s 15 global manufacturing facilities are using the PI System. “We track process control performance and variability indexes to compare one site to another,” says Sarnecki.

The PI System is able to normalize data without compromising its fidelity, says Sarnecki. Having this common, normalized data can bring specific benefits, he adds, citing a root-cause analysis of a process equipment failure at one site. "Instead of having everyone collect their data and bring it to the meeting and be forced to justify it to one another, we simply hooked up a projector displaying our PI data and dissected it with everyone watching. The unit was put back on-line about five times sooner than it would have taken traditionally."

Performance calculations can be done with the PI System, or data can be moved to Microsoft Excel spreadsheets. Additionally, some data is rolled up to higher-level systems, including to Millennium's enterprise system.

"The way in which we use the information has saved us money, and we've had tremendous improvements in reliability and reductions in cycle time because high-fidelity, real-time historical information is available to people when they need to make critical decisions," Sarnecki says.

### **New enhancements**

Software vendors offer numerous solutions to help manufacturers deal effectively with masses of plant-floor data. "The challenge in making data manageable is to reduce it," says Elliott Middleton, product manager for **Wonderware**, a Lake Forest, Calif.-based industrial automation software vendor. He cites one customer with about 9,000 process data tags and more than 21 billion values of stored history. "There's a lot of data, but not necessarily a lot of information until you do something with it to make it meaningful—like aggregating it into a statistical average or reducing it to some kind of summary information," he says.

Normalizing differences in equipment that produces similar products is something Wonderware's DT Analyst—focused on tracking downtime and equipment efficiencies—handles in conjunction with the company's FactorySuite products. Normalizing boils down to accounting for differences; for example, by expressing performance as a percentage of theoretical capacity, while considering different capacities of one line versus another. As Middleton puts it, "Our product normalizes that operational efficiency information across equipment and shifts to give a better understanding of how things compare."

Foxborough, Mass.-based industrial automation software vendor **Intellution**, recently acquired by Charlottesville, Va.-based **GE Fanuc Automation**, also offers solutions for manufacturing intelligence. The latest release of Intellution's historian, iHistorian 2.0, includes server-to-server capabilities. "The centralized server aggregates the data across multiple facilities so the corporate layer of the organization can make decisions about what products to build in one plant versus another based upon the efficiency levels of those plants," says Kevin Bernier, director of plant intelligence for Intellution. Intellution also is enhancing infoAgent, its Web-based tool for accessing, analyzing, and visualizing production information. The decision-support tool takes advantage of the archival and retrieval capabilities of iHistorian.

OSIsoft's Kennedy notes the company's PI 3.4 release has already tested at 1 million tags and 80,000 events per second. He says this new product, coupled with the power of Intel's 64-bit Itanium chip, will hit 10 million tags and 1 million events per second. Additionally, the company's new reporting package, FlexReports (for the 21 CFR Part 11 requirements), creates an audit trail. "You can clamp down on who made the report, when they made it, and what, if any, changes were made in the lab," Kennedy says.

### **Multiple factors**

Plant data historian software vendors agree that it takes discipline, not just software, to achieve plant intelligence. "You have to 'historize' enough of the data at the right frequencies over a

period of time that captures the various behaviors of a plant,” says AspenTech’s Elley. “This means adapting the accuracy and latency of the data to the requirements of each stage in the ISA S95 MES model [an industry standard addressing enterprise-to-control system integration]. Only then can you even attempt to understand how your plant manufacturing operation performs.”

Manufacturers operating multiple plants rely on Six Sigma quality improvement processes to extract as much value as they can from their manufacturing assets, says Bernier. “The only way a quality improvement team can do this is if they have good metrics, or good key performance indicators [KPIs] across all their plants,” he says. “Our iHistorian version 2.0 product has a robust calculation engine that allows users to automatically create quality and efficiency metrics from collected data tags and store them securely in the historian. Users can create similar calculations or metrics in multiple local historians to normalize data across different plants for the quality improvement teams.”

Historians can offer unexpected uses, says Todd Smith, product manager for Milwaukee-based **Rockwell Automation’s** Rockwell Software unit, which offers industrial automation software, including its RSBizWare Historian. Smith cites a customer interested in collecting data to improve quality performance who discovered that “the data historian, already collecting tremendous amounts of data, could help them eliminate the first few months of their Six Sigma process by mining the data,” he says.

Some vendors, however, warn that users need to carefully weigh core capabilities—like compression—when pondering plant intelligence. John Kalanik, president of Chicago-based **InStep Software**, which offers a plant data historian called eDNA, says the product uses a compression algorithm to accurately compress data for long-term storage. “It allows you to keep an accurate record of all that operational data, without clipping peaks or valleys, or taking out any of the meat of that data,” Kalanik says.

Plant historians, however, aren’t the end-all in manufacturing intelligence. As AMR’s Prouty puts it, “While the plant historian is still the core, we are seeing other integration capabilities throughout the entire enterprise, [connecting] to larger systems with more analytical capabilities, and with the ability to monitor the performance of an organization from the plant floor to the business office.”