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Predicting When Machines Are About To Fail

This is the third and final brief in our “Continuous Asset Management” series. By 2005, firms will be able to achieve near 100% uptime for their manufacturing assets and in-service products using predictive maintenance technologies developed by the Center for IMS.

How thrilled would customers be if they received a call saying, “We are coming tomorrow to fix your machine because it is about to break down.” This predictive maintenance -- the ability to predict and prevent equipment failures -- is becoming possible thanks to applied research done at leading academic labs like the University of Wisconsin-Milwaukee’s Center for Intelligent Maintenance Systems (IMS).¹

Forrester recently spoke with IMS Director Dr. Jay Lee, who is leading an industry-sponsored initiative aimed at helping manufacturers achieve near-zero downtime for industrial assets as well as increase the uptime of in-service products. How? By field-testing predictive maintenance technologies to (see the July 28, 2003 Forrester Brief “How Firms Can Get Value From Physical Assets”):²

- **Analyze real-time equipment data to detect problems.** Otis can’t afford its elevators inside the Eiffel Tower to fail, and TSMC can face \$100,000 in lost revenues for every hour its chip-making equipment is down. Because 65% of such equipment failure occurs between two scheduled maintenance visits, IMS has developed Watchdog Agent -- a neural-network-based prognostic tool that can *predict* degradation of devices and avert their breakdown by analyzing real-time performance data from embedded sensors.
- **Collect and share asset-related insights enterprisewide.** Because they lack insight into asset utilization, manufacturers suboptimize R&D, sourcing, and sales decisions -- like releasing engineering changes to the shop floor before an asset overhaul is complete. To allow software developers to integrate machine data with functional apps like ERP, SCM, and CRM, IMS is testing Java tools for app development and data synchronization -- so Ford’s ERP system automatically

cancels replenishment for metal in its River Rouge assembly line in Dearborn, Mich., if the stamping machine is about to fail (see the May 2002 Forrester Report “The X Internet Makes Manufacturing Flexible”).³

- **Outsource asset management responsibilities.** Half of ChevronTexaco’s plant operators will be retiring over the next seven years -- forcing the oil giant to outsource maintenance of its refineries to third-party service providers.⁴ To help capital-intensive manufacturers extend their asset management processes to suppliers and customers, IMS is deploying a Web services-enabled device-to-business (D2B) platform that can support distributed and collaborative maintenance -- with capabilities like remote device monitoring.

IMS Members Want To Use Its Technology To Preempt Asset And Product Failures

A National Science Foundation-sponsored IMS study has shown that manufacturers can save 51% in maintenance labor costs alone by using predictive asset management tools and techniques.⁵ Lured by significant cost-savings, the 45 IMS members are preparing for large-scale deployment of IMS technologies like Watchdog Agent and D2B -- after field testing them for three years. In particular:

- **GM expects to increase its shop-floor flexibility.** Honda can now launch new cars in less than 12 months and produce eight different models on one assembly line -- but GM’s development cycle is 18 months, and its plants are dedicated to specific models. GM is working with IMS to increase the velocity and flexibility of its factories. Its R&D engineers are using IMS’ prognostic tools to predict degradation or performance loss of production equipment in GM’s assembly lines.
- **KONE wants to keep its elevators humming.** KONE Corporation considers itself a “service company” -- despite being the world’s fourth-largest maker of elevators, escalators, and autowalks -- because 60% of its revenues comes from post-sale services like maintenance and modernization of its machines. KONE plans to embed Watchdog Agents in all of its elevators so they self-diagnose and initiate proactive service calls without human intervention -- allowing KONE to save in maintenance costs by cutting routine inspection and major repair work.
- **Wisconsin Electric Power (WEP) aims to prevent blackouts.** According to ICF Consulting Group, the economic costs of the August 14 power blackout -- the worst in US history -- could be up to \$10 billion.⁶ To prevent similar disasters, WEP plans to use predictive maintenance tools that analyze real-time performance data collected from its power generation and transmission units. WEP is using IMS’ Wireless Evaluation Tools software to test different wireless technologies and standards in the harsh environment of a power plant.

IMS' Predictive Maintenance Technologies Will Be Integrated Into Enterprise Apps

Forrester expects the vendors that sponsor IMS to incorporate its predictive maintenance technologies into their enterprise software -- and make it available to mainstream users. In particular, by 2005, firms can expect:

- **Rockwell Automation to deliver MES software with predictive analytics.** Looking to grow its margins, control systems vendor Rockwell is rapidly expanding its Manufacturing Information Solutions division -- acquiring major manufacturing execution systems (MES) vendors Interwave Technology and Propack Data. Expect Rockwell to add IMS' predictive analytics to its MES apps and sell them to regulated manufacturers in life sciences and consumer goods -- so they maximize their asset utilization while boosting FDA compliance.⁷
- **Siebel-powered call centers to contact customers -- before they call.** Siebel has quietly built partnerships with extended Internet technology vendors like Axeda Systems and R&D centers like IMS. Today, firms use Siebel's call center and field-service apps to receive angry phone calls from customers facing equipment breakdowns -- and to dispatch technicians to fix them. But by integrating IMS' predictive analytics into its CRM offerings, Siebel will make the scenario described earlier in this brief a reality.

¹ The Center for Intelligent Maintenance Systems (IMS) was jointly founded in 2000 by the University of Michigan at Ann Arbor and the University of Wisconsin-Milwaukee with a grant from the National Science Foundation. Its 45 industry members and sponsors include firms like GM, Intel, Hitachi, and Rockwell Automation. More info on the Center for IMS can be found at: <http://www.uwm.edu/CEAS/ims/>.

² To squeeze value from their operating assets, firms must embrace a continuous asset management strategy built on enterprise apps and processes that are extended, composite, and real-world-aware.

³ Today, the manufacturing shop floor is a black box. But by 2008, firms will connect physical shop-floor assets to enterprise apps using X Internet technologies and will manage manufacturing processes by exception.

⁴ Chevron's employees have an average age of 47, with half of the workers retiring by the end of this decade. Source: Chevron Now Online, Jan/Feb 2001.

⁵ The National Science Foundation-funded study shows that predictive maintenance techniques and tools can reduce routine inspections and major repairs from 85% to 24% of total maintenance expenses.

⁶ According to ICF Consulting, the economic cost of the 2003 power blackout could range between \$6.8 billion and \$10 billion. Source: http://www.icfconsulting.com/Markets/Energy/doc_files/blackout-economic-costs.pdf.

⁷ Source: Lou Agosta, "Data Mining Is Dead -- Long Live Predictive Analytics!," Giga Research, October 30, 2003. Data mining was challenged by tough economic times, but it died of disappointed expectations. After a perfect storm of bad economic news, data mining is regrouping around predictive analytics, with more modest expectations and improved technologies. To learn more about Giga or to obtain Giga's research, email: learnmore@forrester.com.