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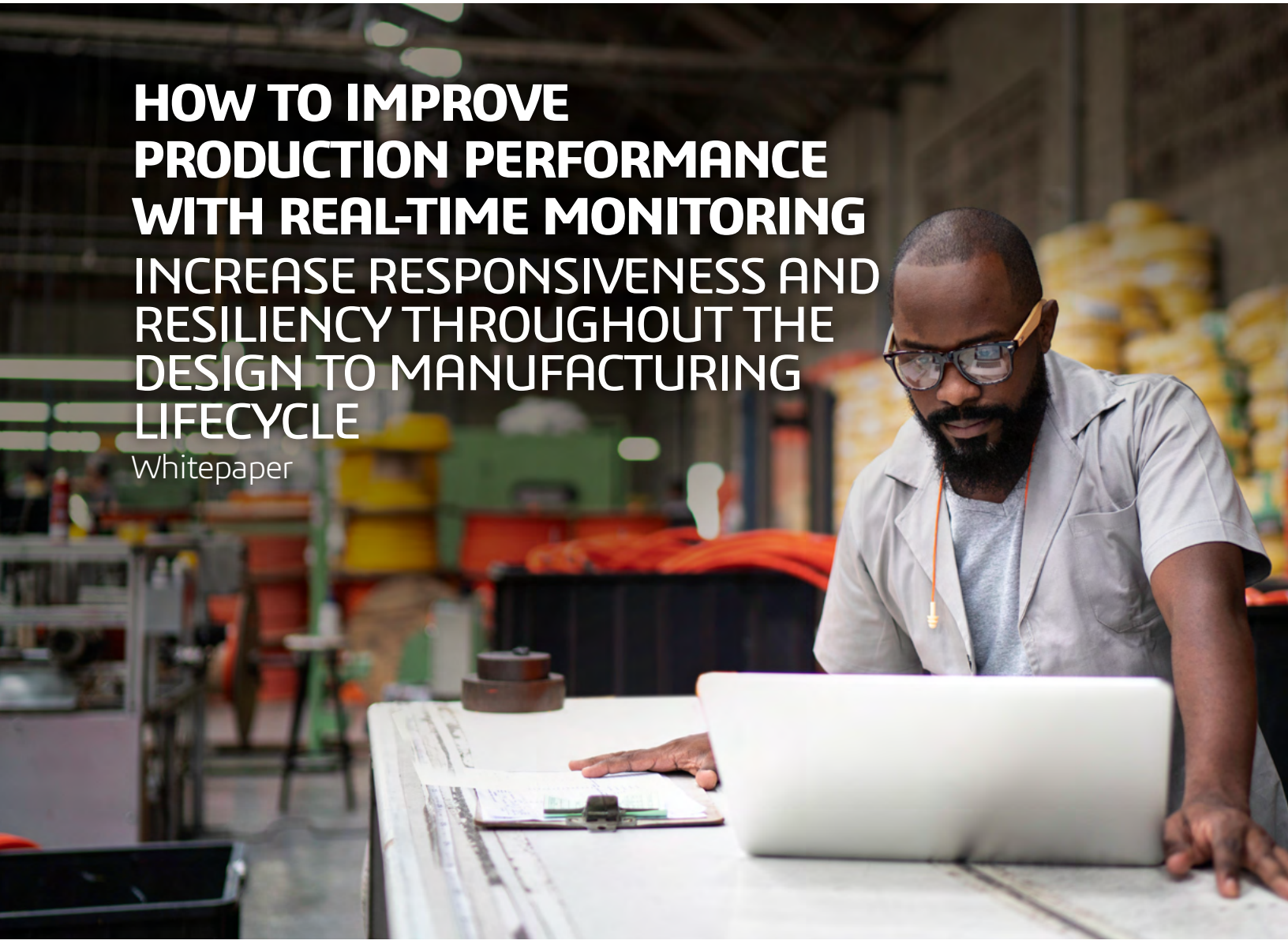


HOW TO IMPROVE PRODUCTION PERFORMANCE WITH REAL-TIME MONITORING

INCREASE RESPONSIVENESS AND RESILIENCY THROUGHOUT THE DESIGN TO MANUFACTURING LIFECYCLE

Whitepaper

DASSAULT SYSTEMES

HOW TO IMPROVE PRODUCTION PERFORMANCE WITH REAL-TIME MONITORING

Increasing responsiveness and resiliency throughout the Design to Manufacturing lifecycle

Bottom Line: Knowing more about every machine and production cycle in real-time helps manufacturers improve design-to-manufacturing results while achieving greater resilience at the same time.

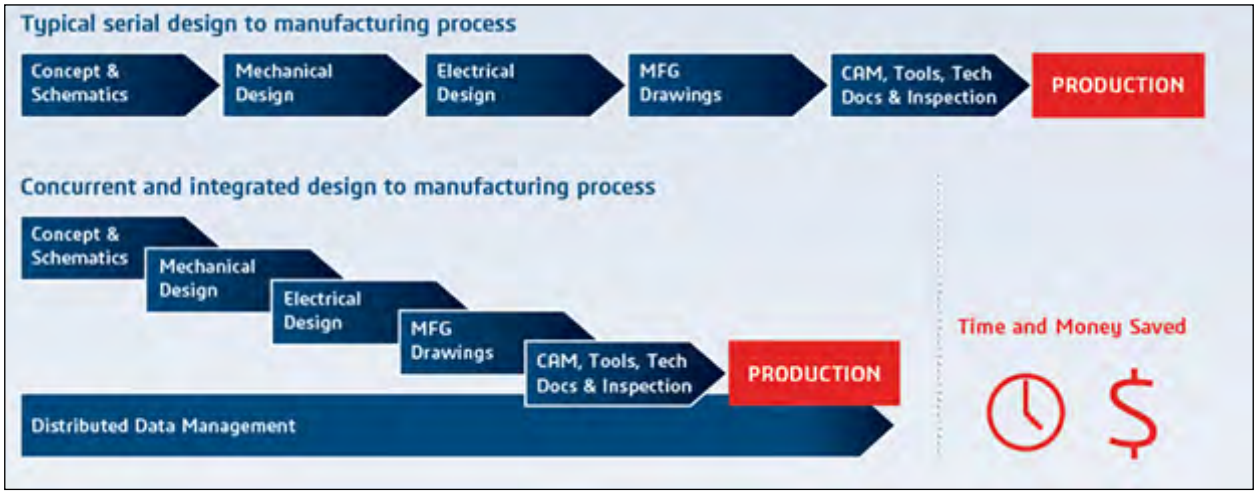
Manufacturers are continually faced with the challenges of improving time-to-market while reducing production costs and increasing quality. Given the massive amount of data a typical production plant generates on a daily basis, it can be challenging to decipher which data signals matter the most. A key insight from interviews with over 30 North American manufacturers finds that the more real-time and contextually relevant the data, the better the ability to excel at every phase of a design-to-manufacturing strategy. When integrated across the design-to-manufacturing process, real-time monitoring helps accelerate every step in creating, producing and selling new products. The intent of this white paper is to provide the lessons learned from manufacturers who have combined real-time monitoring with design-to-manufacturing and become more resilient, able to overcome challenges to growth in the process.

Real-Time Monitoring Improves Manufacturing Efficiency

Improving the performance and reliability of every machine on a shop floor is vital to manufacturing operations. Reliable machines make short-notice production runs possible. And the more flexible manufacturers are, the more new customers they'll attract and the more they're able to stay adaptable and flexible as economic conditions change.

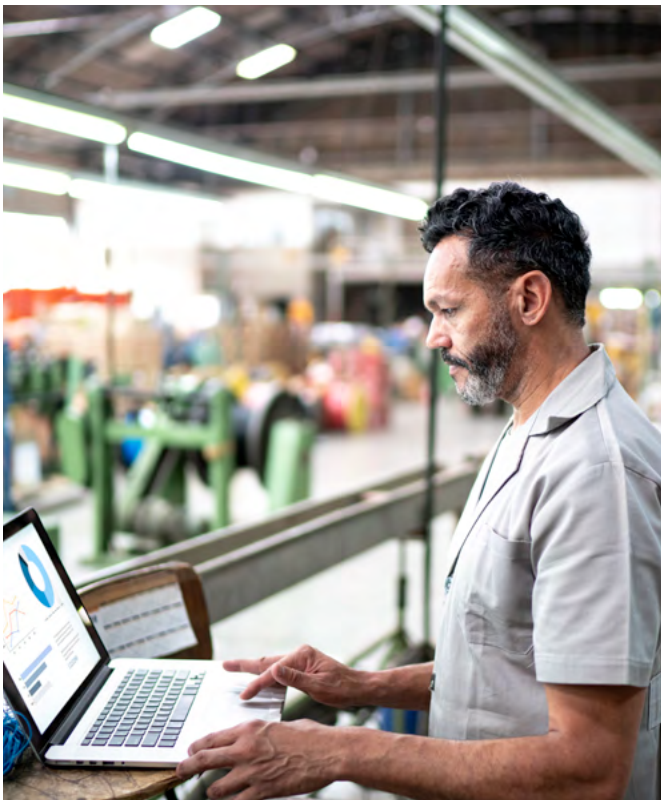
Real-time monitoring is helping manufacturers to keep every system and process synchronized across every stage of the design-to-manufacturing process. Starting with the translation of product designs and concepts created in SOLIDWORKS to initial Bill of Material (BOM) pricing, production scheduling, product inspection and quality, and fulfillment, real-time monitoring keeps every production phase coordinated. Taking a design-to-manufacturing based approach is helping to save valuable time and resources.

By integrating CAD, simulation/FEA, electrical, CAM, inspection, quality management, work instructions, ERP, and manufacturing execution system (MES) software, manufacturers are better able to reduce costs, improve quality and still take on customized short-notice production runs. Each enterprise system runs at a different clock speed, which is why real-time monitoring is essential for synchronizing them all to a common cadence. Real-time monitoring keeps design-to-manufacturing schedules on time so customer delivery dates can be met. The following graphic compares the typical serial-based approach manufacturers take to creating new products versus how the design-to-manufacturing workflow that drastically reduces costs and saves valuable time in each new product development and ensuing production cycle:Key lessons learned from manufacturers who are getting results from their design-to-manufacturing strategies using real-time monitoring include the following:



Key lessons learned from manufacturers who are getting results from their design-to-manufacturing strategies using real-time monitoring include the following:

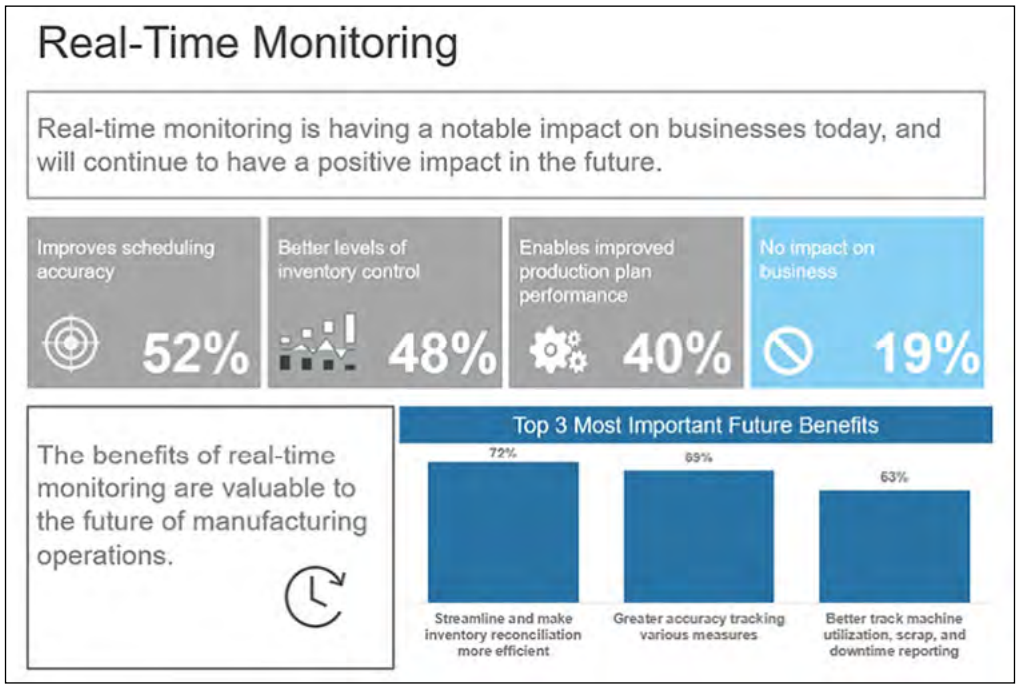
- Use Real-Time Monitoring To Get Verifiable Benchmarks of Performance
- Real-Time Monitoring Is the Glue That Keeps Production Operations Together
- Using Real-Time Monitoring to Fine-Tune Machinery Performance Plans
- Strategies for aligning machinery with design-to-manufacturing to further improve production performance and quality



Use Real-Time Monitoring To Get Verifiable Benchmarks of Performance

Just as the most effective physical fitness plans that deliver lasting change start with a true baseline of performance, the same holds true for defining a machine's baseline performance across a shop floor. In order to create performance plans for their machinery that drive results, manufacturers rely on real-time monitoring for the baseline data they need. By making real-time monitoring an integral part of every production run, they're making ongoing, continuous improvements a core part of who they are, providing needed stability in uncertain times.

A recent Decision Analyst survey completed in conjunction with DELMIAworks found that 81% of all manufacturers stated that real-time monitoring was improving their business. And in process-intensive industries, particularly plastics manufacturing, 87% of manufacturers reported that real-time monitoring is essential to their operations. Overall, 63% of manufacturers anticipated that they would be able to better track each machine's individualized fitness through real-time monitoring, as review utilization rates by type of production run, scrap, and downtime reporting, as illustrated below:



Real-Time Monitoring Is the Glue That Keeps Production Operations Together

Real-time monitoring is essential for synchronizing the diverse base of manufacturing systems and processes needed to create a single design-to-manufacturing environment where designers, engineers, quality management and production teams can collaborate together. Design to manufacturing is predicated on an integrating engineering, quality and manufacturing teams on the same product data model. Real-time monitoring from production machinery contributes to this data model by providing vital feedback to every team regarding the manufacturability, quality and scale of every new product produced. It's an essential feedback loop for everyone in the design-to-manufacturing process, directly contributes to extending the useful life of machinery on the shop floor.

Designers, engineers, quality management and production teams gain valuable insights into how changing a product model impacts product machinery's efficiency and reliability including Mean Time Between Failures (MTBF). Design-to-manufacturing teams take a more agile, iterative approach to creating new products fueled by the insights they gain from real-time monitoring data. Most important is real-time monitoring's contribution to enabling the diverse members of these teams synchronized on a common product model. Taking a more collaborative approach to creating new products predicated on design to manufacturing improves both product quality and profitability by reducing errors in production while increasing yield rates.

Using Real-Time Monitoring to Fine-Tune Machinery Performance Plans

There are three main reasons why a performance plan predicated on real-time monitoring is a great place to start putting together a design-to-manufacturing strategy. Real-time monitoring is a contributing factor in design-to-manufacturing's performance gains in the following areas:

Creating prototypes faster based on initial model designs while evaluating their quality and production scale based on real-time monitoring feedback. For instance, a plastics manufacturer that specializes in marine products relies on design to manufacturing to define the initial product model then produce prototypes in a matter of hours using a high-speed 3D printer combined with a stereolithography-based imaging device. Once product model prototypes are approved by customers, the same model is produced using computer-aided manufacturing (CAM) software to create the initial product mold. From there, the production process begins. Digitally creating and testing the products' quality and durability first saves the customer and marine products manufacturer thousands of hours and dollars a year. It demonstrates how a design-to-manufacturing approach catches problems earlier and gets new products to market sooner.

Help build demand for new products before they ship by taking a design-to-manufacturing approach to production in which real-time data of every machine helps production planners define the optimal workflow for every new product. For example, a leading provider of carbon fiber-based OEM products for the automotive, consumer packaged goods, and plastics process manufacturing industries first creates a model of customers' prototypes, providing rendered images of new products well ahead of shipment dates. Customers use the rendered images to plan their marketing and selling campaigns, assemble sales enablement materials, and define packaging. Here, design to manufacturing makes it possible to deliver more value to OEM customers and help them succeed in selling their new products.

Provide customers more options with their baseline product models through improved Configure-Price-Quote (CPQ) and product configuration strategies. Here, real-time monitoring provides feedback to the design-to-manufacturing teams regarding which configurable products are the most efficient, producible and profitable to build. A case in point is BMW's highly successful approach to selling customized Mini Coopers using product configurators online and in dealerships, supported by model-based approach to manufacturing. CPQ and product configuration excel when all systems supporting these strategies are synchronized and running a common cadence. Design-to-manufacturing makes that happen. And that's great news for manufacturers who can increase the utilization rates of production centers by producing more customized—and higher margin—products for customer than before.

Preparing a Machinery Performance Plan

Machine performance data and production stability are the foundations manufacturers are creating for themselves when they adopt real-time monitoring across manufacturing. To improve operations, manufacturers are tying back to the performance plans they have for every machine tool. This is essential for stay in compliance with tool calibration standards and minimize variation in product quality. This also extends the useful lives of machinery, as the additional data on machine health improves production scheduling. Assigning the most qualified technicians to the best possible combination of machines for a specific production run is greatly simplified when each machine has a consistently high level of production fitness. All these insights are available when real-time monitoring is integrated across production, so machine-level health and productivity can be measured.

Just like someone who joins a gym to get in better shape, millions of manufacturers today have the beginnings of strong fitness plans for their machinery. The challenge is putting them into action and getting results. The following four steps are a great way to start:

Capture baseline data for every machine across several shifts to check for any noticeable, easily-defined variation in output. Creating a dataset of each machine's performance across the shop floor is the starting point for every individualized machine fitness plan.

Choose an initial set of metrics that every machine is capable of reporting today to complete the baseline comparison. Every machine can be analyzed on four metrics: cycle times, set-up times, scrap/rework rates, and yields. Differences between machines will show up immediately. Knowing how well each machine performs against these four criteria provides invaluable insight into how its useful life can be extended.

Identify the most and least in-shape machinery by analyzing the baseline data and indexing machines' prior activity to customer returns and quality problems. The machinery responsible for the highest percentage of customer returns and quality problems are often the same machines that show abnormally high rates of wear and tear. Checking to make sure their mean time to repair (MTTR) and MTBF estimates are accurate is a prerequisite to prolonging the life of the machine and increasing product quality and yield rates.

Combine real-time monitoring with machinery upgrades to uncover how production sequencing impacts machinery reliability and performance over time. Knowing why certain machines are starting to fail may have more to do with their relative position in a production workflow than initially may be apparent. That's why real-time monitoring combined with the latest upgrades to smart, connected machinery make sense. Together, those steps remove two potentially large sources of variation from understanding how to prolong a machines' useful life.

Aligning Machinery with an Agile Design-to-Manufacturing Process

When teams capitalize on the higher performance and scale of machinery that's being managed to a more rigorous, thorough fitness plan, they are positioned to take on more ambitious design-to-manufacturing projects. Knowing the scale, speed and reliability of every machine involved in producing a new product brings even greater agility to the concurrent design, development, engineering, quality and production processes that together create a design-to-manufacturing framework.

Where manufacturers see the greatest benefit from committing to a rigorous, ongoing machinery fitness plan is in accelerating new product development timelines while reducing costs. Knowing how every machine will react to new production requirements is invaluable in reducing errors in everything from initial design concepts to work instructions.

Another key benefit of combining fitness plans with design to manufacturing is that collaborative teams know by how much machinery yield rates have improved and what that means for future production runs.

Finally, fitness plans for machines create the strongest foundation there is for manufacturers to give their CAM, computer-aided design (CAD), simulation/finite element analysis (FEA), electrical, inspection, and manufacturing teams the assurance they need that they can pursue faster development, test and product release cycles than ever before. When every system in the manufacturing process runs at a different cadence or clock speed, achieving concurrency is a must-have, and design to manufacturing combined with ongoing machinery fitness plans are essential.

Conclusion

Speeding up new product development cycles, improving product quality and increasing yield rates happen when manufacturers unify diverse production systems encompassing simulation/Finite Element Analysis (FEA), Electrical, Computer-Aided Manufacturing (CAM), Inspection, work instructions and ERP systems to create a unified design-to-manufacturing strategy. Real-time monitoring helps improve every phase of design-to-manufacturing by ensuring the diverse base of manufacturing systems stay in sync with each other. Manufacturers are able to innovate faster, reduce costs and grow revenue because every system they're relying on for production are integrated, providing real-time data. By having a common data standard to work from and integrate to, design-to-manufacturing strategies are able to transform SOLIDWORKS designs into new products with greater accuracy and cost savings than any manual process could.

For more information, please visit www.3ds.com/delmiaworks or call 1.866.367.3772

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