

TOP FIVE MANUFACTURING PROBLEMS AN MES CAN PREVENT BEFORE THEY OCCUR

Whitepaper



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Executive Summary

What if the data generated every day across every plant floor to the machine and process level could help identify potential failure points and scenarios—before they happened?

Knowing how, where, and why a product's quality, a production process, or a machine is about to fail, as well as what to do about it, can save thousands of hours, millions of dollars, and most importantly customers' trust. Manufacturing execution system (MES) software delivers these insights by unleashing the power of real-time production and process monitoring data to understand fluctuations in product quality, lead times, shop floor productivity, and other factors. By identifying potential issues early, an MES helps manufacturers to determine how they can make corrections, repair equipment, and improve their operations before they become problems.

While there are many issues MES software can address, the most urgent and quickly resolved are related to visibility and control across the shop floor and plant. Among these, the top five ways an MES can help manufacturers to prevent or minimize the impact of problems are:

- Troubleshoot product quality problems before they impact customers.
- Solve supplier quality and compliance problems.
- Eliminate time wasted tracking the status of jobs in production.
- Remove the roadblocks that create longer cycle times and lead times.
- Avoid sacrificing the reliability of machines while ensuring greater yields.

Before examining each of these five areas of prevention, let's first look briefly at the role of MES software.



The Role of the MES

Fundamentally, an MES is designed to provide information that helps manufacturing decision-makers to understand how current conditions on the platform and be optimized to maximize production output. To do so, MES software relies on real-time production and process monitoring data that provides the insights needed to improve production scheduling and execution, compliance, and quality.

The Gartner Glossary provides a useful definition of the role that MES solutions play: “Manufacturing execution systems (MES) manage, monitor and synchronize the execution of real-time, physical processes involved in transforming raw materials into intermediate and/or finished goods. They coordinate this execution of work orders with production scheduling and enterprise-level systems. MES applications also provide feedback on process performance, and support component- and material-level traceability, genealogy, and integration with process history, where required.”

Common functions of an MES include:

- Managing product definitions
- Managing resources
- Scheduling production processes
- Dispatching and executing product orders
- Performing track and trace
- Collecting production and process data
- Analyzing production performance

The last two functions—collecting production and process data, and analyzing production performance—are supported by production reporting, which typically includes production schedules, inventory, quality metrics, and overall equipment efficiency (OEE), among other factors.

Importantly, an MES often shares data with other key applications that support manufacturing operations, such as enterprise resource planning (ERP), quality management, customer relationship management (CRM), and a warehouse management system (WMS). For this reason, MES software is most effective when it shares the same database as these other applications. This ensures an accurate view of the organization at all times and facilitates the real-time updates needed to identify and address anomalies before they become problems as demonstrated in the five scenarios that follow.



#1 Troubleshoot Product Quality Problems Before They Impact Customers

The most costly problems to solve are those related to product quality. Using the combination of real-time production and process monitoring and an MES integrated with quality management, CRM and ERP systems makes it easier to catch potential quality problems before they impact customers.

Real-time data can be utilized by the MES to produce statistical process control (SPC) charts and analysis that identify when a machine or process operates out of its control limits. Meanwhile the data used by the quality management system helps to ensure that inspection set-up is correct and that document control and key product quality metrics are measured accurately.

Notably, when metrics and key performance indicators (KPIs) are captured at the machine level via the MES, aggregated using analytics, and then displayed on dashboards, manufacturing managers gain the insights to make trade-offs and collaborate with senior management to reach operations-based and financial

goals. By having production management, product engineering, and senior management all use the same KPIs, symptoms of potential major problems are found faster and acted on. This close collaboration enables greater insights into key areas including yield rates, quality levels, scrap rates, production efficiency and cost of quality—helping to avert production delays and stabilize product quality.

Moreover, when the MES, quality management application, and other systems share the same database, it enables end-to-end visibility and control of a plant floor, a plant, or a series of production centers in real-time. This allows information—such as the latest gage calibration data, customer complaints, return material authorizations (RMAs), and customers' product requests—to become immediately available. As a result, production and quality engineers can take action and resolve any issues without having to wait for the end of the production shift or rely on final inspection to find quality defects.



#2 Solve Supplier Quality and Compliance Problems with Track and Trace

Traceability is invaluable for troubleshooting supplier quality problems and averting larger supply chain and visibility challenges in the future. The track and trace functionality in an MES automates the processes associated with traceability. This provides visibility across a manufacturer’s production locations and supply chain to ensure compliance with stringent customer, industry and government requirements; maintain quality levels, and meet production forecasts.

By using track and trace, many manufacturers are able to avoid the unpredictable expenses of a product recall by catching product quality problems early. Other benefits of automated track and trace include the ability to reduce or in some cases eliminate inventory carrying costs, inventory obsolescence, days sales outstanding (DSO), stock-outs, duplicate chargebacks, and lost sales due to allocation issues.

Additionally, when an MES’s production reporting is integrated with the WMS, manufacturers can gain more accurate lot tracking and traceability, as well as the ability to catch labeling and scanning problems before they start—saving hundreds of hours and keeping customers’ production lines running.

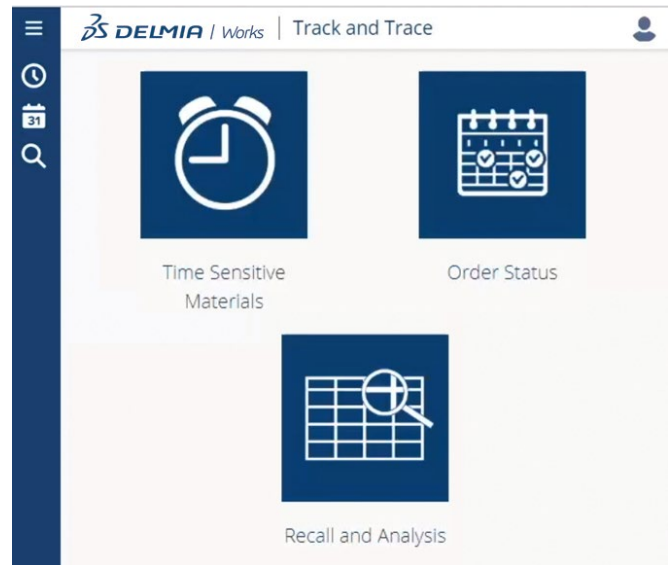
#3 Eliminate Time Wasted Tracking the Status of Jobs in Production

Knowing the status of each order is essential for keeping sales, channel partners, and customers informed of when their orders will ship. However, many manufacturers waste thousands of hours a year trying to stay on top of orders in progress or recover lost orders that didn’t get scheduled in time to meet customer delivery dates. The manufacturing scheduling and planning module of an MES addresses these challenges by combining automation with accurate, timely data to facilitate forecasting and production planning. It also organizes materials and resources to minimize lead times and ensure all product and packaging components, whether manufactured in-house or outsourced, are present when needed to run a job.

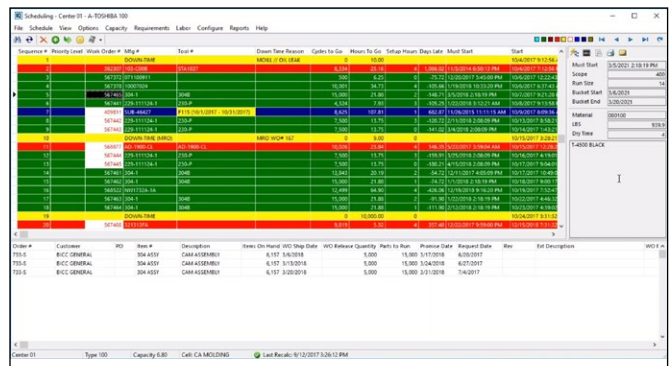
A core part of an MES scheduling and planning module is bill of manufacturing (BOM) management, which needs to support manufacturing types and cells at a minimum to be effective. This will enable manufactures to produce BOMs with industry-specific attributes for planning and control while also minimizing changeovers by scheduling by tool type or color. Additionally, the MES should provide demand-driven scheduling where the system considers demand, current work orders, and projected on-hand balances to schedule production jobs only when there’s sufficient manufacturing availability.

To catch potential problems before they occur and ensure that demand planning and finite scheduling are running correctly, the MES scheduling and planning module should be integrated with the ERP system—particularly with modules, such as order entry and sales order—in order to share real-time data. Ideally, the MES will also be integrated with material requirements planning (MRP), which often includes items manufactured internally and outsourced inventory, as well as master production schedules (MPS), and capable-to-promise (CTP). Working together, these modules provide manufacturers with a 360-degree view of the schedule and its many constraints along with end-to-end visibility across their production processes.

The following is an example of a real-time scheduling screen that displays the status of every production job by the work center in real time.



The main menu for DELMIAWorks’ Trace and Trace module within its MES system.



Intuitive scheduling screen within DELMIAWorks manufacturing software.

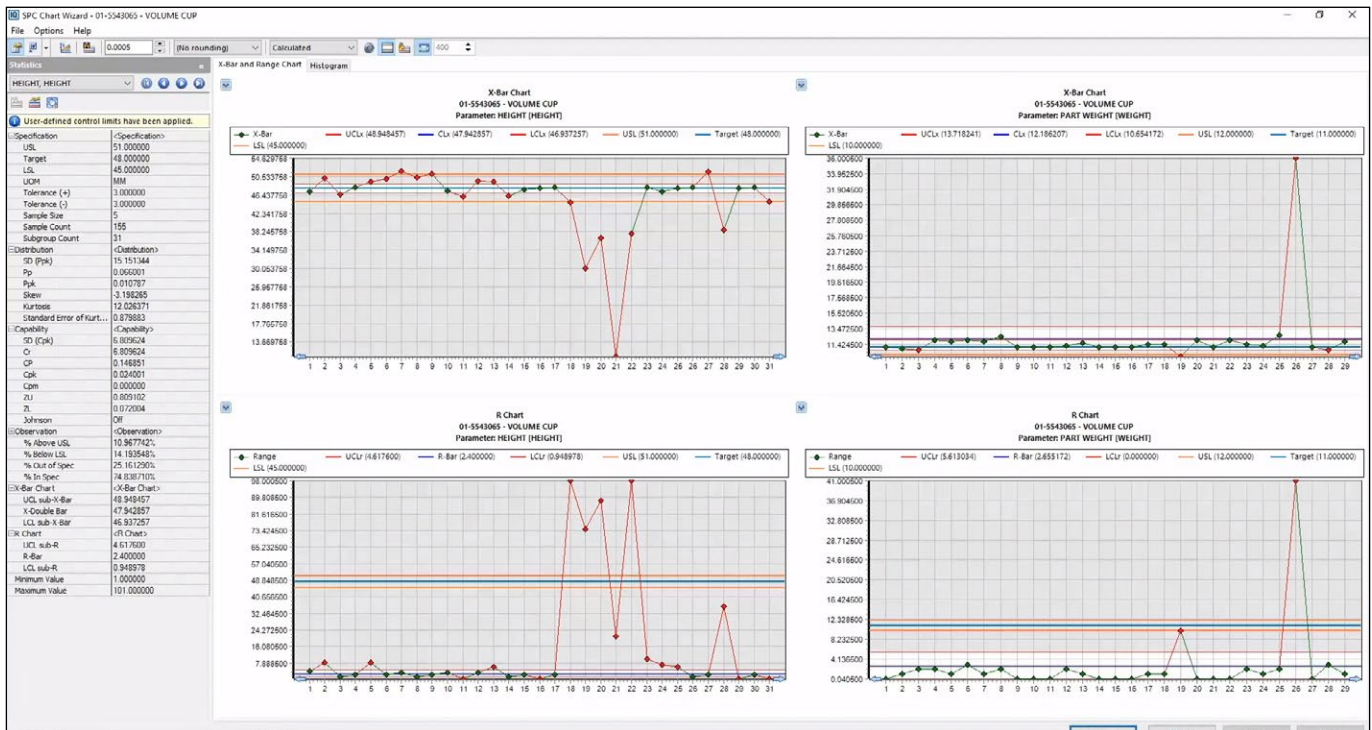
#4 Remove Roadblocks that Create Longer Cycle Times and Lead Times

Shop floor control is essential for an MES to identify potential roadblocks and guide manufacturing teams around them. Here, real-time production and process monitoring data bring the contextual intelligence and insights needed to identify which factors are causing cycle times and lead times to slow down. With this knowledge manufacturers then can detect anomalies in production performance early enough to alleviate quality problems, a line shutdown, or worse.

Manufacturing engineering and plant managers use real-time production monitoring data to count production cycles, measure scrap, ensure all production steps are executed, measure production times and predict order completion times. In short, real-time production monitoring provides an immediate, quantified view of every machine's current status and health and process being used to complete an order.

Real-time process monitoring relies on programmable logic controllers (PLCs) attached to machines that measure a variety of process parameters during production. These include tracking temperatures, pressures, weights, and measures of materials just entering the production process (and how they change throughout production), and event durations. Production and process monitoring data are stored in historian databases for future analysis and are invaluable in troubleshooting why cycle times and lead times fluctuate.

Using the historian database to perform SPC and root cause analysis (RCA) to identify why a machine on the plant floor is overheating can explain why cycle times are lower than normal. By deciphering real-time production and process monitoring data, It's possible to understand what's causing cycle times to drop. The following graphic illustrates how historian data provides invaluable insights into problems before they get out of control.



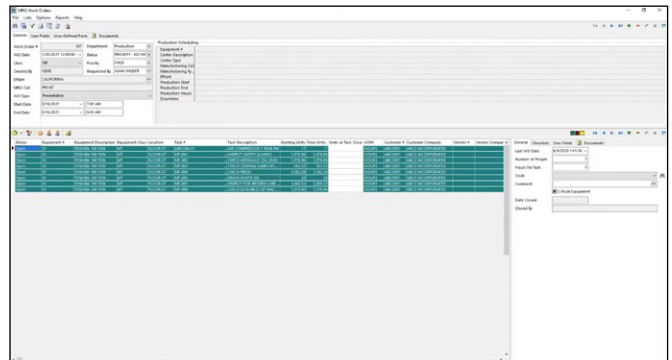
The Statistical Process Control Chart Wizard from DELMIAWorks enables the real-time tracking of product and process quality to facilitate continuous improvement.

#5 Ensure Greater Yields from Machines Without Sacrificing Their Reliability

Machine components, such as specialty seals, precision bearings and sensitive valves, can be hard to reach and very expensive. Yet, too often manufacturers make one of two mistakes. Some run machines so close to their limits to get the most productivity out of them as possible that they break down during jobs. Others conduct preventative scheduled tear-downs of maintenance repair and overhaul (MRO) items according to the manuals only to find that they are still in acceptable operating condition. Either way, the company is left with a loss of precious production capacity and wasted time for skilled techs.

A more effective approach is to use an MES to measure true output and the needed maintenance schedule. Doing so will prolong the life of equipment, machinery, and tools while avoiding unnecessary shutdowns of production lines. An MES combines real-time production and process monitoring data with predictive analytics to understand when MRO updates actually need to MRO updates.

For example, sensing a drop in pneumatic or hydraulic pressure, fluctuation in motor current, variations in shaft rotational speed as an unusual vibration, or a rise in temperature can be valuable tools in predicting and preventing production disruptions. Monitoring of such events can be accomplished by using simple sensors, smart sensors, or the equipment's own controller to gather data and analyze it immediately. Then, using feedback via real-time, predictive analysis, employees have a factual basis for managing asset "health" and ultimately production risk—empowering them to set application-appropriate maintenance schedules for equipment, depending on how they are used in a given plant.



The Maintenance, Repair and Overhaul (MRO) module within DELMIAWorks provides all the tools needed to properly manage manufacturing equipment and perform preventative maintenance to prolong its lifespan.

By relying on automated process digital dashboards and alerts provided by the MES, instead of exclusively using planned preventative maintenance intervals, manufacturers can maximize uptime, minimize the effort and costs needed to keep the factory running, a drive up the return on invested capital (ROIC) of their machinery. This also translates to better business results for the manufacturer, both in supporting customers' demands and finding opportunities to take on extra work with existing machinery.

Conclusion

The ability to identify potential manufacturing problems before they grow and impact customer trust, profits and revenue is leading more manufacturers to automate their operations with MES software. Increasingly, these MES solutions leverage real-time production and process monitoring data for the insights needed to identify potential issues. The most effective MES implementations are also integrated with other key applications—such as ERP, quality management, CRM, and WMS—in order to share data that affects multiple aspects of the manufacturer's business. In this way, companies are gaining the 360-degree views needed to mitigate or prevent problems before they impact quality, production, inventory, customer satisfaction or profits. This in turn, is leading to greater profitability, higher customer satisfaction, and more opportunities for growth.

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