



# SOLVING THE NDT PEOPLE PROBLEM

AI and machine learning will combine in the next-generation of industrial equipment to help solve talent shortages in testing

// JOSH LOUKUS

**N**DT and Chemical Etching are coupled industrial processes that are motivated to provide assurance of quality, reliability and safety. These same assurances motivate REL, Inc. of Calumet, Michigan, to develop and support onboard AI Machine Information tools powered by QModoAI to ensure the manufacturing industry can transfer tribal knowledge to the next generation worker. There is a messy stigma associated with chemical processes. This stigma applies to both the plant conditions and the ability to automate, maintain, and scale throughput. Training the next generation worker is a challenge with the labor shortages that have been prevalent in manufacturing in the past decade. This integrated control solution is offered to maximize training and operator efficiency in the most critical areas of manufacturing.

The goal of any automated process control system is to be able to run the process as good as the best human being

operator. The Locktime Machine Information Tool (iMIT) integrated approach has proven throughput and data logging to the second to demonstrate that capability. This system also offer maximum visibility into the process for all stakeholders involved in the business. Maintenance personnel, process owners, and management personnel all can see into the manufacturing process that they are interested in from anywhere in the connected world. This means all plant assets with this tool installed can be maintained and more importantly accessed from all plant locations by an individual.

This Control system is an Industry 4.0 solution that positively impacts quality, flexibility, agility, and visibility across the entire NDT system.

A safety control system is integrated seamlessly with the mechanical design of the machine, including Emergency Stop Pushbuttons throughout the system, safety



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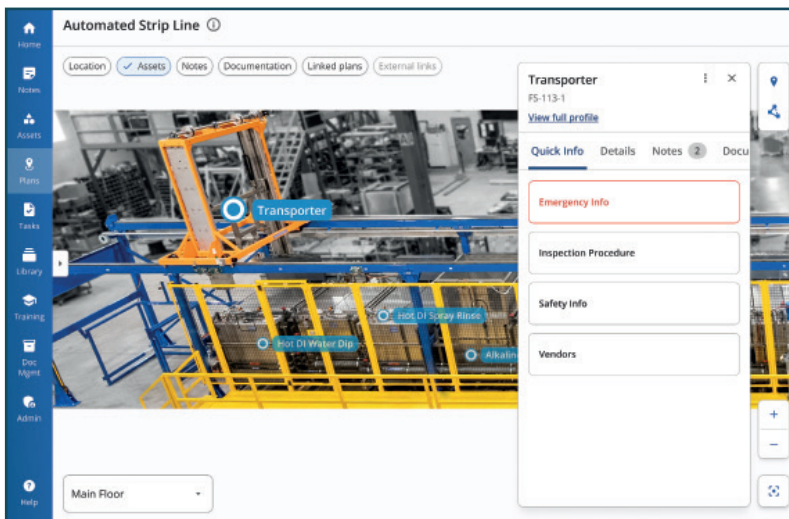


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1 // The overall REL Strip Line

2 // Real time processing throughput monitoring

3 // Sensor data live view



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**“THE GOAL OF ANY AUTOMATED PROCESS CONTROL SYSTEM IS TO BE ABLE TO RUN THE PROCESS AS WELL AS THE BEST HUMAN OPERATOR”**

proximity sensors on machine doors, light curtains to protect open areas, and safety output modules to control safety components. In many ways, Locktime iMIT can be thought of as a PLC on steroids, but it also performs operations a PLC simply could not support, such as an unlimited number of process schemes, sometimes called recipes. Each recipe represents an operations profile to be performed on a tray of parts, defining every process parameter, such as spray duration and dunk tank temperature. Optimal schemes can be defined and selected for a given category of parts. It also saves the process recipe and actual parameters for every part serial no. run through the system.

**DOCUMENTING QUALITY**

In the past, NDT quality data were

4 // iMIT UI showing station flags

captured manually, consisting of pages of hand-written notes by multiple operators, maintenance personnel, quality control engineers, and responsible NDT Level III's. The variability of how the information was recorded lead to lengthy quality audits from outside OEM's and accrediting organizations such as NADCAP and ISO. Anytime one person (the auditor) has to sift through multiple hand-written documents structured in different formats by different people from varying departments of a company, it becomes a lengthy process.

With this pain comes the cost in capital and employee involvement with the auditors. Simply put, Locktime iMIT unifies all these separate entities into one database automatically. Operators and Maintenance personnel can manually scan

(bar code, RFID, etc.) or the system can automatically scan parts in and out of the system. Operator commands are logged as they occur. Quality control simply enables function check boxes on the user interface UI to dictate run recipes. Management has a continuous view of production and machine maintenance with the historian expansion capacity equal to infinite years. The quality of the NDT and Chemical processing procedures is uniformly visible and understood from all corporate vantage points.

In addition to logging of built-in sensors along the entire processing line, scans of parts receipts, personnel, and process times are logged continuously. This enables tracking of vital factors, such as penetrant spray time, penetrant dwell time, wash cycle times, wash temperature, wash spray

**“LOCKTIME IMIT UNIFIES ALL SEPARATE ENTITIES INTO ONE DATABASE AUTOMATICALLY, GIVING OPERATORS, QUALITY CONTROL, AND MANAGEMENT FULL VISIBILITY INTO THE PROCESS”**

pressures, drying time, drying temperature, developer dwell time, and holding time before being inspected. The iMIT AI addition allows for the tracking of the machine uptime, sensor longevity, and onboard training to ensure the process operates now and decades into the future.

Should a processing trend run outside of set limits, the iMIT system can alarm and notify stakeholders the problem – including the steps to fix the problem. The maintenance personnel don't have to search for troubleshooting procedures they are onboard and displayed step by step. The control system is set up for scheduling preventive maintenance. Personnel can be assigned to varying levels of authorization for process, maintenance and recipe control. This allows for correct authorization for each stakeholder in the equipment for the life cycle of the machine to ensure correct and safe processing.

Because maintenance is crucial to quality, service records, on-board maintenance procedures, images, training videos, and locations of probes, grease points, tensioners, and all safety hardware are documented and available in the onboard control system. Maintenance actions are likewise recorded, and an automatic account of service records are available for troubleshooting or auditing. iMIT AI goes a step further and shows the plant infrastructure tie ins and locations for ease of access for facility engineers.

Should there be a loss of electrical power

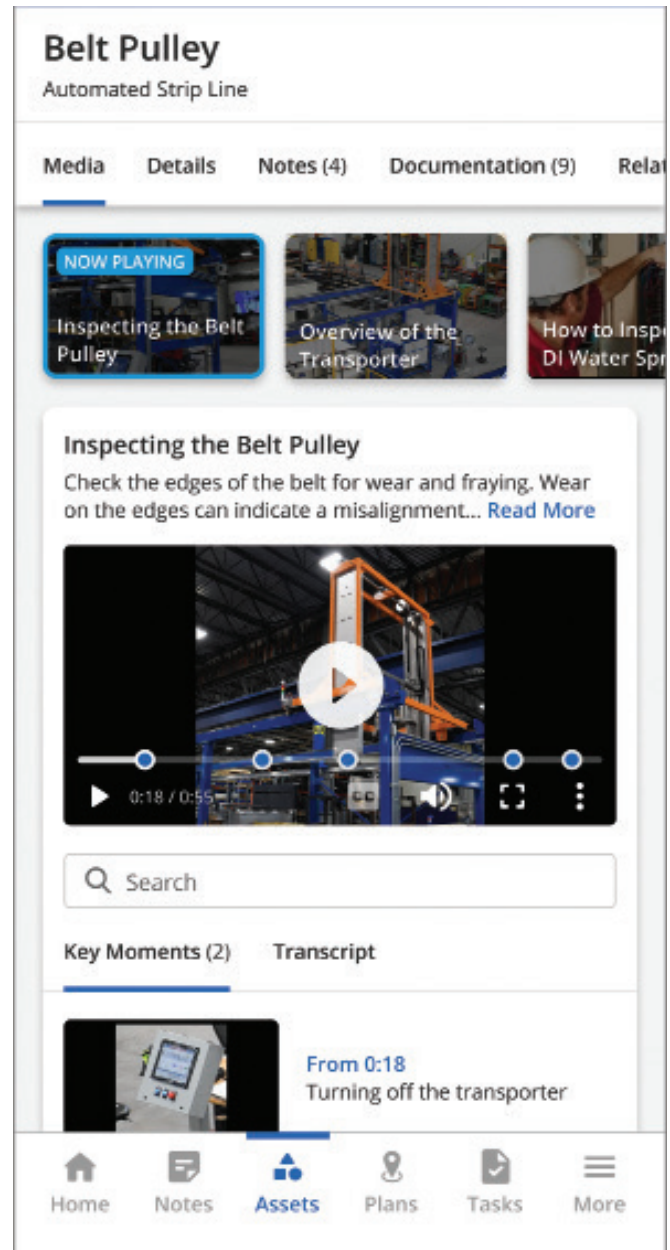
or other energy supply to the equipment, Locktime real-time data log ensures that the process record is captured. The process line can recover quickly and seamlessly, picking up each process where it left off with the onboard visual dashboard to guide start-up from a stop.

**ENABLING UPTIME**

The Locktime iMIT control system is inherently configurable to maximize system uptime. For example: If a dip tank needs to be changed from one treatment to another, there is an onboard visual video-guided procedure to ensure there is minimal work associated with the changeover. A new treatment for the tank is created, constraints are assigned in the setup, and it runs the newly arranged process. This is especially useful for tank maintenance/chemical changeouts. Such flexibility represents greater value to the owner than traditional, more rigid control schemes.

**EXPANDING VISIBILITY**

Being able to verify real-time throughput and maintenance records on a line gives peace of mind that production needs will be executed quickly enough to meet the line performance requirements. The visual processing journey also communicates effectively to everyone from top management to individual operators, so that each knows what to expect while executing actual functions AND what to do



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5 // Transporter belt-pulley assembly onboard maintenance media

in the event of a fault. This gives floor managers some understanding on how their equipment can handle a rush of work, and whether it can be handled through a split shift or if another full shift is needed.

Because the control system logs to a local server on the internal network, managers with desktops can view the current state of operation and queue of upcoming recipes. Operators can use traditional UI stations to view the same data or input commands. Engineers can browse and control the system using a tablet or smartphone on the internal network or over a secure VPN.

The onboard database provides a high-fidelity view of the treatments applied to a part. This allows a user to definitively show that a specific part was properly



6 // A system utility lockout/tagout safety module



7 // A level Sensor

**“WITH AI-DRIVEN INSIGHTS AND REAL-TIME TRACKING, THE IMIT SYSTEM ENSURES THE MANUFACTURING PROCESS OPERATES SMOOTHLY—NOW AND FOR DECADES INTO THE FUTURE”**

treated, even years after the fact. In a chemical processing line, this provides the user with absolute confidence and evidence that the process specification was met as expected.

Trends of each probe can be viewed over a nearly indefinite amount of time, allowing a maintenance engineer to determine the source of a problem as well as the sensor maintenance history. For each sensor, a current status is displayed, with the ability to see the history of the sensor, a picture of the sensor on the line, and a manufacturers' manual. Each station will come with an easily accessible manual,

including wiring diagrams and description on how to use. In diagnostic mode, each controllable item in the line can be activated separately to ensure proper operation of the equipment.

**INCREASING AGILITY**

The control system very closely tracks its state, giving it robust recovery in situations such as when there is a power loss or when an emergency stop occurs. This eliminates the need for a line to be unloaded, or other specific manual functions because an e-stop was hit or other conditions occurred that need to

have accurate system recovery. Problem diagnosing is made simple with an accurate history. The exact state, the series of buttons pressed, and each fault are logged into the database and are easily understood/recalled using the historian.

Processing equipment utilizing Locktime iMIT control will have a history documented with unprecedented veracity, production lines will operate with maximal flexibility and issues will be resolved based on an accurate ground truth. A triple winner if ever there was one. \\\

*Josh Loukus is president of REL, Inc.*