Next-Level Fabrication

Focus On Software

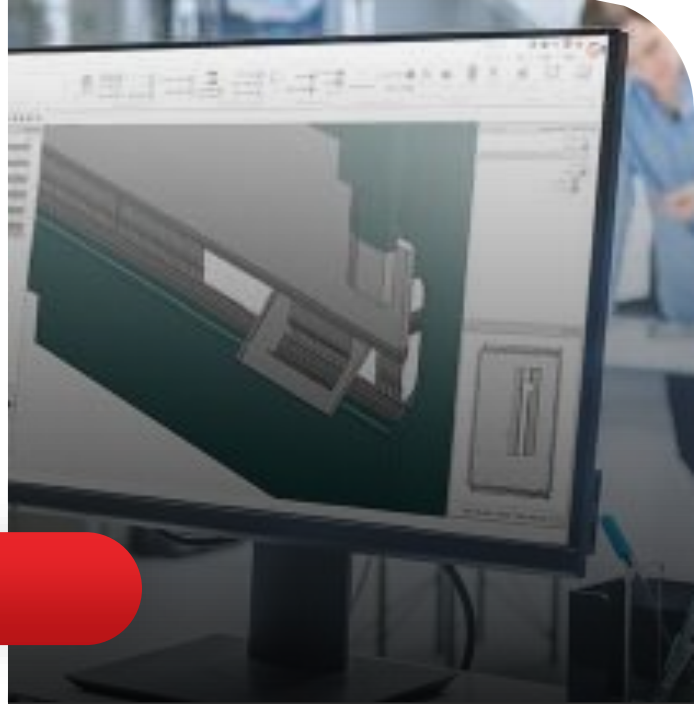
AUTOMATION TALK

THE FABRICATOR

CANADIAN Fabricating & Welding

In partnership with salvagnini

Why Software Matters



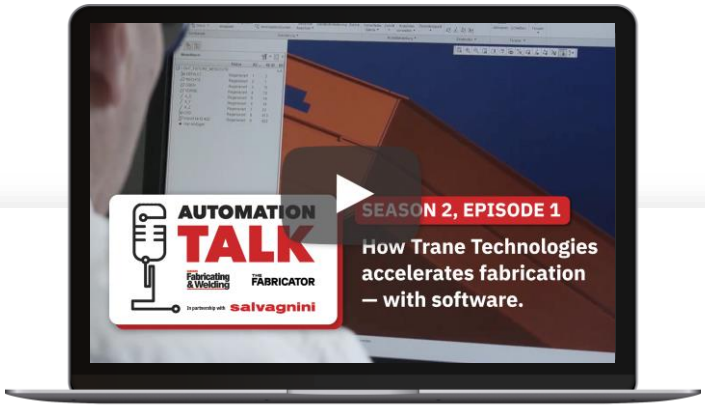
Good fabrication hinges on good information.

Joe Wheatley at Trane Technologies is a self-described computer guy. He has a degree in computer science and, since the days of old-school serial ports, he has found ways to enhance Trane Technologies' precision sheet metal fabrication operation in Columbia, S.C. The company's processes have plenty of "hard' automation. But the true engine behind all that cutting and bending machinery is information technology: specifically, software that organizes and sequences jobs to meet the demand of operations downstream. The operation exemplifies just how important software has become. Industry software has evolved to become a form of automation itself, streamlining or outright eliminating some of the industry's most tedious and mistake-prone tasks, like scheduling and order entry. Automating the tedium has allowed the fabricator to focus its talent on true value-adding activities, including optimizing part design for specific processes.

All that said, the real devil is in the details. The same flange bent on a press brake will have a different k-factor on a panel bender. The way the clamping tools hold and bending blades form causes the material to elongate differently. The blank size on a panel bender might be different than the same part bent on a press brake. Today's software accounts for those details. The same goes for process idiosyncrasies in punching and laser cutting. When reality matches what the software predicts, jobs flow. When there is a mismatch, the flow slows, stops, backtracks, and sometimes falls apart altogether. Good software gives access to the right information, from the machine and tooling level on up to scheduling, planning, and strategy. Good software has evolved to become the keystone to it all.

Watch & Learn Videos

Why Software Matters

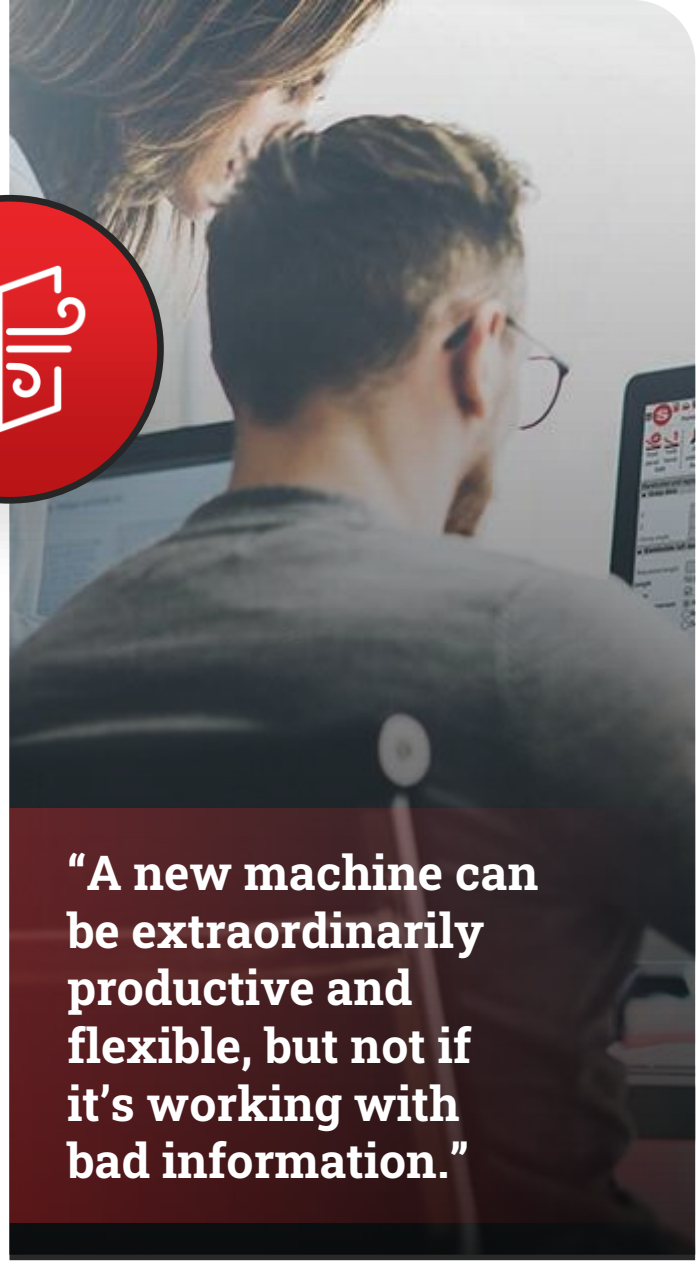


Trane Technologies takes a pioneering approach to production software.

Learn how software automation transformed Canada's Custom Metal Contracting.

Why Do Fabricators Automate?

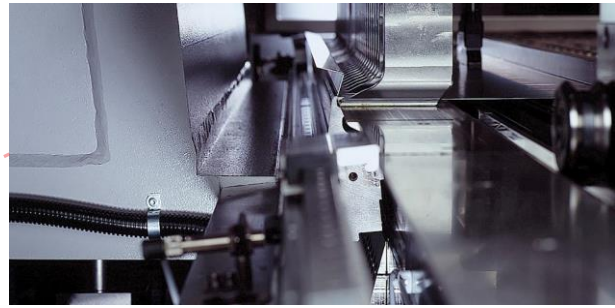
In a 2021 survey conducted by the Fabricators and Manufacturers Association (FMA), lack of skilled workers did not, surprisingly, top the list of reasons why fabricators automate. Worker skill is still a factor, of course, but most ranked “increased throughput and shorter lead times” as the primary driver of automation investment. Herein lies a subtle complexity of manufacturing technology. A new machine can be extraordinarily productive and flexible—but not if it’s working with bad information. Most improvement methodologies, especially those tailored for high-product-mix production, preach the virtues of holistic thinking. Customers want shorter lead times, and that entails everything from the initial quote or order to the final shipment. Think of a precision metal fabrication plant as a river of disparate jobs. Planners balance good material yield in blanking with process reliability and optimal part flow. When everything flows in an optimal way, productivity skyrockets.



“A new machine can be extraordinarily productive and flexible, but not if it’s working with bad information.”

About Optimization

With good information, disparate jobs flow quickly through downstream processes. Without good information, jobs sit idle, waiting for rework. What does an operation need to avoid this? Good information, optimized through software.



It All Starts in Bending

Different tooling and bending technologies, be it a press brake or a panel bender, affect the blank size, which affects nesting, how sheets are optimized in cutting, and how jobs are initially released. Better bending leads to better welding and assembly.

Quoting | Engineering Purchasing | Order Processing | Scheduling

More visibility and intelligence early means better throughput later. The less visibility there is, the more time jobs sit idle on the shop floor.

Order Release

Timing of release is critical, balancing due dates, material flow, and material yield.

Laser Cutting and Punching

A finely tuned operation balances process reliability, material yield, part identification and ease of denesting (no lost parts), and flow to downstream operations.

Blank and Bend in a Flexible Manufacturing System (FMS)

FMS jobs can be released later to ensure minimal work in process (WIP) between processes, or earlier to adapt to downstream capacity requirements. Such flexibility comes after careful scrutiny of part design to make best use of the FMS's capabilities.

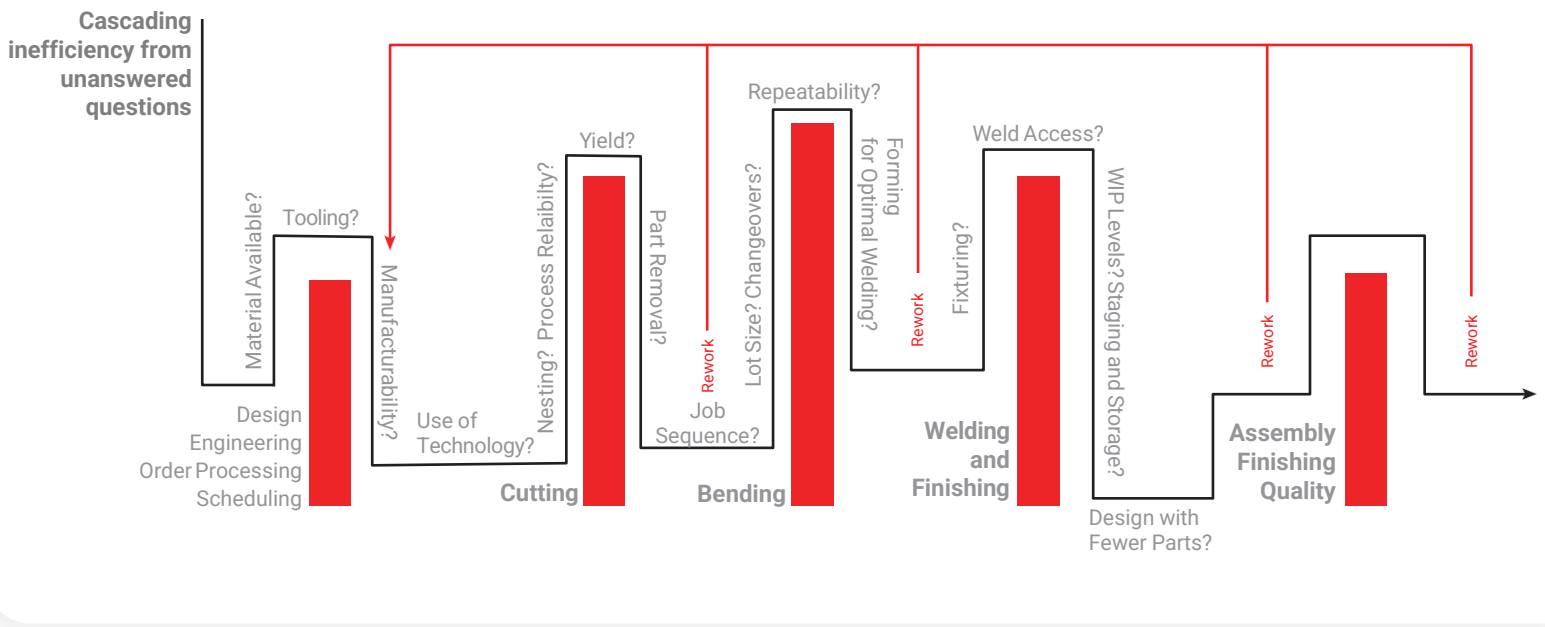
"When a part must be reworked or scrapped, all the value created making that part in processes upstream goes out the window."

Break Down the Walls of Inefficiency

Manufacturing overall has a long history of scrutinizing "local" efficiency: inches per minute on the laser or welder, strokes per minute at the punch or press brake. Machine speeds matter, of course, but they become irrelevant in a vacuum. Modern machines have amazing productive capacity, and it's a shame to waste it producing the wrong parts at the wrong time—and even worse to spend time with rework. When a part must be reworked or scrapped, all the value created making that part in processes upstream goes out the window.

All this stems from two principal root causes. One occurs in the office, before a job reaches the floor. The second comes from the way information flows throughout the enterprise—not in a stream, but in batches thrown awkwardly over metaphorical walls. *Manufacturing will figure it out*, the thinking goes. Modern software addresses both root causes and, ultimately, eliminates those metaphorical walls that foster so much frustration.

Break Down the Walls of Inefficiency

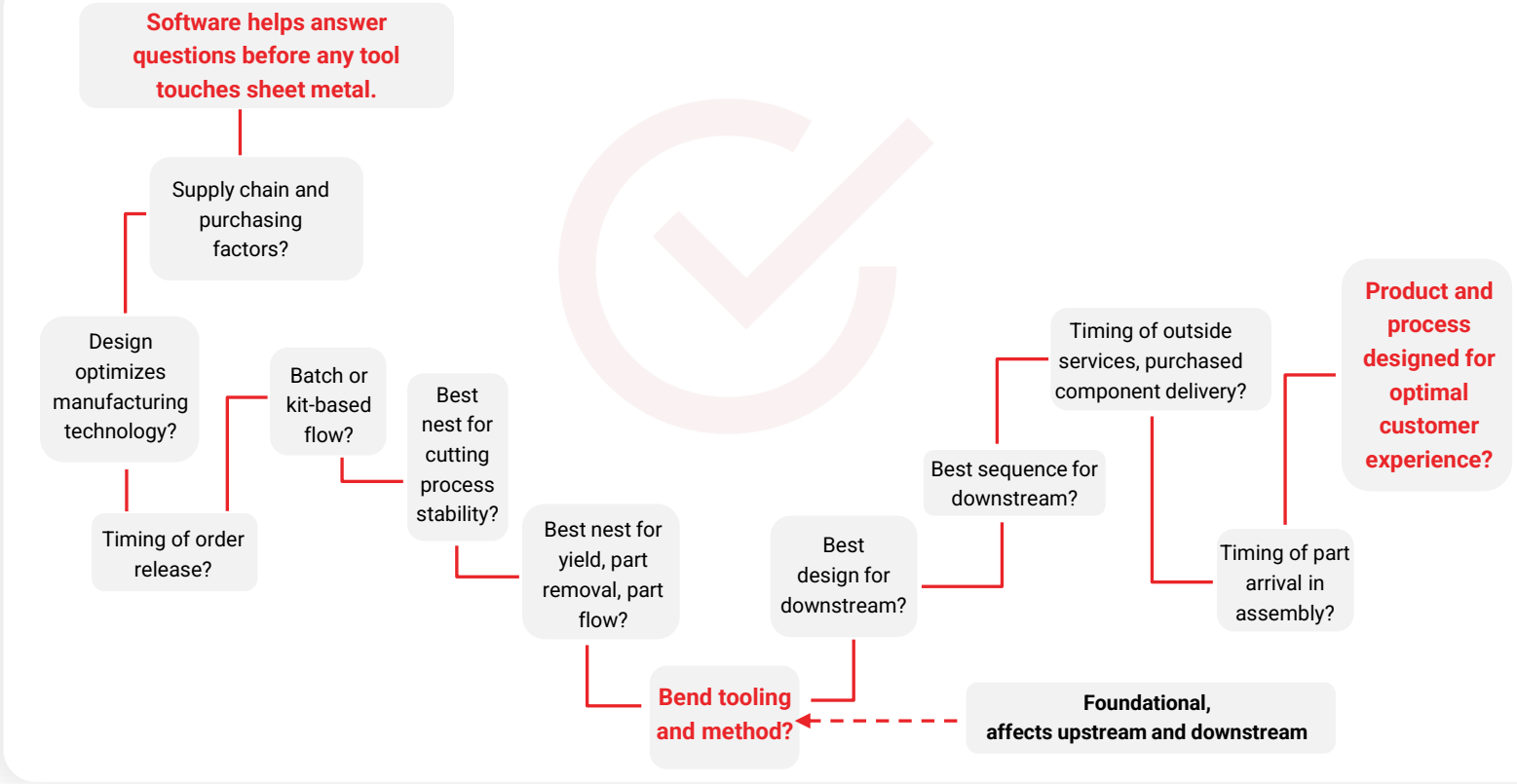


The Hidden Waste

So much inefficiency occurs with information mishaps, or information “waste.” This could apply throughout multiple levels of any operation, starting with where tools contact metal. Is brake tooling defined and standardized? How do the flat blank calculations change from one bending method to another, like switching from air forming on a press brake to forming the same workpiece on a panel bender? How will the panel bender grasp the workpiece between bends? In laser cutting, do cut lines really need to be right above the slats, or can they be moved to extend slat life? Do microtab placement and web width ensure process stability? If cutting with a stand-alone system, what about ease of part removal from the nest? In a flexible manufacturing system with cutting and bending, are parts removed from scrap in a repeatable way?

Part removal relates directly to flow, job sequencing, and pinpointing the optimal time for an order release. Release the order too early, and you risk building up excess WIP or failing to accommodate last-minute changes in demand, like orders that are cancelled or changed. Every action has a reaction. Every decision has consequences. A nest could have incredible material yield, but what about the tradeoffs? A slight change in tabbing strategy can cause material to tip up or move, spurring rework. Cutting continually over slats can increase buildup and the frequency of slat cleaning. With a last-minute design change, WIP becomes scrap. Modern software is designed to look at everything at once, yet in the proper sequence—starting in bending. A tooling or bending method change also changes the blank size, which changes the cutting nest, which in turn can affect what can or cannot fit on a sheet. That affects the order release strategy, which has to be balanced with the proper routing, ensuring every job has a lane where it can keep swimming forward. Fabricators have a complex web to consider, and it is a challenge that modern software can tackle. The idea is to free operators and managers from the minutiae and focus on elements that have the greatest value for customers.

Questions Answered



Levels of Software Automation

The latest software platforms involve work in three levels of the organization: **technical**, **production**, and **business**. Each level acts not in isolation but in concert.

1

Technical Level

This involves translating CAD information to parts made in specific material on specific machines: punching machines, laser cutters, press brakes, and panel benders.

- Extracts sheet metal parts automatically from the 3D-CAD design file.
- Corrects for splines and other issues.
- The forming machine and tooling determines the blank size and nesting strategy.

Levels of Software Automation

Every decision at each level immediately affects others. For instance, a change in bending method (technical level) affects job costs (business level) and product flow (production level).

2. Production Level

This level covers resource consumption. Programmers see a part list, each with assigned times and plant routing. Software communicates with enterprise resource planning platforms to streamline information flow and marry enterprise platforms with machine-specific software platforms.

- Workflow for specific parts can be flexible (multiple potential routings) or dedicated to a specific machine, like an FMS or other automation.
- Automated processes have predictable cycle times.
- Planners utilize software intelligence to weigh production options.
- The focus is on maximizing overall throughput while meeting customer due dates.

Levels of Software Automation

Automating tasks at each level frees experts to work on manufacturability, workflow, business strategy, and other activities that add more value.

3 Business Level

Incorporating costs like material, energy consumption, and manpower, software estimates costs based on resources the job requires, drawing from a history of actual versus estimated time. At the same time, IIoT platforms record actual machine performance metrics, refining and streamlining machine performance and maintenance.

- Actual-versus-estimated data, combined with profitability information, drives a fabricator's business strategy.
- What kind of work (part geometry, manufacturing steps) does the fabricator excel?
- How do job mixes and capacity levels affect performance, reliability, and customer satisfaction?

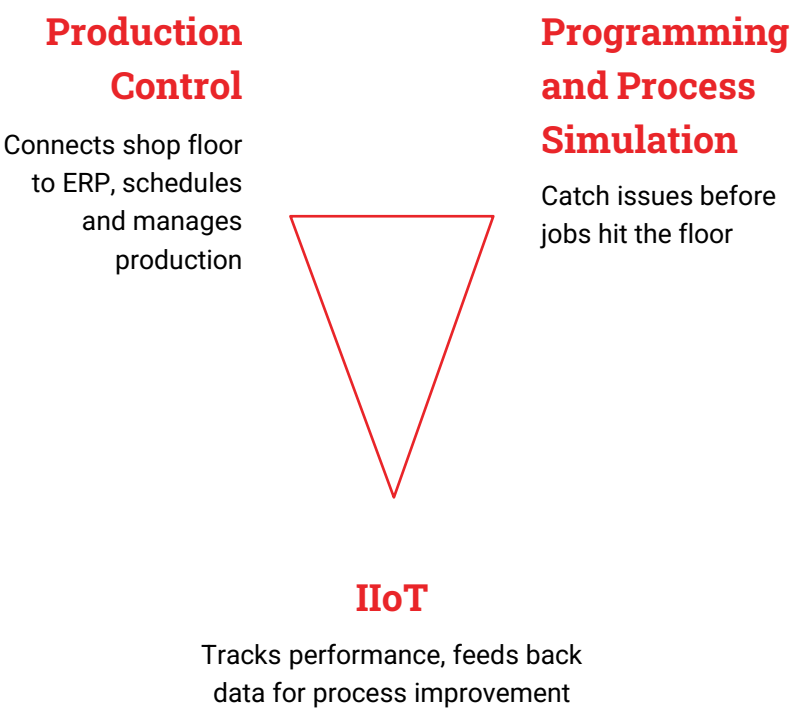
The Software Trifecta

The trifecta includes (1) **production control,** (2) **programming and process simulation,** and (3) the **Industrial Internet of Things (IIoT).** All three work together to accelerate fabrication.

The first element, programming and process simulation, ensures process stability, looking at everything from the correct bend programming to optimal placement on a laser cutting bed, not just for material yield but also process stability and efficient material handling.

Every detail enters the picture—ease of part removal from the skeleton, material handling time, error-proofing in part sorting. Material yield is just one factor. Production control software looks at hundreds of factors at once, then gives planners the information they need to sequence orders in ways that provide the most value.

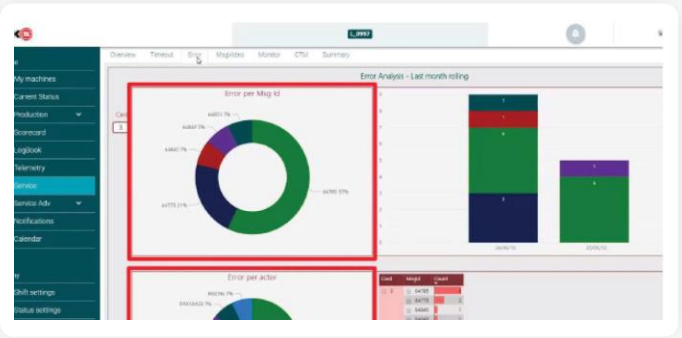
The second element, production control, automates the minutiae of planning so that skilled personnel can concentrate on what really adds value: broader strategies to better serve customers.

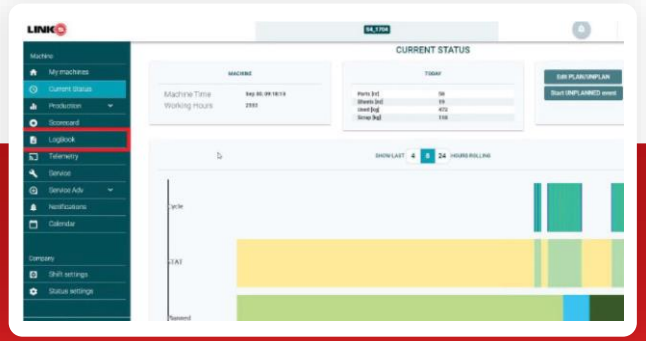


The Software Trifecta

The third part of the trifecta, IIoT, provides a holistic look at machine performance, sending notifications in real time, measuring OEE, and revealing true machine uptimes—when the bending blades are actually bending flanges on the panel bender; when the ram is actually moving on the press brake; when the tools are stroking on the punch press; and when the cutting head is moving on the laser. This in turn spurs different strategies to take within the other two software platforms in the trifecta: production control and programming. For instance, does it make sense to nest multiple jobs together, or fill a sheet with just a few parts? The thinking goes that batching would increase WIP and, therefore, slow production. But by how much? Compare that with nesting multiple jobs in one sheet. This might increase material yield, but it could also increase part sorting complexity and lead to lost or damaged parts.

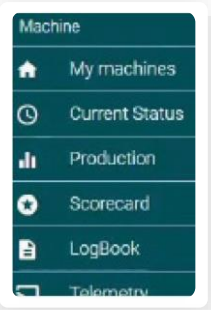
Which is best? Data, gathered and transformed into actionable information by the software trifecta, can show the way.

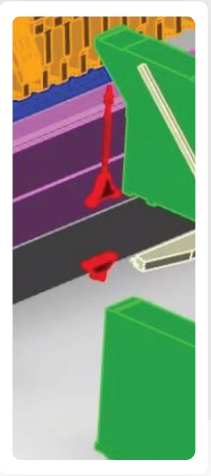




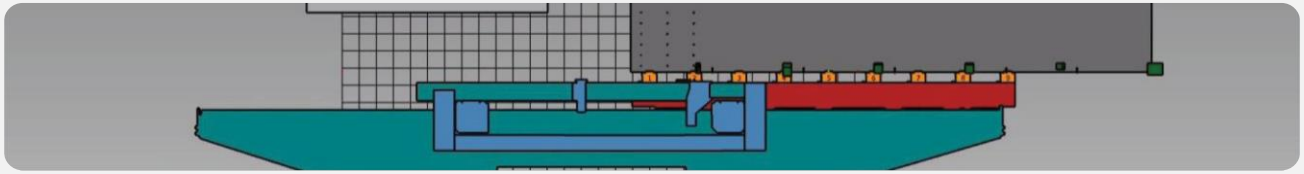
Case Studies in

Flexible, Quick Response

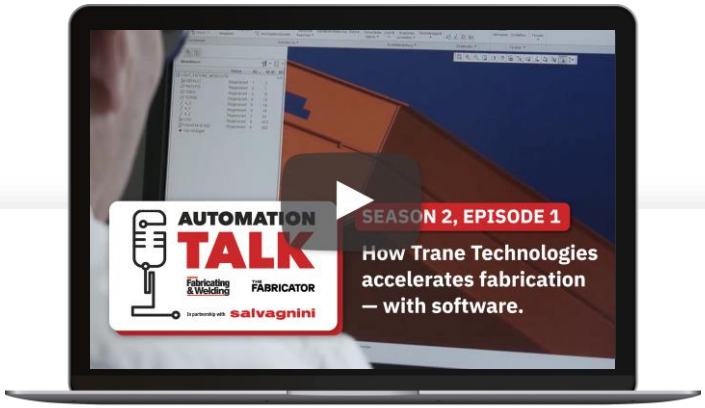




In this season of Automation Talk, we cover two very different organizations. First, we speak with **Joe Wheatley at Trane Technologies'** commercial division, focusing on the air-movement giant's advanced sheet metal operation in Columbia, S.C. Next, we speak with **Brad Shykitka, operations manager at Custom Metal Contracting (CMC),** a Canadian fabricator of metal cladding systems. The two unique organizations share one common goal: to be as flexible and responsive as possible. They accomplish this in a similar way too. They have married advanced blanking and bending automation with the power of software. This, in effect, allows each to respond quickly to downstream demands. If those demands change—and they always do—automation allows each organization to respond quickly. Both are high-product-mix operations. Keeping WIP sheet metal inventory after blanking or bending just isn't an option. To that end, "hard" automation brings sheets through blanking and bending quickly. Meanwhile, software automation shows when and how to send work to the hard automation and, most important, how to improve over time.



Two Companies, Two Software Paths, One Goal



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Thanks

Automation is poised to grow throughout manufacturing, and the precision sheet metal business is no exception. To learn more, check out a **recent study** produced by FMA in partnership with Salvagnini.

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