

Issue 5 May 2020



**DETROIT ROBOTICS**  
COMPLEXITY. AUTOMATED.

# AUTOMATING FOR TIME

**HOW A CULTURE OF  
PREPAREDNESS LEVERAGES AUTOMATION  
IN HIGH-MIX LOW-VOLUME COMPLEX  
MACHINING PROGRAMS**



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# Automating For Time

## Chess, not checkers

Ask engineering or program managers their single biggest challenge and both will most likely answer: **Time**.



Managing multiple departments and suppliers, revision changes, and a slew of reporting, all adding complexity and unknowns, create a multitude of variables except, of course, the clock.

**In aerospace, defense, and medical programs the time challenge is far greater than most typical production projects.**

HM-LV (high-mix low-volume) programs typically encounter a higher consequential magnitude (tangible impact of delays) than their high-volume low-mix (production) counterparts, especially in the testing & evaluation phases of a new RDT&E program.

The fact is, managing complex programs is chess, not checkers.

Even small problems create big delays. These delays have serious costs and consequences. Planning at least several moves ahead is essential, and the hallmark of the successful program manager.

## Planning for the unexpected

Modern manufacturing best practices are rooted in traditional strategies. Kanban, 5S Kaizen, Lean Manufacturing, etc. all attempt to manage complexity + time by relying on adapting a linear, first-in first-out approach.

They are all limited by planning for the “expected.”

Applying automation as a solution onto a traditional manufacturing model (e.g. high-volume production) works well if very little changes. Set and go, lights out, grab a cheeseburger.

**But, the complex RDT&E program team know better. They expect the unexpected.**

Just ask Elon.



# Automating For Time

## Change the culture

Some years ago, instead of focusing on what automation could do, the Detroit Robotics team created a companywide exercise to focus on what automation couldn't do.

**This was the point where we stopped looking for new solutions in old manufacturing practices and found our Eureka! in a business culture that simultaneously manages both quality and urgency, without deprioritizing either.**

A culture that we are all familiar with, to varying degrees.

Hospitals.

Think about how hospitals, specifically the A&E, cardiac and intensive care units, plan for the unexpected. They don't know what's coming through the door at the start of the shift.

**Doesn't matter. They are prepared.**

## Quality vs. Urgency.

The hospital staff, duty or on-call doctors and nurses, day shift consultants and specialists, are fully harmonized to handle a higher capacity of patients than the mean average daily-shift admittance rate. They have busy days/nights, weeks, and months. But, busy or slow, does not affect the culture of preparedness.

Urgency in manufacturing often = chaos. At the very least, people working late and pushing it through.

This is not sustainable, scalable, or adaptable.

Mistakes happen when manufacturers rush. Speed can be an antithesis to quality.

**Urgency in medical care is just another day in the office. It's baked into the culture = Preparedness.**



# Automating For Time

## Bending time

Using the hospital model, we went back to our list and asked another much harder question: how can we “beat the clock” or “bend time?”

Here’s an example. For a machined prototype part of average complexity (i.e. 50+/- features with somewhat tricky geometry) between 25% up to 40%+ of the entire process is represented by programming alone. Add about another 20% +/- for machining setup. In other words, at least 50%+ of the entire production cycle occurs before the first chip is cut.

By flexing these pre-production processes in a variety of ways (ask us how) we significantly reduced the entire production cycle time in relation to the delivery deadline.

Advanced 5-axis machining cells with automated pallet changers further accelerates the machining cycle time.

Add in some clever SPC using in-cell robotic probing and QS bottlenecks are eliminated while simultaneously providing more quality data.

**By meeting complexity + time with preparedness + automation we are able to reduce total production time from start (receipt of order) to delivery by up to 40%, on average.**

Since then, we have applied a number of non-conventional approaches to the challenge of complexity + time. Even typically non-automated functions such as project management now follow the “hospital model.”

**For example, we know that if the customer states they are “not 100% ready” it often translates as “we’re 98% ready.” We can work with that.**

Sick robot? Redundancy is applied to every single machining cell, tool, and even our people and IT.

We train our entire staff to perform at least one other key role as lead or support. This yields the happy bonus of helping our departments integrate and harmonize. Like a hospital.



# THE TAKEAWAY

- Time has the greatest consequential cost in complex prototype and low-volume program management.
- In HM-LV programs, the time advantages of automation can only be truly leveraged if all the people and processes are fully aligned and prepared.
- A culture of preparedness does not mean rushing when the work comes in but being prepared before it does.
- All parts are the same i.e. they need to be made exactly to spec. Quality is not a variable in manufacturing any more than quality of care is in a hospital.
- A good supplier delivers on time every time. A great supplier helps the customer team look good and presents new ways to collaborate.
- PS. This article was written in January 2020, pre-COVID. We salute and acknowledge each and every essential health worker who met the unexpected with courage and compassion!

## RELATED CONTENT

Issue 3 March 2020



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### AUTOMATING FOR COMPLEXITY

USING PROGRAMMING HEURISTICS AND ADVANCED 5-AXIS MACHINING TECH TO SIMPLIFY COMPLEX PARTS & PROGRAMS

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### AUTOMATING FOR PART FAMILIES

INTEGRATING AUTOMATION TOOLS TO REDUCE LABOR, COST, AND TIME FOR LOW-TO MID-VOLUME MACHINING PROGRAMS

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### RED HOT PROTOTYPING

THE COST OF NOT HAVING THE PART "NOW!"

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## THE DATA

When you run a 24 hour automated lights-out and manned operation you get a different result to the traditional 8-12 hour shift based approach.

It's not just about cramming more hours into the day to get more done. Although, sure, that's part of it.

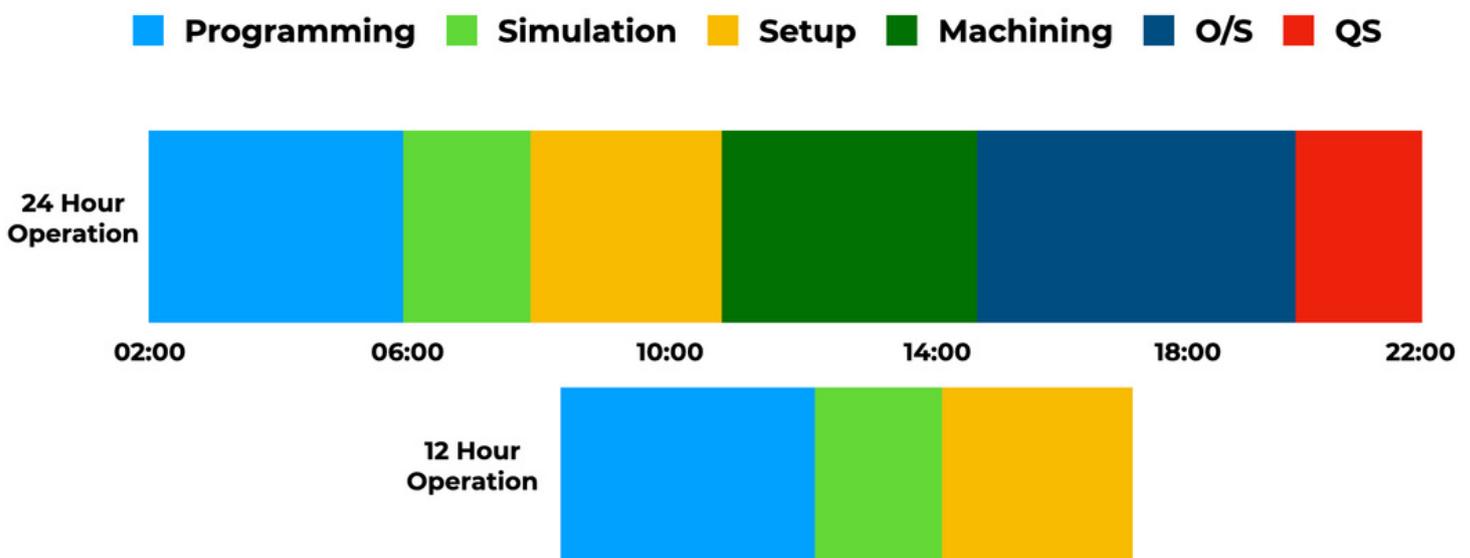
Imagine cooking Thanksgiving Dinner. But, you have to cook half before bed, and the rest when you get up. Not only is there a continuity disconnect to the process flow and disruption to momentum, but the breakdown (putting things away) and setup (taking them out) simply adds time.

Some key personnel roles even lend themselves to night shifts with fewer distractions....hello programmers and engineers! [insert engineer joke]

There's a "flow" to the manufacturing process, especially at speed. Having segments of the process "ready to go" for the machining or outside operations keeps the wind at our back and synchs with our daytime supply chain.

Sustaining the hospital metaphor, if you've ever had surgery you'll know they wake you up early. This is so all the surgery prep is precisely aligned so that the patient is ready for the surgeon operating on a tight schedule. The post-surgery procedures follows the same path.

This is how hospitals use the clock, and achieve speed without rushing.



# THE TOOLS



Hermle HS Flex Automated  
Pallet Changer



Vericut Simulation Software

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*Ingenuity for life*

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A lot of coffee

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