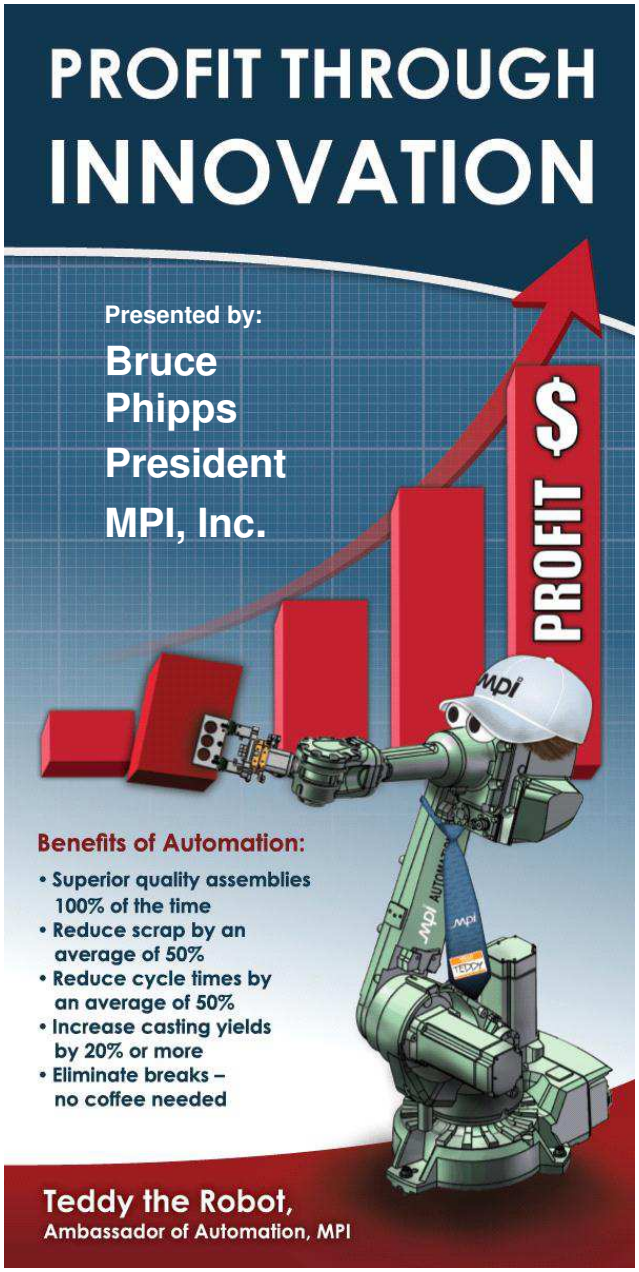
58th Technical Conference and Equipment Expo

October 9 – 12, 2011

Marriott Cincinnati RiverCenter

Covington, KY



Profit through Innovation

Increase Your Profits 100%

Profit through Innovation

How can we do it?

Through Innovation & Automation

Customer Results

INCREASED YIELDS + DECREASED SCRAP = INCREASED PROFITS

The answer is Automation

From an article on automation:

Drew Greenblatt, the President of Marlin Steel Wire Products, LLC, a Baltimore based manufacturer of fabricated wire products speaks about his facility and the decision to automate.

Automation is critical to pursue

It is intrinsic to improving the livelihoods of employees and ensuring the survival of your business

After investing $2.5M in robots for his small factory Marlin Steel Wire now employs 25 people, compared to 18 when he purchased the company. According to Mr. Greenblatt "without automation we would have gone from 18 to zero".

Six years of record revenue growth, record profit and record cash flow. Due to a couple of things, but high on the list is automation

Prior to automation a single worker could hand-bend wire at a rate of 300 bends an hour – now with four robots, he still has one person – now running the robots - and now gets 20,000 bends per hour. All 20,000 bends are highly accurate – repeatable, and most of all – profitable.

March, 2011, *Automation World,* (pg 11-14)

Why Automate?

We have seen foundries have significant gains by the implementation of automation by:

- Increasing the number of patterns per assembly by 20 percent or more
- Increase casting to raw material ratio 25% or more
- Decrease their casting defect rate by as much as 50%
- Decrease cycle time by as much as 50%
- Decrease labor required per assembly by 50% or more

Why Automate?

If you combine these individual gains with an innovative approach it is very possible to double your profit per casting

Who can Automate?

- Small Parts long runs
- Complicated High Value Assemblies
- Companies ready to buy more Equipment
  - See what is available for automation before you buy.
  - Try automation before you buy equipment. Purchase Assemblies ready for the Shell Room.

Automation Experience:

Successful Automation Projects covering:

1. Automated Injection of Turbine Blades
2. Automated the Assembly of DS and Single Crystal Turbine Blades
3. Automated Pattern Assembly

Sharing Facts

My goal for this paper is to: Share foundry success stories
- real hard facts of processes and gains achieved.

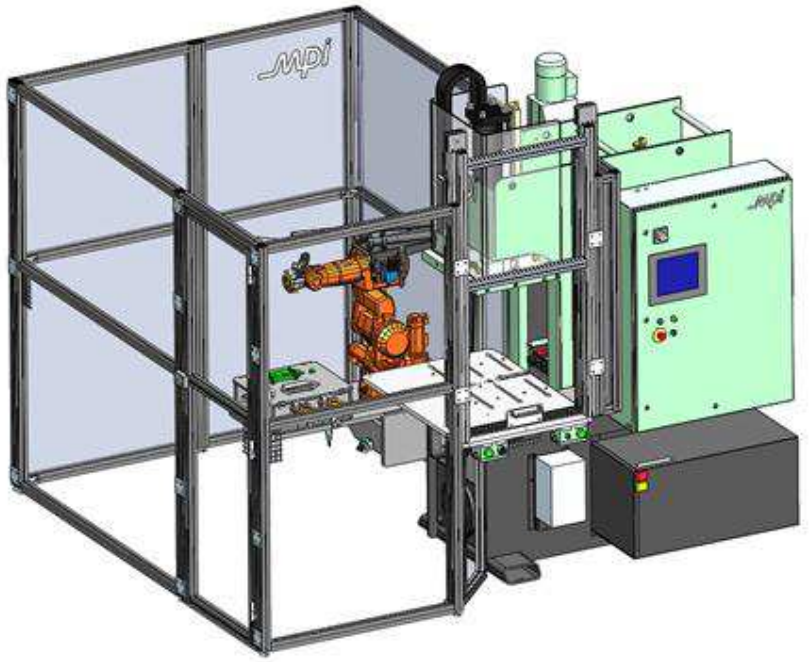
- Reality: The first two projects, automated injection and assembly of Turbine Blades, I am unable to tell you who all the players are, nor can I give you details of the processes or the real gains achieved.

- Why – Our customers do not want to lose the competitive advantage they have gained through the automation of their processes.

So bear with me while I tell you the success of automation without the ability to tell you who is winning.

Example #1
Automating a Wax Injection Machine

- Foundries have reported that the manual handling of wax pattern is the greatest cause for pattern to pattern variation.
- Depending on the pattern geometry, this variation can be the cause for as much as 50% of the metal scrap.
- By automating the injection process, including secondary operations to the patterns, much of this variation can be *eliminated*.

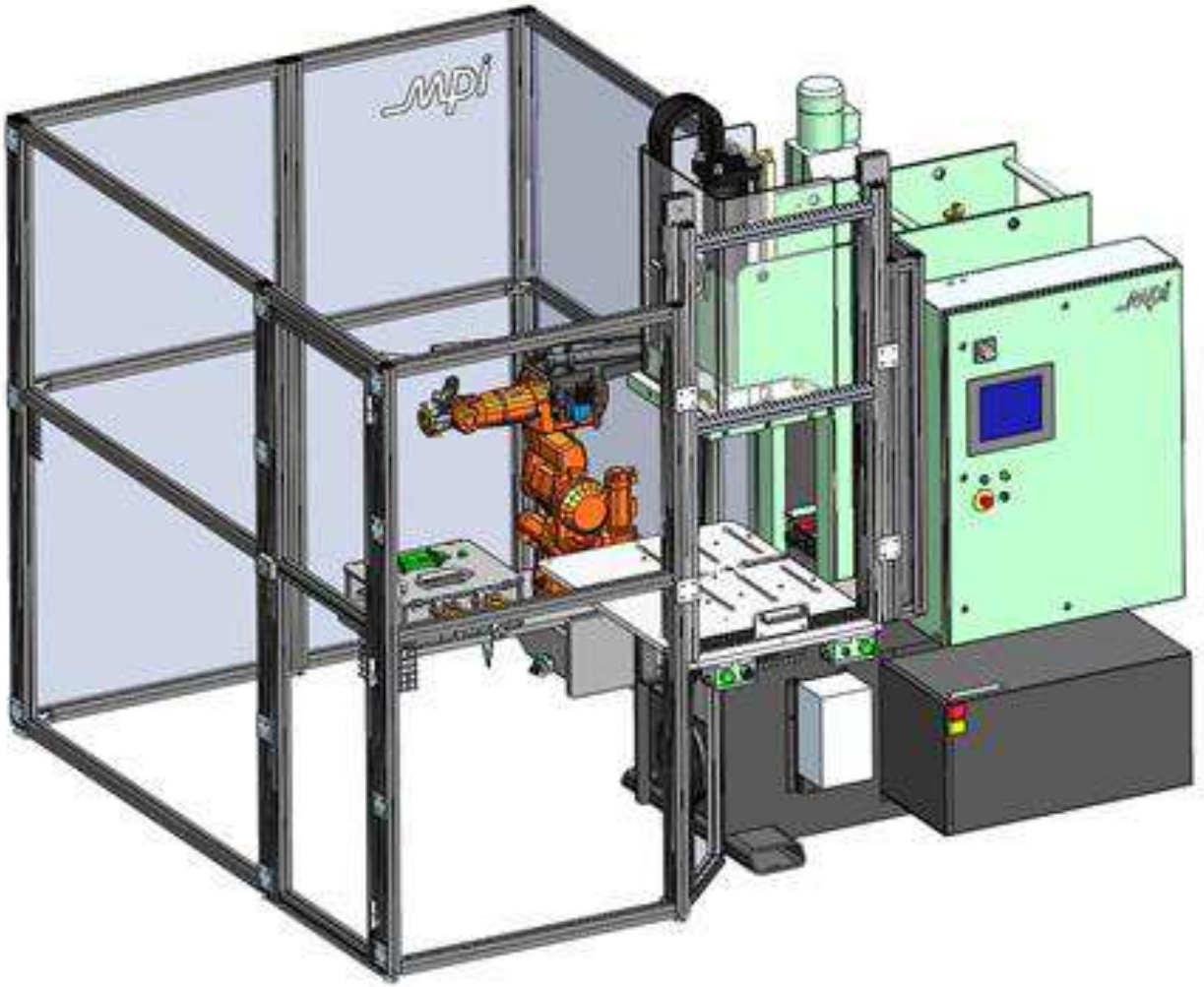


A semi-automated wax injector married to a 6 axis robot

See operate at Booth 213

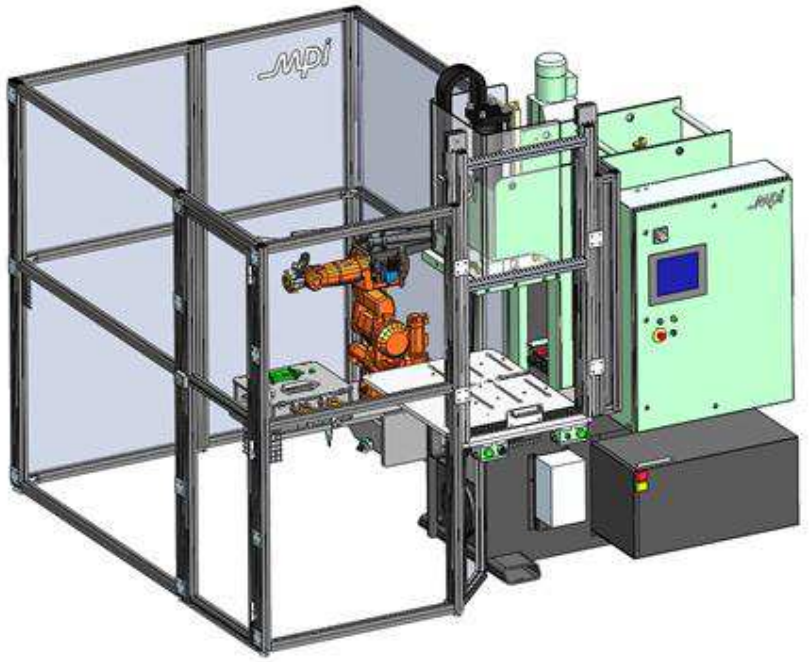
Example #1

Automating a Wax Injection Machine



The part being injected in the video is a Single Crystal Turbine Blade.

You will see the loading of the ceramic core and the grain selector.



A semi-automated wax injector married to a 6 axis robot

See operate at Booth 213


MPI
AUTOMATION

Customer Results

- Double the number of patterns injected per day, automated versus manual.
  - The cell runs more hours, no coffee breaks
  - The machine cycle is always the same length of time, no chit chat
- Pattern yields 10 to 20% higher than the same die run with an operator
  - Reduced pattern distortion, no human handling the pattern
  - Reduced pattern defects from improper die lubrication
  - Uniform pattern trimming, minimal variation
- Higher casting yields from reduced pattern to pattern variation

Customer Results

INCREASED YIELDS + DECREASED SCRAP = INCREASED PROFITS

Example #2

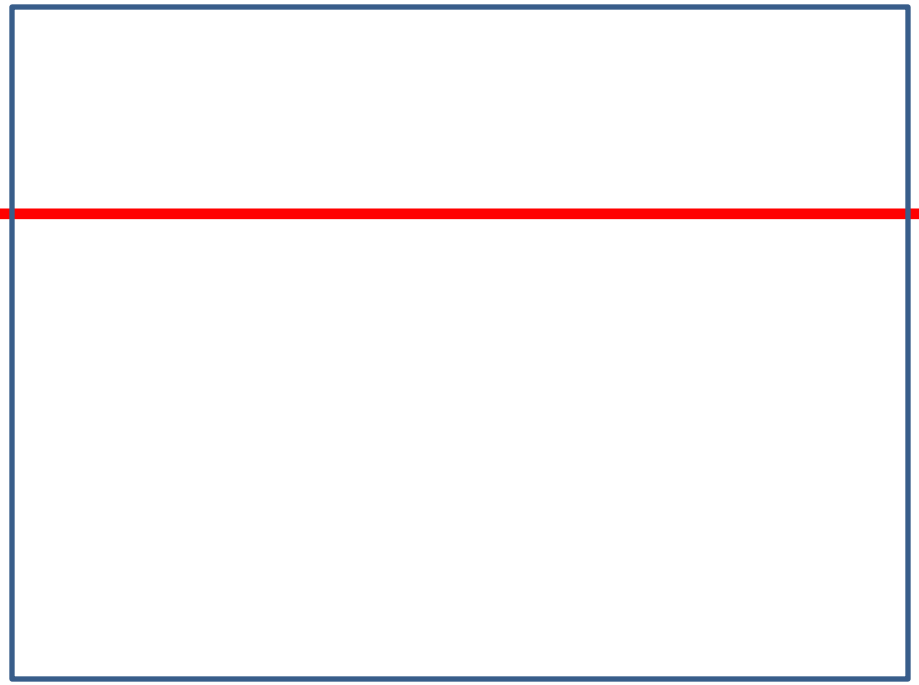
Automated Assembly of DS and Single Crystal Turbine Blades

Example #2

Automated Assembly of DS, and Single Crystal Turbine Blades

Foundries' Goals: Reduce costs and improve profits.

They all have a common approach, to automate an assembly and eliminate the variability that comes from manual assembly.

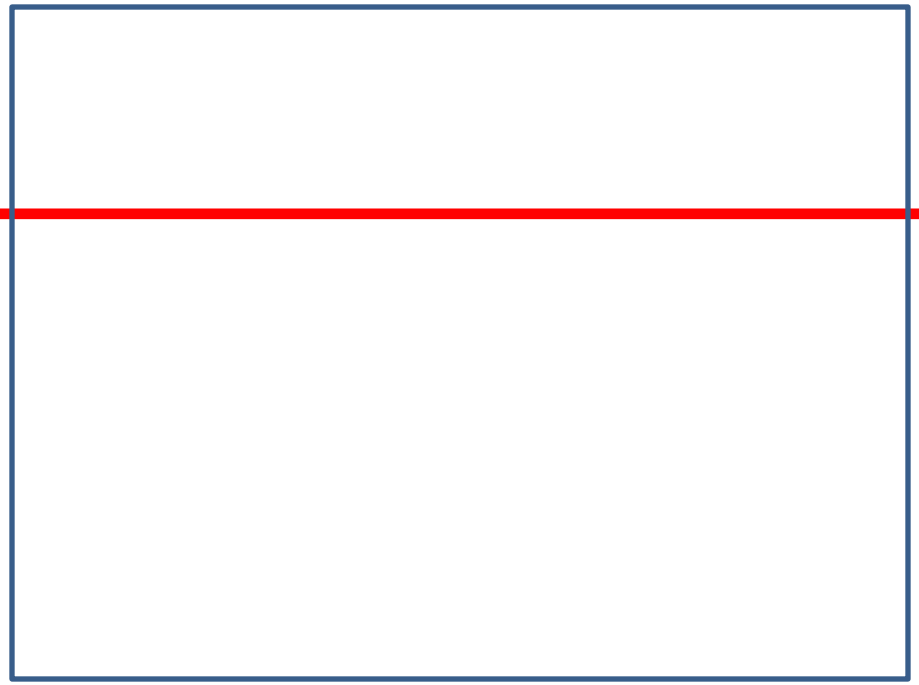


Example #2

Automated Assembly of DS, and Single Crystal Turbine Blades

What are the steps that we are taking to achieve this goal?

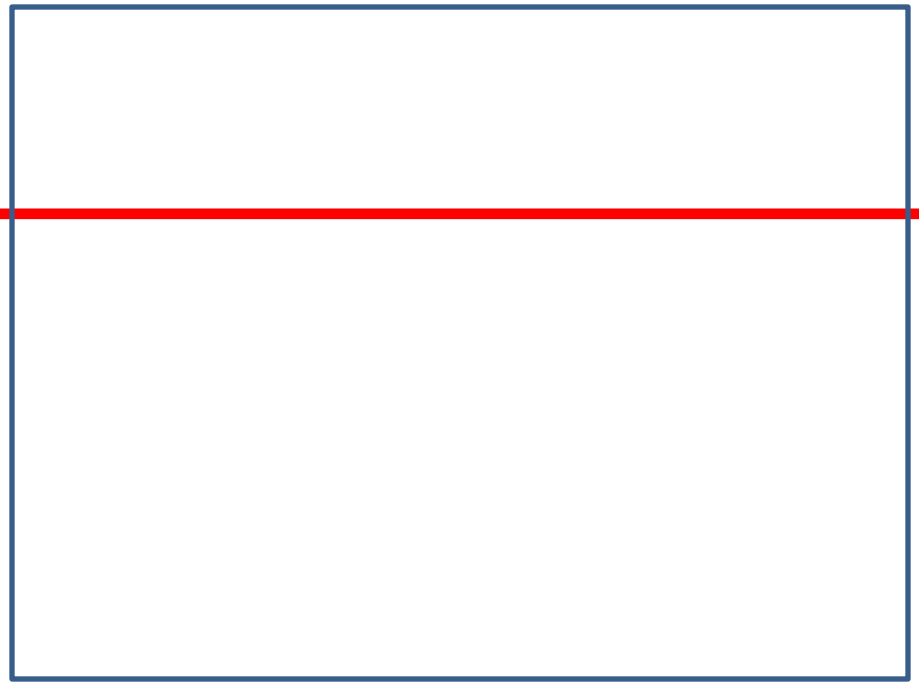
- Elimination of variation caused by use of extrusions.
- Elimination of variation caused by manual assembly of sub-assembly components.
- Grain selectors are assembled in the injection process.



Example #2

Automated Assembly of DS, and Single Crystal Turbine Blades

- Elimination of wax dripping and increased strength of horizontal fusion welds with 100% penetration. This horizontal weld can be done two different ways by:
  - Redesigned part with weld in horizontal plane or
  - Assembly manipulated using two axes of movement so each weld can be positioned for an optimal horizontal drip free weld.
- Virtually variation free – complete subassemblies are now welded into complete wax assemblies ready for shell.

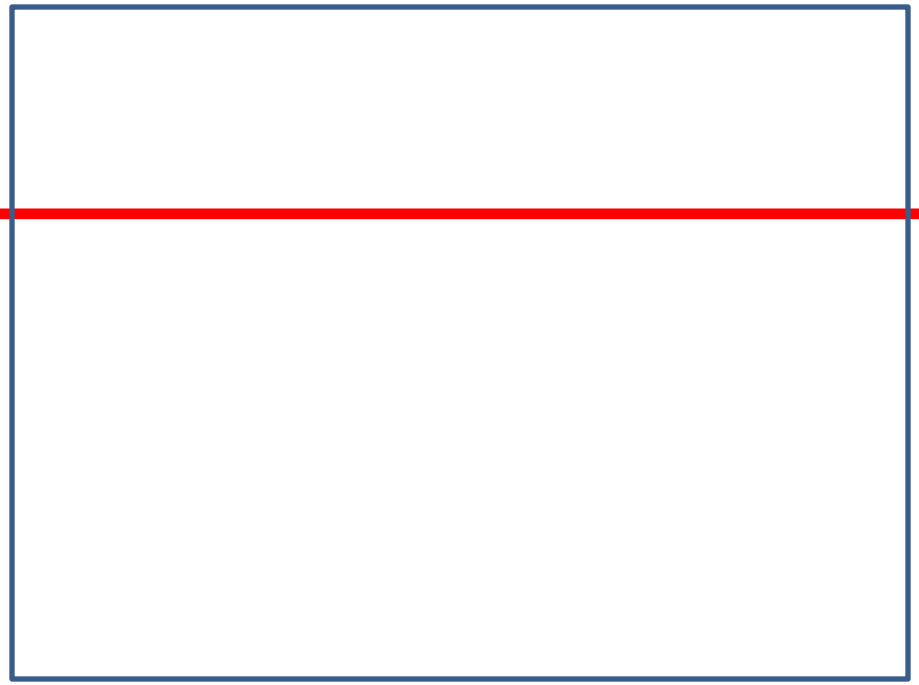


Example #2

Automated Assembly of DS, and Single Crystal Turbine Blades

The gains achieved by automating the assembly are:

- Extremely uniform and repeatable assemblies
  - Increased strength of the wax assembly
  - Repeatability in Process
- A more uniform shell coverage due to accurate spacing



Example #2

Automated Assembly of DS, and Single Crystal Turbine Blades

The gains achieved by automating the assembly are

- Improved thermal gradient of the final shell
- Improved metallurgical properties
- Higher casting yields
- Decreased cycle times
- Reduced labor

Example #3 - Avalon Precision Casting

Outsourced Automated Pattern and Assembly

Avalon is a job shop foundry specializing in commercial and aerospace hardware components.

I want to thank Avalon for allowing us share their name, and specifics.

- Management at Avalon has wanted to embrace automated pattern assembly for some time but was reluctant to make the required capital investment.
- Their biggest concern was a lack of factual data to substantiate the potential ROI.
- Avalon worked directly with MPI to develop a program where MPI provides complete assemblies, which are ready for the shell room from MPI's automated pattern assembly division.
- This solution has allowed Avalon to get into automation without making the initial investment in automation equipment.

Example #3 - Avalon Precision Casting

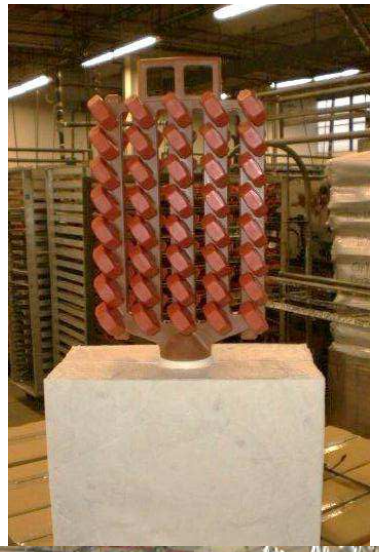
Outsourced Automated Pattern and Assembly

MPI and Avalon have worked closely together to select the correct parts to be automated and establish families of parts that utilize common tooling.

MPI now injects the runners and patterns needed, and then completes the assembly process using MPI's Automation equipment.

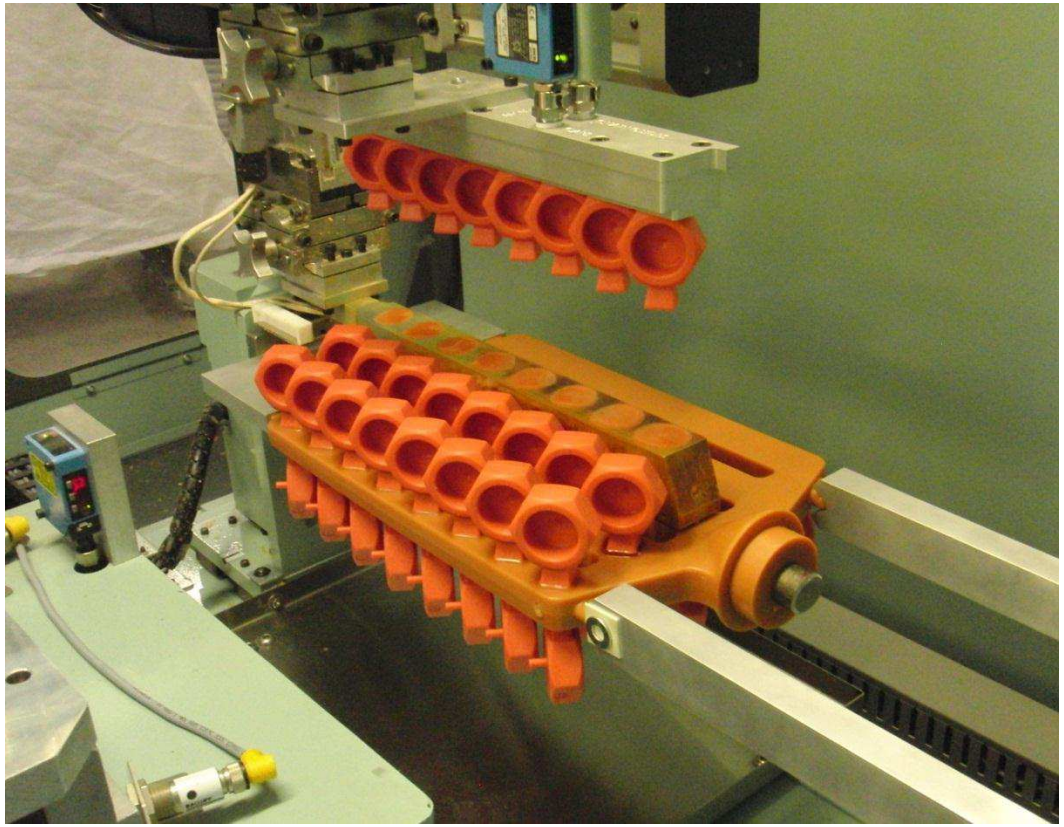
The shell ready assemblies are then delivered to Avalon.

Outsourced Automated Pattern and Assembly



Example #3 - Avalon Precision Casting

Outsourced Automated Pattern and Assembly



According to Mel Kman, the company owner and President, “I want cost savings while improving quality”.

He also sees the foundry of the future being run with fewer manual laborers, Mel feels that a fully automated foundry would significantly improve the safety of the operation.

Avalon’s goal in this endeavor no doubt includes increasing the profitability of their operation.
The results are assemblies with more patterns per assembly, higher metal yields and increase casting yields.

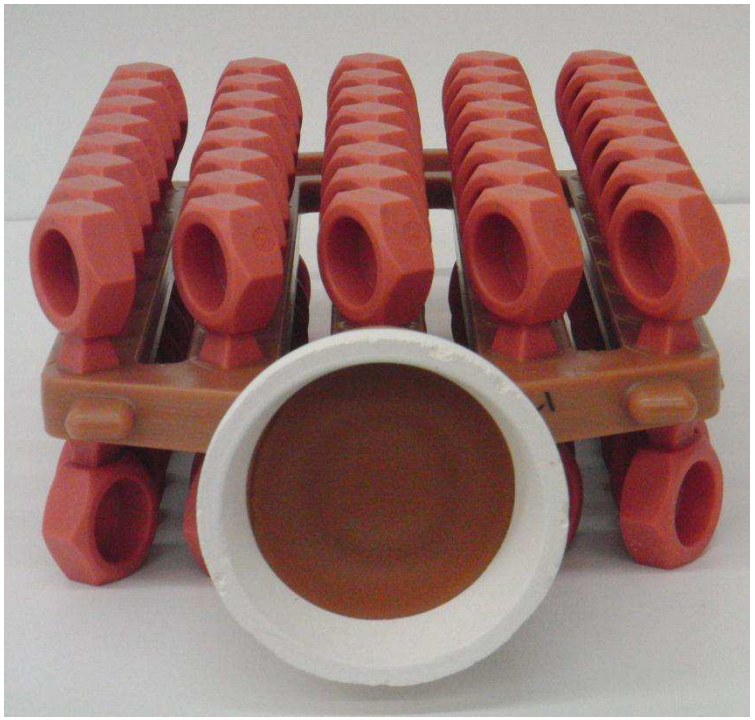
Outsourced Automated Pattern and Assembly

Mel Kman provided the following information to be shared with the industry:

- We have automated several different assemblies with patterns per mold increasing between 15% and 28% depending on the assembly.

- Metal yield has increased between 23% and 31%, again depending on assembly.

- Overall yield has improved 0.8%



Outsourced Automated Pattern and Assembly

Mel Kman provided the following information to be shared with the industry:

There was a pleasant and very unexpected surprise.

The tighter pattern spacing caused bridging of the shelling material between the parts.

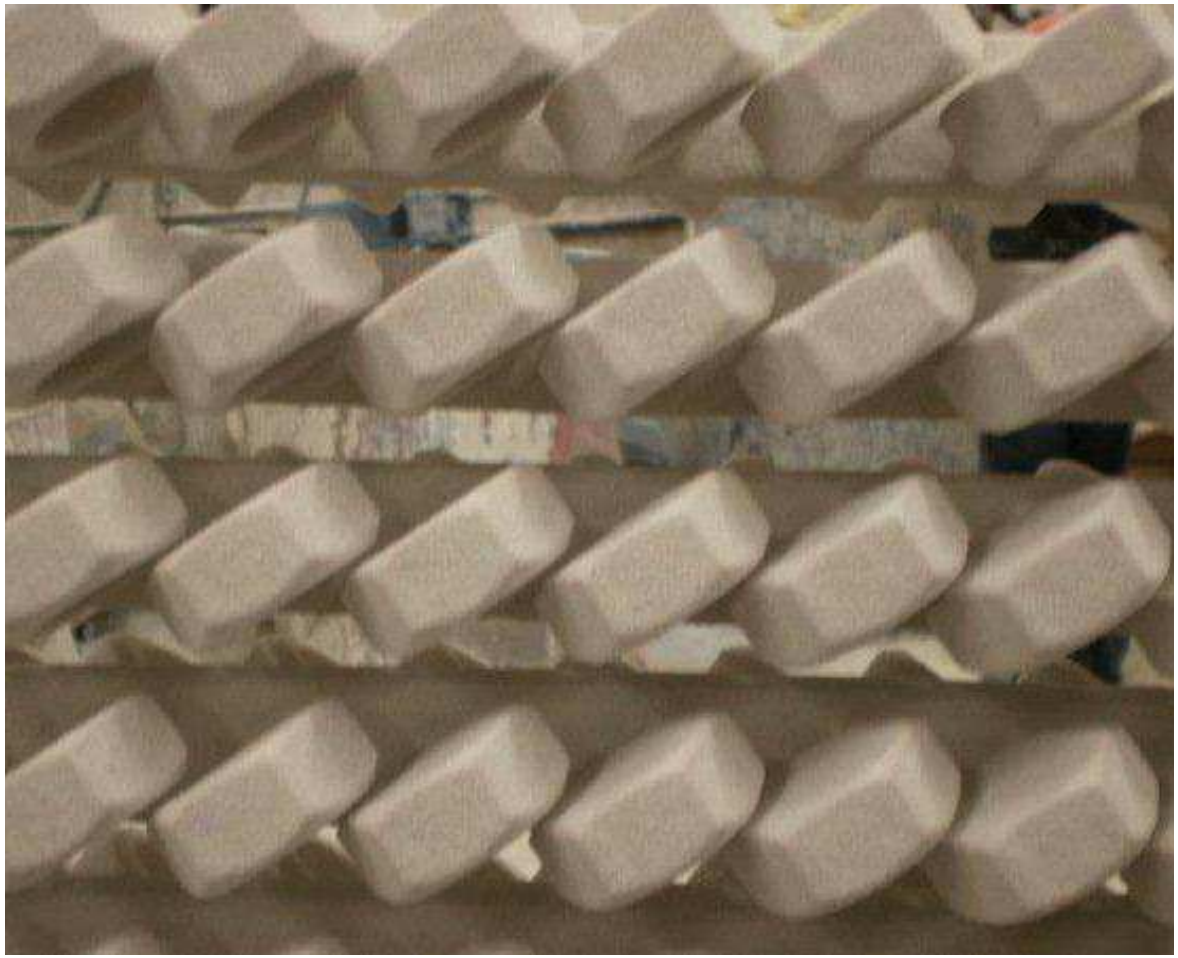
This bridging uses less shell material per assembly. Another net savings!

Mel stated **“What was the one finger rule now is the one finger nail rule.”**

This had no impact on the metallurgical properties of the parts.

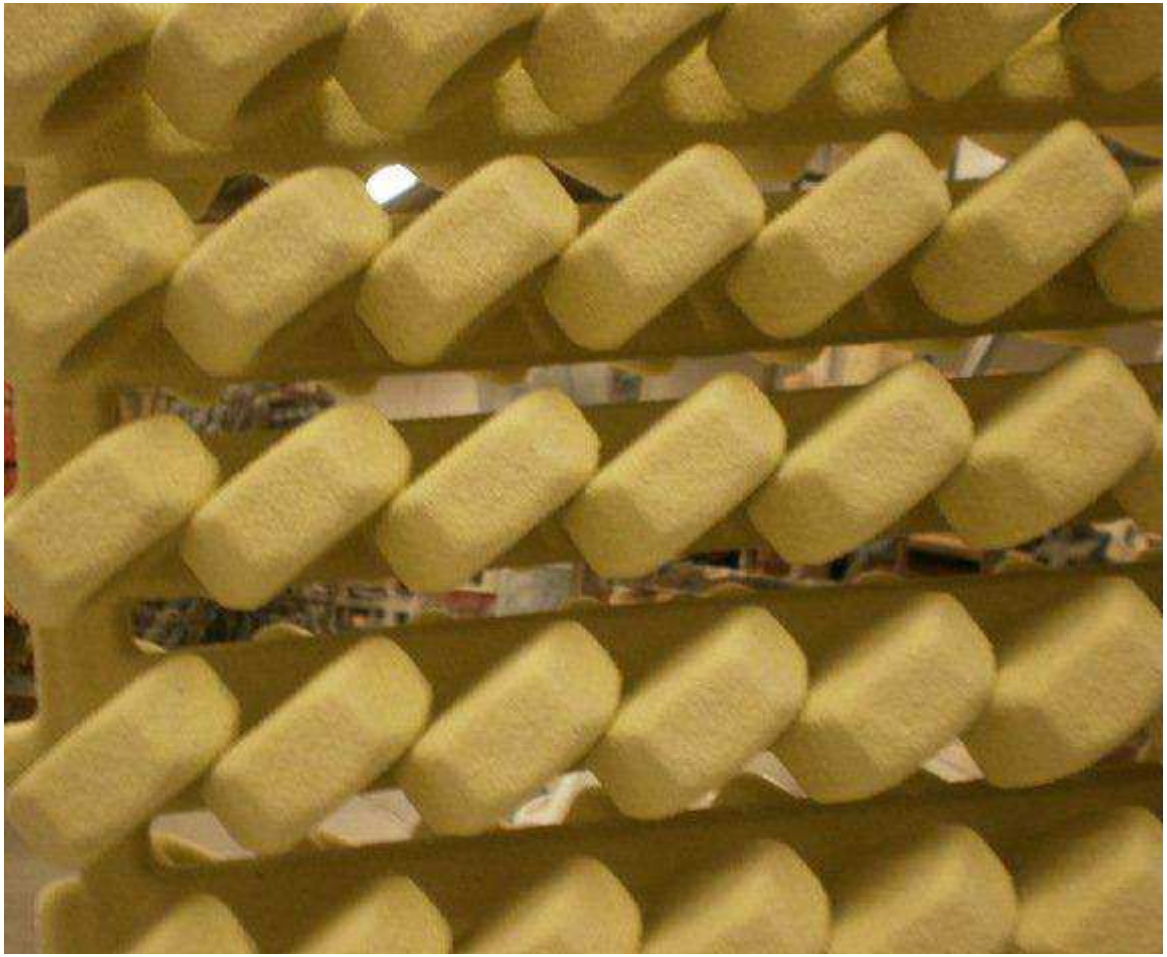
Outsourced Automated Pattern and Assembly

1st Coat

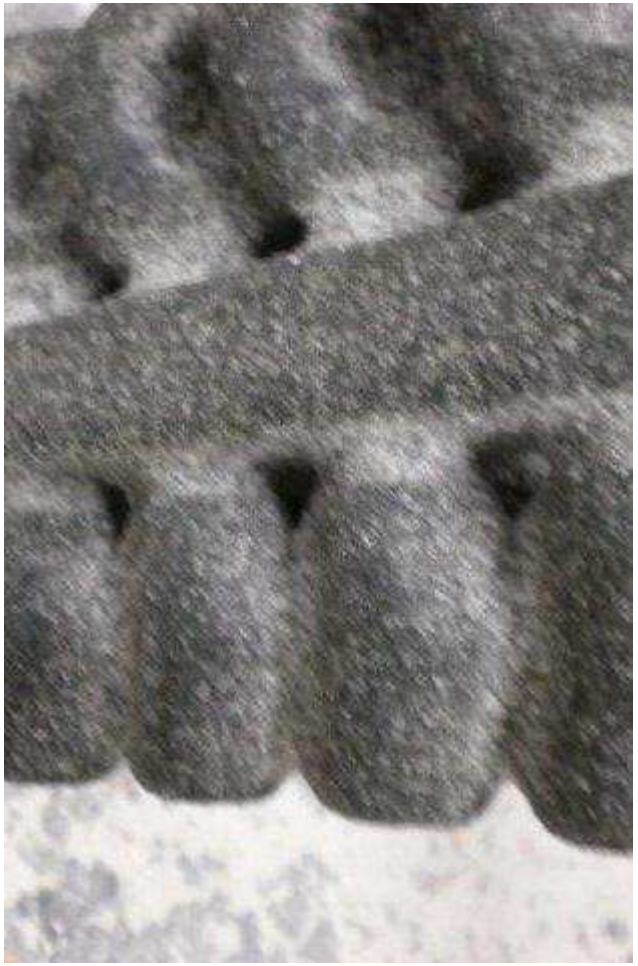


Outsourced Automated Pattern and Assembly

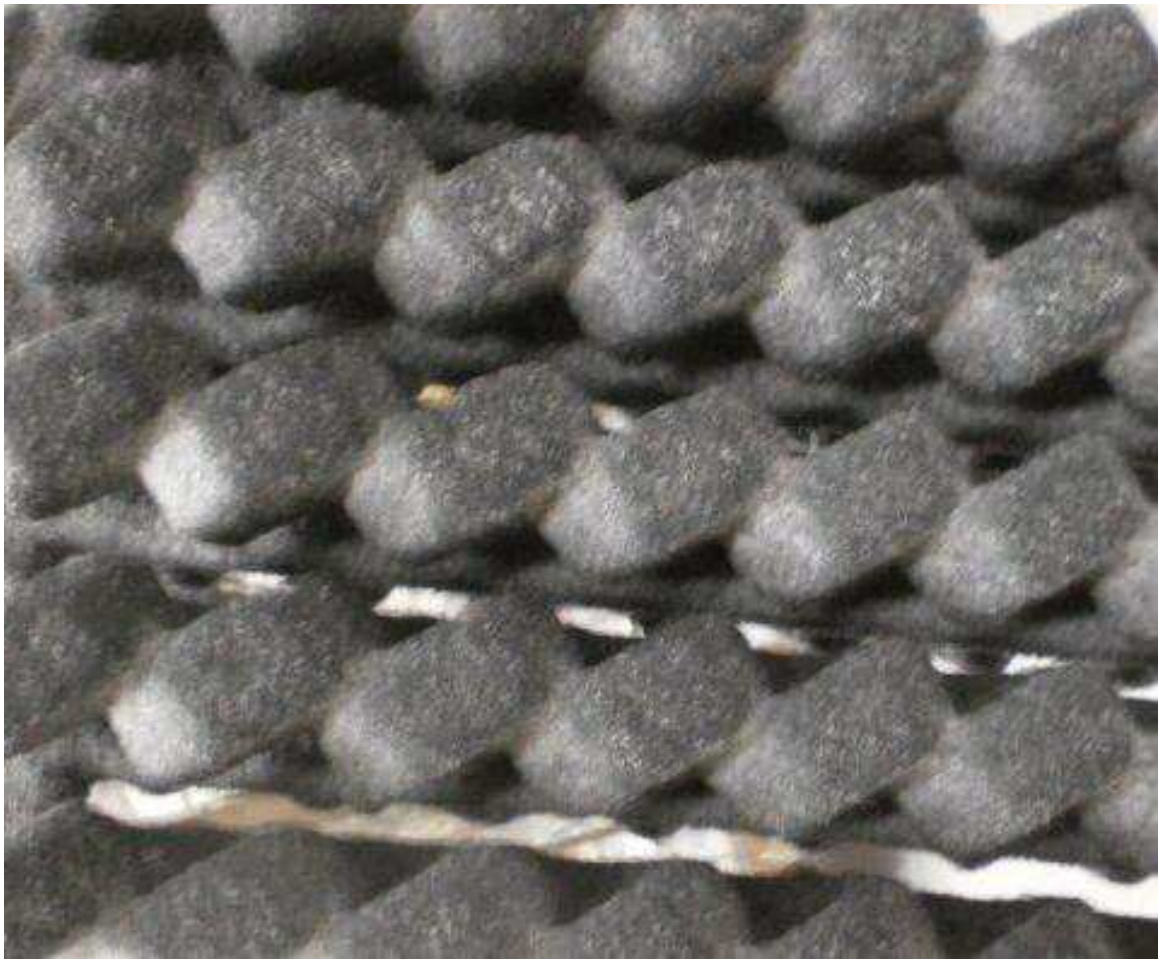
2nd Coat



Outsourced Automated Pattern and Assembly

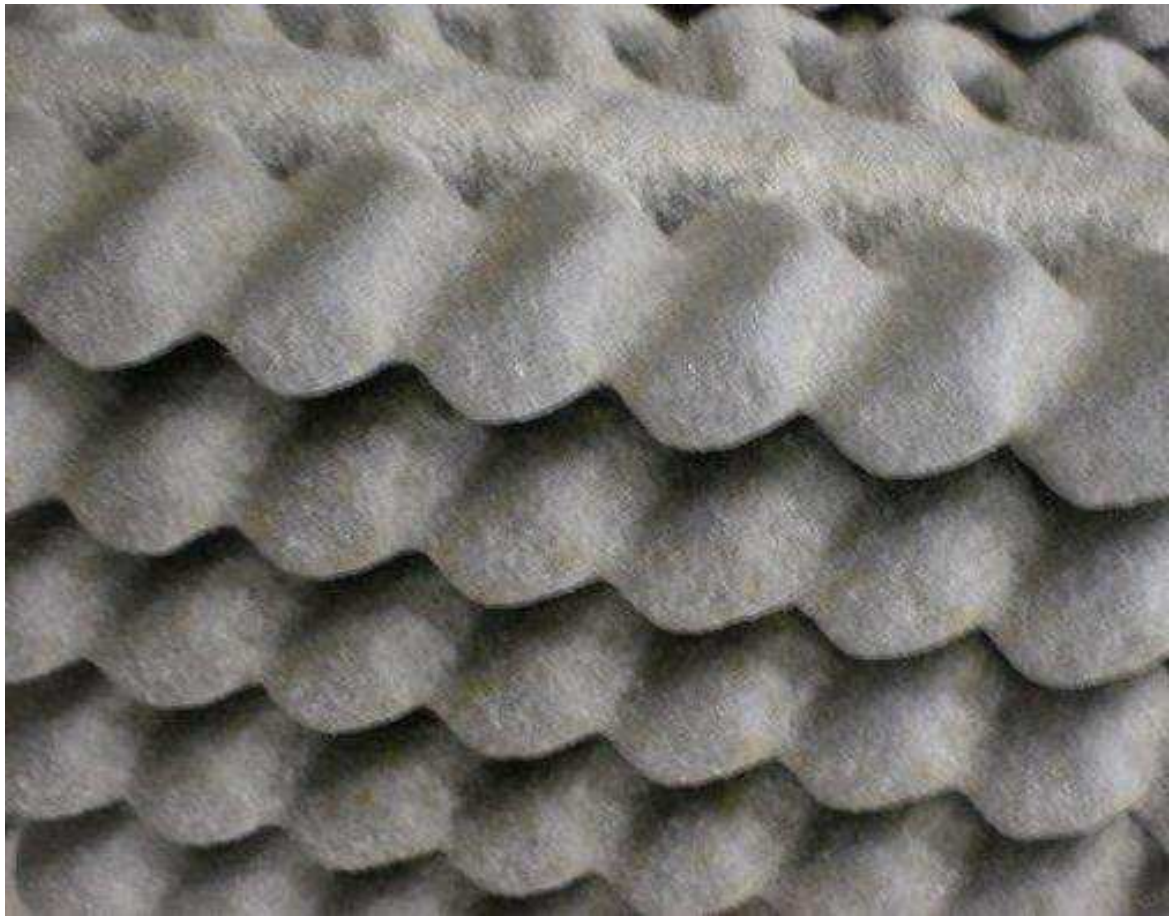


3rd Coat



Outsourced Automated Pattern and Assembly

4th Coat



Outsourced Automated Pattern and Assembly

5th Coat

Outsourced Automated Pattern and Assembly

5th Coat with Seal Coat

Customer Results

INCREASED YIELDS + DECREASED SCRAP = INCREASED PROFITS

How can you approach Automation in your wax room?

- Be selective in what you automate
- Look at your total foundry operation and measure your casting scrap rate. Read article by Cliff Fisher in July / August issue of Incast Magazine
- Analyze your scrap rate, and do a root cause analysis to see where your scrap is really coming from
- Understand the ROI associated with each automation effort and determine which area to automate based on the ROI associated with each process step

How can you approach Automation in your wax room?

- Labor reduction
- Other ROI items like customer satisfaction and delivery improvements.
- Safety – cleaner work areas with fewer, more highly skilled workforce
- Partner with a proven innovator in Wax Room Automation!

Conclusion

Automation provides you with repeatability!

Pattern to Pattern Repeatability

Assembly to Assembly Repeatability

Resulting in:

- Decreased Defects
- Higher Casting Yields
- Reduced Operating Expense
- Netting a Significantly Greater Profit Per Casting


Questions?