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# SIMPLE SOLUTIONS THAT WORK!

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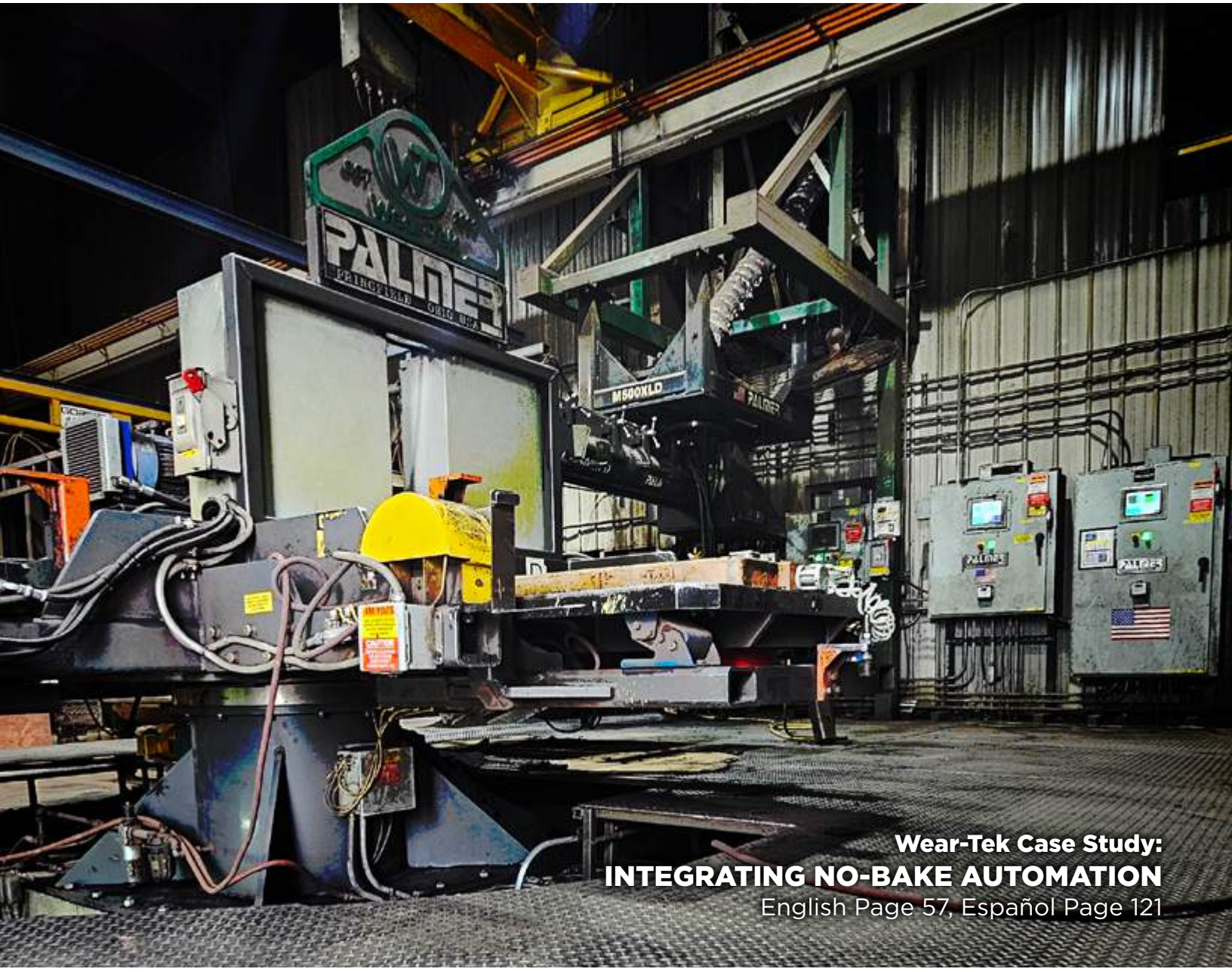


**Wear-Tek Case Study:**
**INTEGRATING NO-BAKE AUTOMATION**
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THIS ISSUE'S FOCUS

## WHAT'S NEW & WHAT WORKS

CONGRATULATIONS TO
WEAR-TEK
ON THEIR FOUNDRY EXPANSION

**JAKE REYNOLDS**
Foundry Manager,
Wear-Tek

**JACK PALMER**
President,
Palmer Manufacturing & Supply

PALMER
MANUFACTURING & SUPPLY, INC.

Palmer has been a proud equipment supplier to Wear-Tek for decades and is pleased to have been selected to automate their no-bake line with our Flip Molding Machine, yielding amazing results—increased production, faster pattern changes, and a much safer environment.

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# INTEGRATING AUTOMATION INTO THE NO-BAKE CASTING PROCESS

**JACK PALMER**
President
Palmer Manufacturing & Supply, Inc.

**ARTICLE TAKEAWAYS:**
- Defining the need for integrating automation
- Understanding the challenges of advanced automation
- Measuring Results - more than just increasing molds per hour

**Sometimes it's just better to hear about an installation of new technology, from the foundry versus the supplier; therefore, today's article, is a case study by Wear-Tek's Brandon Roy, as he presents the needs, research, and results of the installation of a Palmer Flip Molding Machine (FMM). Due to space limitations. several sections were excluded. To see the entire presentation, please visit** palmermfg.com/installations.php

**ABSTRACT**

This paper covers recent upgrades to our steel foundry as we continue to automate our no-bake molding line. In November of 2022 we installed a Palmer Flip Molding Machine (FMM), as well as the required support equipment into our mold-making processes. We will look at some of the historical challenges of foundry work and delve into the possibilities for automation to make the work more bearable. Given the steel industries pressing need to attract and retain employees, our story highlights the delicate balance between manual labor and technology. We strive to improve efficiency, consistency, speed, and safety while remaining competitive in a demanding industry.

**IDENTIFYING A NEED**

Like most businesses we have been dealing with a shortage of employees in the last few years. Given the intensive labor and difficult, dirty work we do in foundries, we perhaps have an even more difficult time finding workers. We do not see a solution to the worker availability problems anytime soon, so as we modernize our facility, we must plan to do more with less. Our challenge is to make foundry work more attractive to employees so that they stay long term while at the same time increasing productivity and making more sand molds, and therefore parts, per hour.

Wear-Tek
Wear Solutions for Industry

Figuring out how to make our employees' work easier was not merely an act of altruism, it was necessary for our survival. Our experienced workers were being lost due to injuries and attrition, and new workers wanted no part of the hard labor. Our no-bake system was based on a closed loop molding line for many years. Molds were hand packed and after setting up they were manually flipped over; large mold halves were flipped using an overhead crane. Many of our smaller molds ranged from 10 to 150 lbs. and large ones weigh several thousand pounds. Back injuries were common, as were crushed fingers and ankle injuries due to chunks of sand creating tripping hazards. I saw many new employees excited to start work only to get a taste of the mold line and never return for their second day.

We knew we had to automate a large part of our molding process but a clear-cut solution had yet to present itself. Successful upgrades can bring high rewards, but a failed one can bring financial ruin. It is a stressful decision to make.

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**EFFICIENT DESIGN**

We considered many different options including a traditional carousel with a mold rollover. This setup could have added the automation we wanted but the system had a large footprint and the rollover was too slow, maxing out at around 20 molds per hour. After consulting with Palmer Manufacturing about our needs, they recommended their Flip Molding Machine (FMM). Palmer had previously built and installed a smaller FMM at another foundry where it had been very successful for years. While our FMM would be considerably larger, after visiting the other foundry and seeing their machine in action, we were convinced that this would be the best solution for our foundry. The other foundry's employees looked calm and relaxed as they made molds; it made me wonder if they knew how easy they had it.

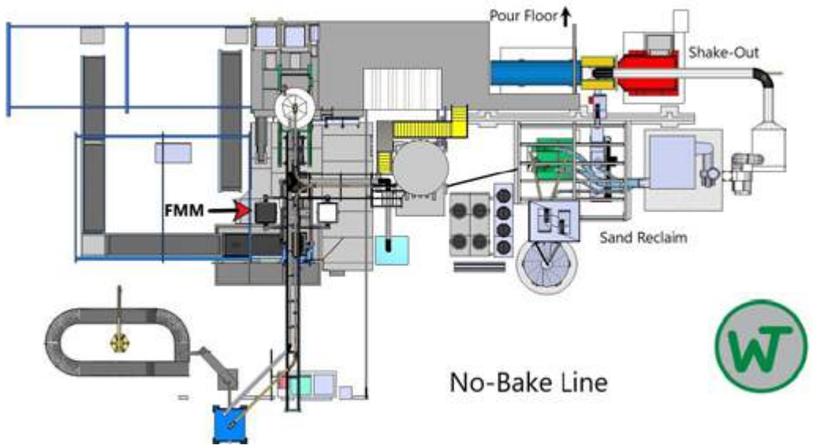
The FMM combines the traditional carousel and rollover into a single machine. It has four platens that revolve like the carousel; however, the stations also take on the function of the rollover by inverting the mold as they arrive at the final draw station. Pricewise the FMM, as a single machine, was more cost effective than buying a separate carousel and rollover, in fact it was comparable to the rollover alone.

Another requirement for us was rapid pattern changes, since we must swap patterns several times per shift. We worked with Palmer to design platens for the FMM that would be adaptable to a wide variety of pattern shapes. Our engineering team designed a clamping system that mounts in different configurations to the platens allowing for rapid changes. We kept everything as robust and simple as possible.

**SIZING THE MACHINE**

Sizing the machine for our needs was a tedious process. Palmer kept telling us that larger platens add very little additional cost, but while we didn't want to undersize our FMM we didn't want a behemoth either. We had a large warehouse filled floor to ceiling with patterns, but no list of their exact dimensions. Each pattern was measured and logged onto a spreadsheet.

Our first instinct was to aim for a machine that was large enough to accommodate 90% of our patterns. However, we came to the realization that this was the wrong metric to use. Some patterns were only used for a few molds a year, while others were used for thousands of molds. So, to arrive at the final size, we pulled production numbers for the previous 5 years and calculated the percentage of molds we produce that could fit on various size platens. The final decision was made to go with 48"x48" which would accommodate 95% of our molds produced. For reference, if we chose to go with 42"x42" platens we would have been able to get approximately 88% of our molds made on the FMM, but the extra 6" per side was deemed to be worth the extra cost and space.

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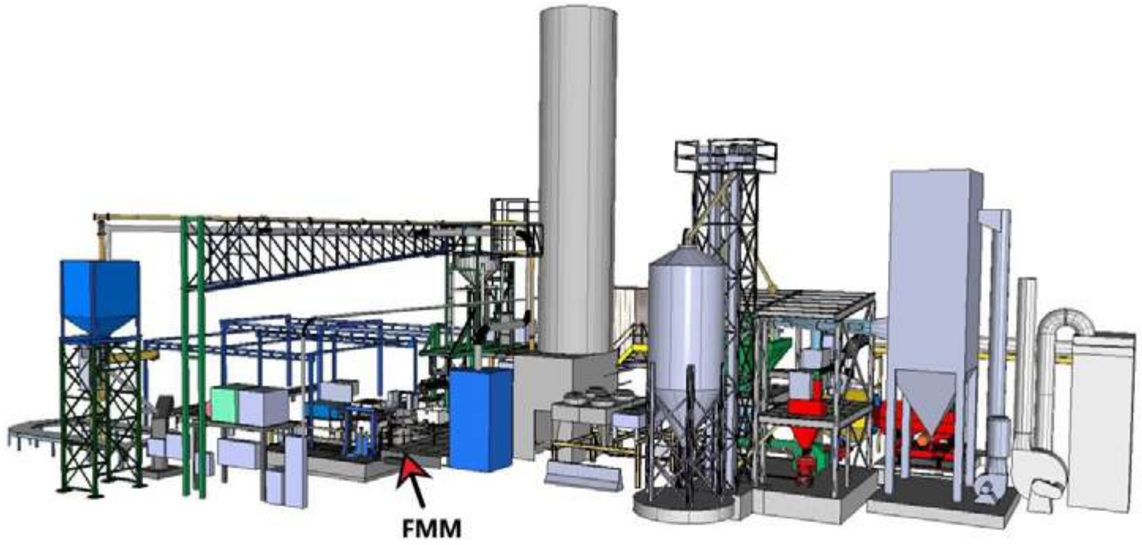


A 14" draw capacity would have also worked for 95% of our molds, but instead we chose to go with a 24" draw capacity. The increased draw was virtually the same price and provided more potential usage in the future. We also considered rectangular, rather than square, platens, but that didn't make sense due to our pattern sizes and the nature of the rotating set-up. Another thing that we took into consideration was the size of our pour carts and maneuverability of moving molds/carts to the pouring area. We have 2 sizes of pouring carts, 54"x36" and 63"x43".

We had a lot of numbers to look at and on paper things seemed pretty good. However, there was a lot of concern from management and from Palmer about how the system would fit into our existing infrastructure and how well the workflow would function once you added employees and forklifts constantly navigating around the machinery. Luckily, we have a detailed 3D model of our facility that is constantly updated as we make modifications and install new equipment. Palmer provided us with 3D models of their proposed equipment, and we were able place the models into our facility layout as well as try them out in different configurations.

Once we felt confident about the setup, management reviewed our design, but there was still concern. A slight miscalculation at this stage could have dire consequences when it came to the installation and productivity of the equipment. I ended up putting the equipment into an augmented reality program that allowed us to take a tablet out to the foundry, set a few reference points to the building, and then take a virtual tour of the work area. Management was able to hold up the tablet and view the equipment as they walked around it to make sure there were no obstacles and pathways were wide enough for forklifts to safely operate. This visualization alleviated everyone's concerns and we were given the greenlight to move forward with the project.

In addition to the location of machinery, it was crucial at this stage of the design to take into consideration how the machinery would be transported, unloaded, and moved into the foundry. The FMM has a width of 16.5' making it too wide for a Semi-trailer and also too wide to fit into our roll up door. Palmer was able to design the FMM so that two opposing platens were removable and could be shipped separately. This brought the width down to just under 12'. The FMM was shipped on a Semi-trailer as an oversized load, and it fit into our foundry doors with about 1" of clearance on each side. We were able to unload the FMM with a large forklift that we rented. I try to avoid hiring a crane whenever possible as that dramatically increases installation costs.

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**RESULTS MATTER**

It took us several weeks to get everyone synchronized so that we could utilize the full output of the FMM. We are still working on ways to improve the performance of both the machine and the employees; only now it is an orchestrated dance rather than a brutish fight. No more heavy lifting and crushed fingers, instead there is a multitude of hand signals and emphatic yelling as each station gives all clear to signal the FMM to rotate.

If we look at the number of molds per hour that we are making with the FMM it can be a little deceiving. Our old line was making 16 molds per hour on average. Now we average 21 molds per hour from the FMM with our fastest shift on record making 32 molds per hour. It may not look like a huge improvement, but the FMM has allowed us to change our molding workflow in ways not possible before.

Previously, with large patterns we could only make one or two molds per hour and we would run several smaller patterns in between them. But the FMM does not care what size the pattern is, it does not get fatigued or slow down. We can now run the pattern and make 20 or more molds per hour, regardless of whether they are large or small. With smaller patterns we are able to double them up on the platen, producing the cope and drag at the same time. Also, we have started to optimize patterns from which we make a large volume of castings. For example, patterns that previously produced four castings have been changed to now produce eight castings, making each mold from the pattern twice as productive. Previously the optimized patterns would have been awkward to manually flip over but the FMM has no issues.

This increased productivity has allowed us to reduce our mold making from three shifts working around the clock to a single shift running the FMM. Odd sized patterns and ones that only require a few molds are still made on a separate closed loop line that also runs one shift per day with minimal staffing and much safer working conditions.

**CONCLUSION**

Our Foundry Manager, Jake Reynolds, recently told me that without the FMM upgrade, he feels like we would have been moving backwards as a company. The pandemic brought about a lot of hurdles for companies to jump, and we were able to mitigate the employee retention problems we were already having by automating our no-bake molding process. For me personally, I knew we were going to be successful when I saw one of our long-time employees bring his 5 kids in on a Saturday to show them what we were building. I was used to hearing people complain about foundry work and sometimes dismiss it as a dead-end job, but as I watched this employee show his kids around you could see the pride and excitement in his face. After installing the FMM, employee morale has been high and we experienced an 18 month run of profitable months, even with all the supply chain turmoil. It is still a tough dirty environment, but the improvements are leaps and bounds beyond the physical work we were asking people to do before.

I see the FMM as being the core of our no-bake line for at least the next decade. However, I also know that to stop upgrading is stagnation. The practices that are profitable today aren't necessarily going to be tomorrow. Without upgrades competitiveness declines, workers motivation evaporates and soon the furnaces will go cold. I have faith that the metal casting industry will continue to innovate in ways that are beyond my imagination. The final line of Birringuchio's passage seems a fitting way to end this paper. After his colorful description of the sufferings of the foundry profession he simply concludes "But, with all this, it is a profitable and skillful art and in the large part delightful." I couldn't agree more.

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# ARTIFICIAL INTELLEGENCE IN THE FOUNDRY

**DAVID WHITE**
Co-Owner
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**ARTICLE TAKEAWAYS:**

- Understanding the benefits of virtual reality in the foundry
- AI is revolutionizing predictive maintenance, and resource optimization
- Steps to getting started with AI

First of all, congratulations to Simple Solutions That Work! for their 10-year anniversary! It has been a privilege and honor to write for this very informative metalcasting and die casting e-magazine.

In the dynamic landscape of metal and die casting, a notable shift is the increasing adoption of AI and VR technologies. These innovations offer advantages, from enhancing operational efficiency to improving safety protocols. VR, in particular, revolutionizes training by providing immersive experiences for equipment operation, production floor layout, safety procedures, and maintenance tasks. Notably, industry leaders are leveraging VR specifically to streamline their operations to reduce waste. AI, on the other hand, empowers these industries with predictive maintenance, quality control, and process optimization. By embracing these technologies, companies can stay ahead in a competitive market while ensuring the highest standards of productivity and innovation.

The integration of AI technologies isn't merely a trend; it's a strategic imperative for ensuring sustainability and competitiveness in today's market. AI systems, are sophisticated software platforms adept at analyzing data and making informed decisions. In the context of die casting and foundries, AI is revolutionizing processes such as predictive maintenance, quality control, and resource optimization. For instance, AI-powered predictive maintenance algorithms can preemptively identify equipment failures, minimizing downtime and reducing operational costs. Moreover, AI-driven quality control mechanisms enhance product consistency and compliance with stringent industry standards. By embracing AI, companies can not only enhance their operational efficiency but also mitigate environmental impact, thus fostering long-term sustainability. Furthermore, AI enables companies to stay ahead of the curve, enhancing their competitiveness in an ever-evolving market. From optimizing production schedules to refining supply chain management, AI empowers businesses to adapt swiftly to changing market dynamics and customer demands. In essence, AI isn't just a technological advancement; it's a strategic enabler driving the future of die casting and foundry operations.

While the concept of artificial intelligence might evoke images of cutting-edge technology, simple forms of AI have been integral to the industry for decades, primarily through the use of robots. These robots, with their programmed tasks, have played a crucial role in automating various aspects of the manufacturing process. For over 20 years, they have been extracting parts from die-cast machines and placing them in trim presses, directing ladles to holding furnaces, and pouring molten metal with precision. Additionally, robots excel in common foundry tasks such as grinding and deburring. Though these applications may seem routine, they represent the foundational elements of automation that have significantly enhanced the productivity and reliability of manufacturing operations.

What's truly groundbreaking is the integration of AI that enables direct communication between vendors and machines for troubleshooting and monitoring purposes. This advancement not only ensures that machinery operates within design parameters, optimizing efficiency,

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