

## Progressive Solution for Progressive Dies

### **MAJESTIC INDUSTRIES, INC.**

Majestic Industries, Inc. makes sheet metal stamping dies for industrial, consumer and automotive products. To set itself apart in this ultra-competitive market, Majestic specializes in high-speed progressive dies for large stampings. Presenting greater challenges and higher complexities, the company incorporates advanced technologies to manufacture these state-of-the-art tools.

The sheer size of its progressive dies makes them difficult to inspect and measure. Up to 18 feet long and 100 thousand pounds, they can be too big for a coordinate measurement machine (CMM) and too unwieldy to transport to an inspection lab. So, the company invested in a 3D scanning and portable CMM system that travels to the dies.

The 3D scanning system, which includes Leica Geosystem's handheld T-Scan and T-Probe and InnovMetrics' PolyWorks® software, handles the bulk of tooling and stamping inspections. According to Mike Reed, quality manager, "The system is working very well for incoming, in-process and first article inspections. We are very pleased with what it is doing for us." However, Majestic has realized that the scanning system can do much more than assure quality. "We are discovering more and more things that it can be used for," said Reed.

**One of Majestic's discoveries is that the combination of Leica scanner and PolyWorks software cuts die tryout times in half.**

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# Progressive Die Tryouts

Before submitting sheet metal stampings for customer acceptance, each progressive die goes through an exhaustive die tryout process. Following design and construction, dies are loaded onto sampling presses and the first-off stampings are measured. The die is then machined, adjusted and reloaded in the press for another run of sample parts. This iterative process is time consuming and labor intensive.

With the size and complexity of its progressive dies, Majestic previously spent upwards of two months in the die tryout phase. Reed said, "Depending on the part, there could be five to eight iterations before we get it just right." The samples were measured with a coordinate measurement machine (CMM), which gave Majestic's talented design team only a few hundred dimensions to diagnose the stampings. Without the whole picture, the die designers relied on experience and intuition to determine where adjustments were needed and how much springback compensation to use.

Since removing too much steel from the die is undesirable, "We would make conservative adjustments to make sure we were always cutting 'metal safe'," said Reed. With each iteration taking nearly a week, the conservative approach to die tryouts lengthened deliveries, raised expenses and lowered profits.

Reed said, "Something that we are very excited about is using the scanning system to help with compensating for springback during die tryouts. With the Leica scanner and PolyWorks, we are cutting that time by more than half." The time reduction comes from faster reporting and better information that lets the tool makers be more aggressive in each round of die adjustments.

As first-off samples come off the press, they are laser scanned with the handheld Leica T-Scan. The scanner feeds up to 20,000 points per second directly into the PolyWorks/Inspector™ package. Within moments of completing the scan, PolyWorks produces a global comparison of the part to its CAD data. The resulting color map vividly depicts the sheet metal stamping and highlights areas needing modification. Reed said, "It is almost instantaneous feedback on the quality of the part. I scan it and tell the designers exactly what is going on."

The software not only shows where the part is out of spec, it also removes the guesswork. "With PolyWorks V11, there is a Morphing tool that allows us to predict and adjust for springback of the stamping," said Reed. "And that is how we are reducing the number of die tryout iterations."

The bottom line for Majestic is that reducing die tryout times helps it to be competitive. Its customers are designing complex stampings yet expecting shorter deliveries and lower prices. To address the demand, Majestic leverages the 3D scanning system to accelerate the die making process.



"Even with a tight deadline on a tough part, we know we can get the job done right."

**Mike Reed,**  
Majestic Ind., Inc.  
Quality  
Manager

**Mike Reed**  
at Majestic,  
scanning a sheet  
metal stamping,  
directly into  
PolyWorks,  
with the Leica  
T-Scan portable  
laser scanner.



# Accepting the Challenge

To prove his point, Reed cited a project that started with a complex, two-piece assembly that the customer wanted consolidated into a single stamping. This project was challenging because the parts were very long, very contorted and very unpredictable in terms of springback. Reed said, "Without 3D scanning, we would not have been able to tackle this job. It would have needed too many die iterations, taken way too long, and been too risky."

Relying on the 3D scanning system to make short work of the die tryout, Majestic accepted the challenge of making the progressive die for this difficult stamping. As is now its standard practice, first-off stampings were investigated in PolyWorks/Inspector. Using the live feed capability, the data from the T-Scan laser scanner and T-Probe portable CMM was brought directly into PolyWorks as the sample was scanned. Next, a polygonal model was automatically generated from the scanned data using PolyWorks' meshing technology. After importing the reference model (meshed CAD model), it was compared to the scanned part to perform a global deviation analysis (Figures 1 and 2). The die makers then reviewed the resulting color map to determine exactly what changes were necessary.

When the modifications involved springback compensation, Majestic used the new Morphing tool in the PolyWorks/Modeler™ package. This application automatically makes the necessary adjustments to have a stamping that is within design specifications. "With the Morphing tool, I lock in the points on the scan data that I don't want to move. Then I select points in the areas that I want to adjust in the CAD model, and PolyWorks automatically matches them to their corresponding points on the scanned part (Figure 3). Finally, I set the compensation percentage, and PolyWorks does all of the calculations for me, compensates the auto-match points, and creates a new mesh for the CAD model (Figures 4, 5, and 6)," said Reed.

After the changes were made, the data was imported into CATIA® to be used for modification of the die design and creation of new machining tool paths. Then the team started the second round of machining, stamping and 3D scanning. Reed said, "Even with the scanning system, we needed six die iterations to get this part right." But he was quick to note, "Without it, it would have been more than double that."

When the project was completed, Majestic was happy that it accepted this difficult project, and its customer was very pleased with the results.

According to Reed, Majestic Industries has a history of staying on top of technology, and he believes that that is a big reason that it continues to be successful.

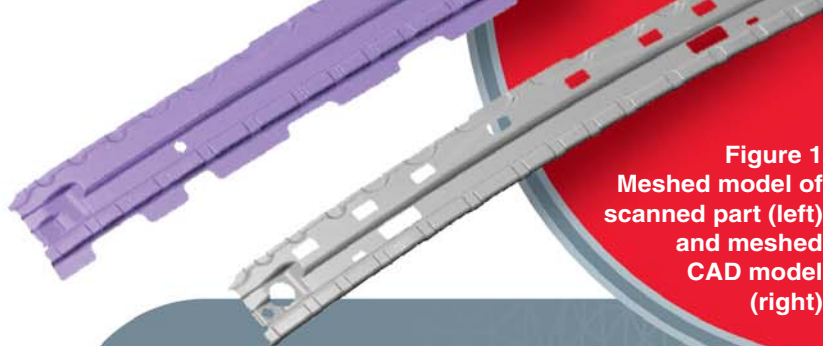


Figure 1  
Meshed model of scanned part (left) and meshed CAD model (right)

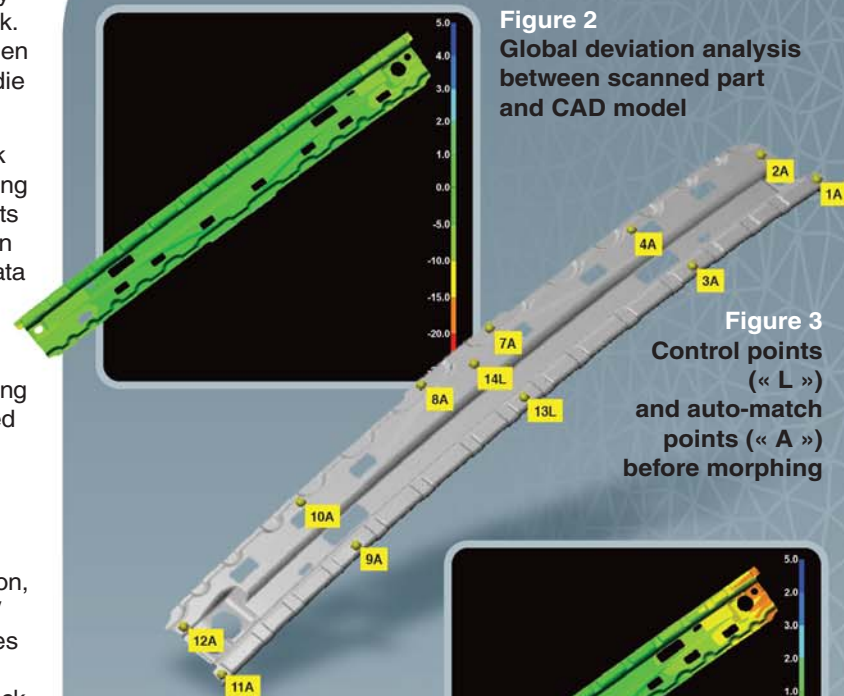


Figure 2  
Global deviation analysis between scanned part and CAD model

Figure 3  
Control points ( $\llcorner L \llcorner$ ) and auto-match points ( $\llcorner A \llcorner$ ) before morphing

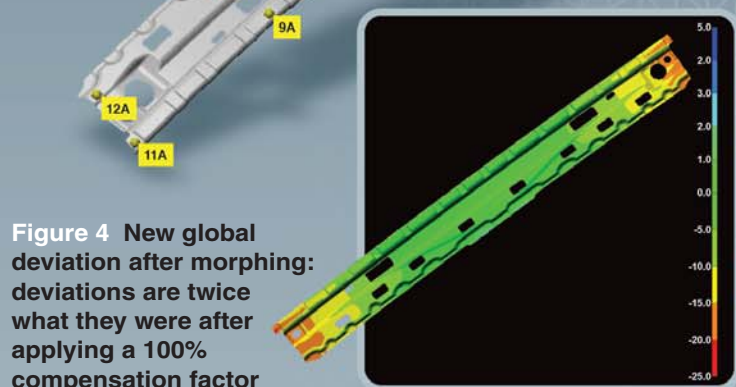


Figure 4 New global deviation after morphing: deviations are twice what they were after applying a 100% compensation factor

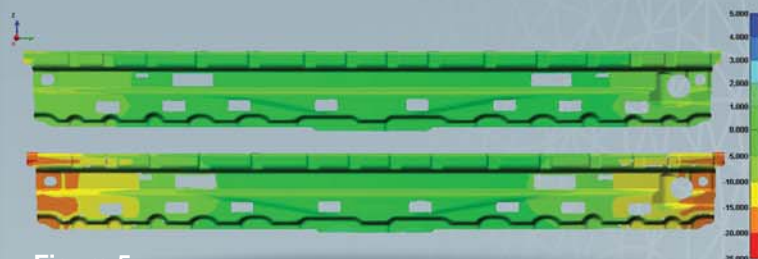
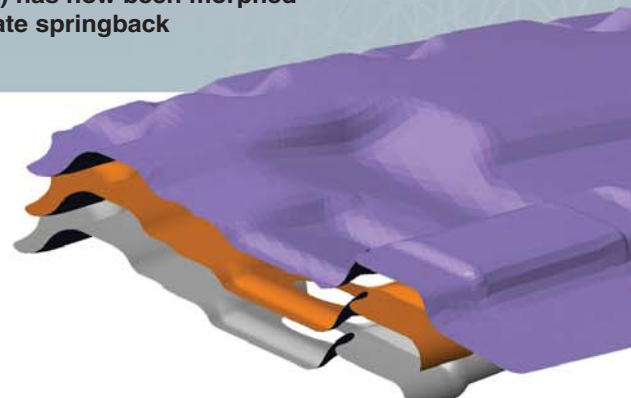


Figure 5  
Above: Original deviation (CAD-to-scanned-part comparison)  
Below: Deviation for the new compensated CAD model.  
The tool (die) has now been morphed to compensate springback

Figure 6  
Top (purple): Scanned part  
Middle (orange): Original CAD  
Bottom (grey): Compensated CAD



"The 3D scanning system has proven to be a great investment that has helped us stay competitive in these tough times. We respond faster and can do more than ever before, which means taking on even the toughest jobs."

**Mike Reed,**  
**Majestic Ind., Inc.**  
**Quality Manager**

# MAJESTIC INDUSTRIES, INC.

[www.majesticind.net](http://www.majesticind.net)

Founded in 1980 by Al Janiszewski and Jim Butler, Majestic Industries provides state-of-the-art progressive dies for the automotive and consumer industries. Given the opportunity Majestic will provide a complete project team approach to all your tooling needs.

Majestic's world-class 70,000 sq ft design and build facility located in Macomb Township Michigan allows it the ability to provide all services in house and to control all aspects of quality delivery, and cost.



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