

# QUALITY Springs FORWARD WITH 3-D PRINTING

Spring-maker/stamper uses additive manufacturing to improve quality assurance

By Tim Heston, Senior Editor

The thinking goes that our grandchildren will look back at the early 2000s as a quaint time when companies actually made things by cutting and shaping them out of larger elements, be it by machining a rough casting or cutting a blank out of a larger piece of sheet metal. Why go through the trouble? Why not build up the part, layer by layer?

Additive manufacturing is making its mark in the machining world. Hybrid systems now allow machinists to mill or turn a component—a subtractive process—then build up certain areas via an additive process. In sheet metal forming and fabricating, additive manufacturing has piqued interest, but it still takes time for an additive process to build up a component layer by layer, while a stamping press still can blank and form a sheet metal part in a matter of seconds.



**Figure 2**  
This stamped component doesn't lie flat, so it needs a custom fixture to be measured. That's where 3-D printing comes into play.

So why exactly has Newcomb Spring Corp., a 400-employee spring-maker and stamper with nine locations in North America, embraced additive manufacturing? Don Jacobson III, technical salesperson at Newcomb's Ooltewah facility, outside Chattanooga, Tenn., pointed to a small sheet metal part that was stamped on a four-slide machine. Its odd shape prevented it from lying flat, which meant that the quality department had to build a fixture to measure it.

Today an engineer designs a fixture in CAD and exports it to the 3-D printer in the next room (see **Figure 1**). In short order he has a fixture capable of holding the small component at the correct orientation for the quality department. It boils down to saving time, and 3-D printing saves plenty of it, not for the actual stamping or spring-making, but the steps that support those core manufacturing processes.

## High-value Springs and Stampings

Ooltewah has grown tremendously during the past few years. New construction is everywhere. Driving along Tennessee Route 321, you can see rustic barns next to mini-mansions and other new construction, much of it brought about by the nearby Volkswagen plant.

Newcomb's Tennessee facility sits on a hillside on what *was* a residential road. In fact, decades ago the Newcomb facility *was* a residence. In the early 20th century, a spring-maker retired and moved to what was then rural Appalachia.

"He loved the area, but he also wanted to get back into the spring business, so he opened up a facility behind his house. He was a friendly competitor, and

**Figure 1**  
Newcomb Spring's 3-D printer builds up a fixture component (blue in the photo), layer by layer.

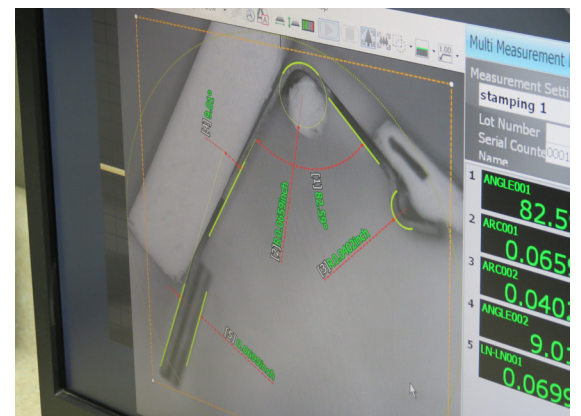
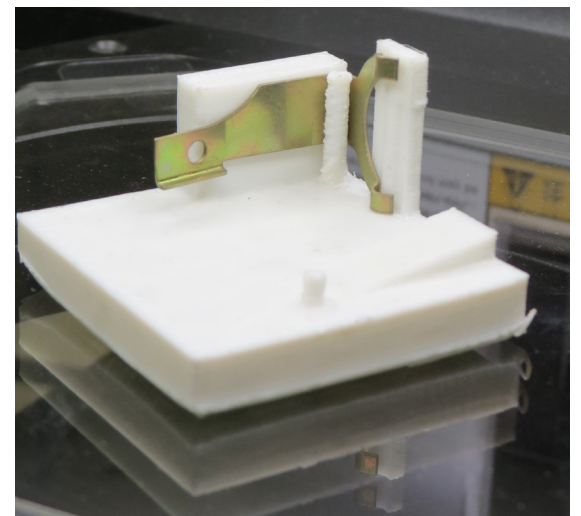
47 years ago he wanted to retire—for real this time—so Newcomb purchased the facility from him," Jacobson said, whose great-grandfather, George Jacobson, helped launch Newcomb in the 1920s.

Newcomb Spring has grown not by offering millions of a certain spring or stamping; that commodity work has moved overseas. It instead has specialized in lower-volume work, measured in thousands instead of millions of parts a year, and much of it requires a lot of upfront design and prototyping. Customers range from small start-up companies to major players in power generation, automotive, aerospace, lawn equipment, and other sectors.

Maintaining a competitive edge has required continual scrutiny to increase efficiency and quality. The company designs proprietary spring-making machinery to eliminate or reduce the number of secondary operations and ensure quality. Such machinery has streamlined production significantly, but until six years ago, inefficiencies remained in a small but critical department: quality assurance.

## Efficiency in Quality

Quality Engineer Daniel Lewis walked toward what looked like a small refrigerator, only it wasn't a fridge. It was a 3-D printer, a CubePro® Duo made by 3D Systems of Rock Hill, S.C. As its name implies, the printer can deposit two different materials at once, and two different colors. It can process several types of plastic (including polylactic acid, or PLA, and acrylonitrile butadiene styrene, or ABS), as well



**Figure 3**  
The component in Figure 2 sits in a 3-D-printed fixture for measurement.



# JOIN US FOR THIS FREE WEBCAST

Brought to you by [thefabricator.com](http://thefabricator.com)

## Modern Manufacturing in the Cloud



Presented by:

**Craig Downing**  
Sr. Director, Cloud Deployed Epicor ERP  
Epicor Software  
Tuesday, April 14, 2015  
2:00 p.m. Eastern (1:00 p.m. Central)



The manufacturing renaissance we're seeing is fueled by new technologies. Technologies that have changed our shop floors. Technologies that better connect us to our customers. And increasingly technologies that reimagine the back office processes that have collectively been labeled Enterprise Resource Planning (ERP).

Most noticeable is how "cloud enablement" is allowing companies to re-think the way their ERP solutions connect their locations, empower mobile engagement by field and remote works, and simplify collaboration with external stakeholders—from contractor to designers to customers themselves.

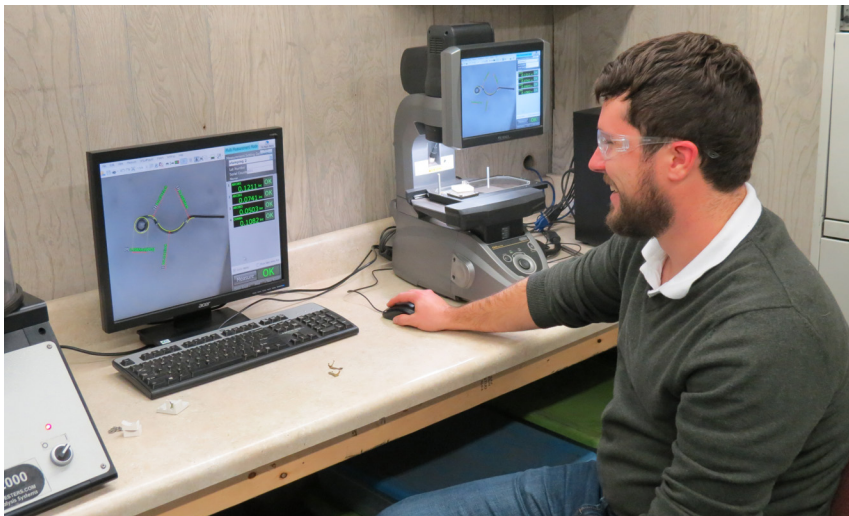
Epicor – long a leader in modern ERP solutions is helping the industry make the move to the cloud. Join us for this hour long conversation as we talk about how modern manufatures are transitioning their core ERP Processes to the cloud, and the business benefits they are experiencing.

If you're still not sure of your own cloud ERP strategy you owe it you yourself to understand why 47% of mid-sized manufacturers forecasting they will have transitioned their ERP to the cloud by 2019 (Gartner, 2014), and the vast majority of those who make the move to the cloud saying they are "hooked, and unwilling to go back to on-premises deployment for ERP deployment." (MintJutras, 2014).

# EPICOR®

## Register today for this free webcast!

Visit [www.thefabricator.com/webcast](http://www.thefabricator.com/webcast)



**Figure 4**  
Quality Engineer Daniel Lewis measures a part using Newcomb's new inspection system.

as nylon. Lewis hit a few buttons to call up a job, and in about 30 minutes the system printed a fixture with a side support and several posts. He inserted the part, which fit neatly inside (see **Figures 2-4**).

This in a nutshell is how 3-D printing goes hand in hand with stamping and spring-making at Newcomb. The system prints the fixtures that hold parts so that Newcomb's measuring machines can inspect them efficiently and accurately.

"Traditionally, when inspecting a piece like this, you have to orient it by hand to several different positions," Lewis explained, "which has room for error in and of itself. And when you measure each piece, a lot of time is consumed, which slows down the quality and manufacturing process as a whole. That's not a good thing when you're trying to get parts out the door."

"We didn't know we needed a 3-D printer until we began researching advanced measuring equipment," Jacobson added. "That's where it started."

### The Road to Additive Manufacturing

Six years ago quality personnel still used an optical comparator to check the angles and radii of all stamped components and springs. It was a manual machine. Technicians had to manipulate the table, bring the part into focus, measure each attribute, then reorient the part to measure other attributes. A comparator still makes sense if parts are simple or the number of pieces requiring inspection is low compared with the overall job size. But for Newcomb's sweet spot—complex low- and medium-volume work—the company needed something better. The manufacturer may need to perform production part approval processes (PPAPs) on dozens of components for a single job, and for this an optical comparator made tedious work.



**Figure 5**  
A stamped component is measured to be within tolerance. The green and light-blue marks show the key areas for measurement.



# the fabricator's Leadership Summit

10th  
ANNUAL

## DRIVING → CHANGE

### On the Road to Excellence

**Feb. 25-27, 2015**

 Gaylord Palms Resort  
& Convention Center  
Kissimmee (Orlando), Fla.


 Bystronic

### Bystronic Invites YOU to the 2015 “Technology Driving Change” Panel during *The FABRICATOR*’s Leadership Summit



Join Frank Arteaga, Head of Product Marketing, Market Region NAFTA (pictured) and fellow machine tool suppliers as they discuss equipment advances available to improve production and increase the bottom line during *The FABRICATOR*’s 10th Annual Leadership Summit on Thursday, Feb. 26 in Kissimmee, Florida.

The experts on the panel will showcase their cutting edge solutions allowing you to compare and contrast processes. Mark your calendar for this popular, open exchange to get your questions answered about opportunities available in today’s fabrication market—you’re sure to be on the road to excellence with a clear sense of emerging trends for 2015 and beyond.

## REGISTER TODAY!



### Conference Fees:

**\$945 FMA members / \$1,195 General**
**Visit [fmanet.org/annualmeeting](http://fmanet.org/annualmeeting)  
or call toll-free 888-394-4362.**

Platinum Sponsor:


 Bystronic

 Mention this Bystronic ad and  
your registration could be free!

[www.bystronicusa.com](http://www.bystronicusa.com)

So Newcomb upgraded to an automatic video-based inspection and measurement system, a machine that effectively removed the tedium. The technician uses a joystick to zoom in and out, and the cameras measure in the X, Y, and Z planes. To check dozens of components, he places the part on a fixture, and the system takes the necessary measurements. He then removes the part and places the next part into the fixture.

It works wonders if a technician needs to check many parts in a run, especially if a customer provided the fixture. Its sensors measure from above and below, so with the right program and fixture, a technician need not reorient a part to capture multiple data points. The company also developed fixtures out of LEXAN™, a clear material that allows the 3-D system to measure parts from below the workpiece.

Nevertheless, a tech using this newer system still needs the right program and fixture, and each can take serious time to develop. The tech also needs to place the part in the same orientation on the bed every time. If he needs to juggle multiple jobs over the workday, as is common for contract manufacturers and job shops, he can spend a lot of time machining fixtures and programming the inspection machine, and not enough time actually measuring parts.

**“We didn’t know we needed a 3-D printer until we began researching advanced measuring equipment. That’s where it started.”**

—Don Jacobson III, Newcomb Spring Corp.

“We were trying to run every job that came in on this system,” Jacobson said, “but we were having to spend anywhere from an hour to four hours writing a program, plus the time we needed to make the fixture. That’s not really practical for our operation. It’s nice to think that you’ll have a job in perpetuity, but we’re not guaranteed it. We’re guaranteed a certain amount of parts at a certain price delivered on certain dates.”

Quality technicians needed an alternative, and they found one. Called Instant Measurement, or IM, the system from Keyence Corp. doesn’t require extensive programming. Unlike the company’s previous system, the IM machine measures from overhead only. Using a proprietary pattern analysis tool it scans and locates the part no matter where it’s placed in the work envelope, and compares it with information exported from the 3-D model. The system can measure multiple parts at once, as long as they’re the same part, and they all fit within the work envelope.

The 4- by 8-inch worktable moves under the camera, which can view an area that’s about 4 by 4 in. “The base can move and stitch together an image that is 4 by 8 inches,” Jacobson said, “and we can stitch together multiple 4-by-8 measurements to check larger parts.”

A green notation on the screen shows that the part is within tolerance, red means it’s out of tolerance, and each point is measured as part of a system. One radius may be within a specified tolerance, but if it’s off enough to throw another radius out of tolerance, the system flags the error. It can also measure multiple parts simultaneously as long as they all fit in the work envelope (see **Figure 5**).

The quality technician now could place a part anywhere in the work envelope, and he didn’t need to spend hours programming inspection routines for each part. This eliminated a lot of setup time. Still, one hurdle remained—the fixturing—because the overhead camera needed to be able to see certain features. If a technician couldn’t set a part in a way that presents the features clearly to the overhead camera, he still needed to build a fixture.

The same applied to components that must be measured in a certain condition. For instance, Lewis pointed to a bracket with a profile simple enough that you might think it could be placed on its side to measure it. But the bracket needed to be measured as part of a subassembly, bolted onto another component, which stretched the bracket slightly. To simulate this in-service condition again required a fixture.

Enter 3-D printing. Last year the company invested in its 3-D printer, sold and serviced through NovaCopy, which has a branch near Newcomb’s Tennessee



operations. "We wanted to do work with a local company that had a local representative," Jacobson said. "You can buy these printers through Amazon and Home Depot, but 3-D printing is still a developing industry in general, so it helps to have local customer service."

It can take anywhere between 30 minutes to two and a half hours to build a fixture, depending on the material thickness and density. "Most initial items are run at a lower quality scale and with the highest speed to check the design," Jacobson said. "Once we have a fixture or item we like, we build the item in the highest quality and thickness density."

Some fixtures are quite complex, with multiple supports and posts; others are simple. For instance, to measure its in-service condition, a technician bolts a bracket to a 3-D-printed block with two threaded holes.

Of course, the beauty of 3-D printing is that making a highly complex workpiece isn't cost-prohibitive. The system doesn't care how many posts, supports, crevices, contours, or other complexities a workpiece has.

### Printing for Prototypes

Most work sent to the 3-D printer heads to the quality lab, but not all of it. Jacobson pointed to a 3-D-printed block with several threaded holes. The block is being used in a spring-making machine prototype. Although Newcomb buys many of its machines, it also custom-builds some proprietary spring-making machines for certain jobs. This has been a key competitive advantage, and 3-D printing has helped streamline the process.

Finally, 3-D printing has helped in prototyping and product development. As Jacobson explained, "A lot of our customers are inventors or part of small start-ups, and they don't have the resources available to do a lot of prototyping and testing. So we're able to help them along the way." He added that a spring or stamped component may fit into a larger subassembly, so the company often 3-D prints the mating components to ensure the spring or stamping fits and works as it should.

Outside its Tennessee plant, Newcomb has another 3-D printer at its Dallas facility, and it's looking to add

more printers in the future as more projects require them. In addition, every Newcomb plant has an IM system to measure parts.

"Because we're a metal manufacturer, if we need something made, we make it out of metal," Jacobson said. "It's not always the cheapest, fastest, or most forgiving way to go."

This includes prototypes and fixtures for inspection. In effect, the 3-D printing system has allowed Newcomb to quickly make components that don't necessarily need to be made out of metal. **FAB**

Senior Editor Tim Heston can be reached at [timh@thefabricator.com](mailto:timh@thefabricator.com).

Newcomb Spring Corp., 9300 Springhill Drive, Ooltewah, TN 37363, 423-396-2167, [www.newcombspring.com](http://www.newcombspring.com)

NovaCopy Chattanooga, 1936 Central Ave., Chattanooga, TN 37408, 423-305-7799, [www.novacopy.com](http://www.novacopy.com)

3D Systems, 333 Three D Systems Circle, Rock Hill, SC 29730, 803-326-3900, [www.3dsystems.com](http://www.3dsystems.com)

Keyence Corp. of America, 1100 N. Arlington Heights Road, Suite 210, Itasca, IL 60143, 888-539-3623, [www.keyence.com](http://www.keyence.com)

**THE NEXT GENERATION... IN METALWORKING SYSTEMS**

**METABO'S ALL NEW ANGLE GRINDERS  
NEW DESIGN, NEW TECHNOLOGY**

- **Up to 20% More Power**
- **Up to 50% More Torque**
- **Up to 20% Higher Overload Protection**
- **Safety Brake Stops Wheels in 2 Seconds\***

\* Brake available on certain models

**metabo**  
-M-Calibur- CER T1  
US616287000  
6" x 1/16" x 7/8"  
150 x 1.6 x 22.23 mm  
10,200 R.P.M.  
CA 46-U  
Inox  
Steel/Stainless Steel/  
High Tensile Alloy  
CUTTING ONLY