

## Two X-ray Routes to Improved Productivity

By Kathryn Cramer

When it comes to improving productivity, contract manufacturers have numerous avenues to pursue. In some cases it's a matter of saving a significant amount of time on a particular task. Or it may involve taking the time to ensure process quality at the start of a product run, to avoid wasting components and boards. Tristate Electronic Manufacturing of Hagerstown, Maryland, has applied both



*With high magnification and resolution, Glenbrook Technologies' JewelBox-70T real-time X-ray inspection system reveals defects and process issues such as shorts; voids in BGA, QFN and LED components; and broken wires.*

of these productivity-enhancing methods to its operations, using the same technology – X-ray – in two very different systems.

Tristate, founded in 1985, provides SMT and through-hole assemblies, as well as box builds, to a worldwide customer base in the health/medical, aerospace/defense, industrial/instrumentation, RF/microwave and communications sectors. The company's wide range of certifications and registrations testify to its ongoing commitment to quality production. One important step in maintaining that commitment occurred in 2016, when Tristate introduced real-time X-ray inspection to its assembly process, to meet the challenges posed by high-end, leadless surface mount packages.

"We were seeing more difficult BGAs, QFNs and DFNs," says Ryan Null, Tristate's president, "and we weren't able to inspect them

efficiently. We could inspect the outside corners with a microscope and a few other tools, but it was difficult, slow, and never gave us a good feeling of quality assurance." But once the company started using real-time X-ray inspection, it became possible to get a clear and accurate picture, in a matter of seconds, of the conditions underneath complex components.

Casey Highlands, who conducts quality assurance testing for Tristate, explains that he performs real-time X-ray inspections of boards at various stages of the assembly process. "We'll do a pre-reflow and post-reflow inspection of a sample size, to verify our process," he says. "We're looking for voids and bridging" underneath BGAs and other leadless components. And if customers request one hundred percent X-ray inspection of a product run, that is done as well.

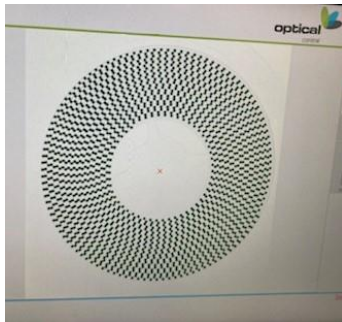
With the increasing miniaturization of many BGAs, Highlands explains, "you definitely need the kind of high magnification" provided by the real-time X-ray inspection system, which has variable magnification from 7X to 2000X and a focal spot size of 10 microns. He recalls one recent job where "we needed to get close in, turn the magnification up on a four-ball BGA, about the size of an 0402 cap." Whatever type of component is used, he adds, first-article inspection is particularly important: "If you

# Glenbrook Technologies Inc.

X-RAY TECHNOLOGY LIKE NO OTHER

get it right at the beginning, then you won't have any problems down the road" on a high-volume production run.

"While our SMT line is operating, Casey, or another associate, will do a first-article check to verify the process looks correct, so we're improving our process very early on, before we build a bunch of boards," Null notes. "In fact," he states, "we have stopped production multiple times, and have had to improve the process before we go on." Assuring quality production right from the start, through real-time X-ray inspection, has made a significant contribution to improving overall productivity for Tristate.



*The component reel counter is a significant time-saver, providing a large, low-magnification image from which the software makes a rapid, accurate count of the small components on the reel.*

With the new counter, Keener explains, "we can verify inventory counts, we can verify discrepancies and catch them early on, we can use group batch counts so we can verify stock counts coming back in from the floor. And when we get customer-supplied material, if they tell us there's a certain amount and there isn't, we have the evidence to show them."

Additionally, components don't have to be removed from trays or tubes before they are counted, so package seals don't have to be broken on humidity-sensitive items. "It just saves us all the time," she concludes, particularly from nasty surprises in the middle of a production run, when "we think we have enough material but we're actually short and we end up running out."

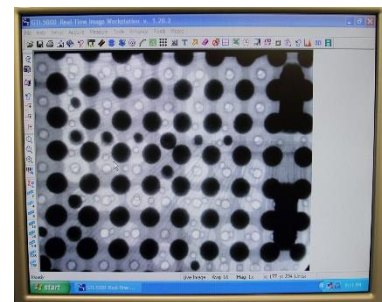
Most critical of all for the company's goal of improving productivity, the component counter saves a significant amount of time. "Our counting time has been reduced to 25 or 30 percent of what it used to be," Null says, "and the easier it is to do, the more likely you are to count something." As a result, inventory is monitored more closely and accurately, in less time.

One function the component counter is not designed to perform, however, is to see inside or underneath components. As Null

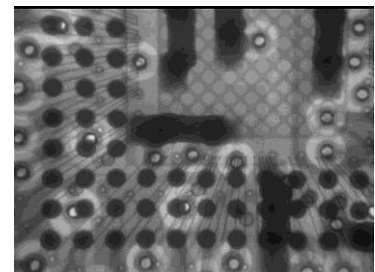
The company took another productivity-improving step in 2020, when it installed a very different type of X-ray system in its stock room – a component reel counter. This system scans reels, matrix trays, cut tape and sticks; provides a fast and accurate count of the number of components in each container; maintains a log of everything it scans; then uploads the data via Excel functions directly into Tristate's ERP system – a feature that Null calls "really sweet."

"Previously, we had an old-school, hand-cranked reel counter," says Courtney Keener, stock room coordinator, "where you load the reel on one side, feed it through, do the count, then hand-crank it back. It did have a digital counter, but you had to enter the data manually and you couldn't do a cycle count electronically. It was time-consuming and cumbersome, for sure."

With the new counter, Keener explains, "we can verify inventory



*Real-time X-ray inspection reveals excess solder in vias ...*



*... or good reflow with no damage to wire bonds.*

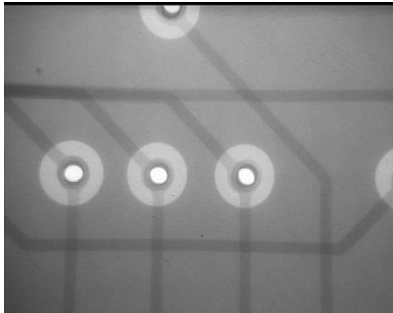
## Glenbrook Technologies, Inc.

11 Emery Ave., Randolph, NJ 07869, USA • Tel: 973-361-8866 • Fax: 973-361-9286  
[www.GlenbrookTech.com](http://www.GlenbrookTech.com)

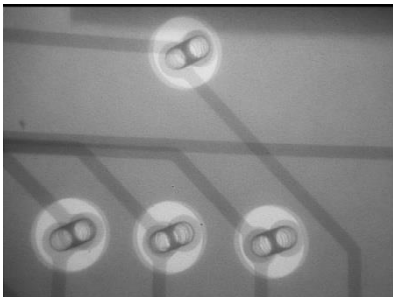
# Glenbrook Technologies Inc.

X-RAY TECHNOLOGY LIKE NO OTHER

explains, the counter “is just verifying the presence of the components in the packets. It’s looking at the amount of metallization on the component body, calculating that, seeing the patterns and using algorithms to calculate the number of components.” But, for inventory purposes, “it doesn’t need to be as in-depth,” says Keener. “We’re doing it for quantity, not necessarily quality.”



*Real-time X-ray inspection reveals precise drill registration on a 4-mil hole.*



*A real-time X-ray inspection system with the ability to rotate the board reveals consistency in the via hole.*

Back on the assembly line, where quality assurance is critical, the real-time X-ray inspection system that Tristate uses – a [JewelBox-70T](#), supplied by [Glenbrook Technologies](#) of Randolph, New Jersey – does provide the in-depth, detailed imaging needed to identify bridging or voids underneath BGAs. “It helps us all the time,” says Highlands. He notes that the system is easy to use, easy for other operators to learn how to use, and, over the past six years, “we’ve never had a problem with it.”

He also finds the system’s video and archiving capabilities particularly useful. “We can take pictures of each BGA in a sample lot, save them and refer back to pictures from a previous job,” for comparison purposes. “And when we have customers who require that they see a sample size of their BGA jobs, we always have the images available.”

When asked whether Tristate could manage both its inventory and quality assurance functions with just one or the other X-ray system, company president Null has a quick answer: “No. They’re two opposite ends of the spectrum. We’d definitely buy both machines again.” And, Keener adds, “they don’t sit and collect dust; they’re in daily use, for sure. We get our money’s worth out of them.” So whether it’s a matter of saving significant time, or of ensuring quality production, Tristate Electronic Manufacturing offers an example of a company pursuing multiple routes to achieve the ultimate corporate goal of improved productivity.

Contacts: Tristate Electronic Manufacturing, Inc., 91 Western Maryland Parkway, Suite #5, Hagerstown, MD 21740; Tel: 301-739-9404; Fax: 301-739-5056; [www.tristateelectronicmfg.com](http://www.tristateelectronicmfg.com).

Glenbrook Technologies, Inc., 11 Emery Avenue, Randolph, NJ 07869; Tel: 973-361-8866; Fax: 973-361-9286; [www.glenbrooktech.com](http://www.glenbrooktech.com).

## Glenbrook Technologies, Inc.

11 Emery Ave., Randolph, NJ 07869, USA • Tel: 973-361-8866 • Fax: 973-361-9286  
[www.GlenbrookTech.com](http://www.GlenbrookTech.com)