

FEBRUARY 2023

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It's All About Strategy

Conferences and trade shows are valuable resources. Now that the 2022 trade show season has closed and IPC APEX EXPO 2023 is behind us, it's time to make a strategic plan from all the pieces of information you've gathered for the year ahead.



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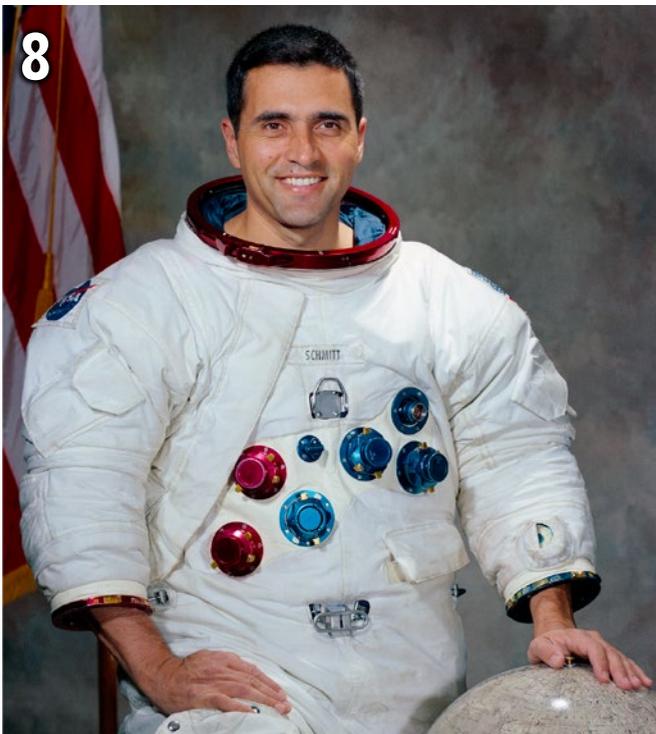


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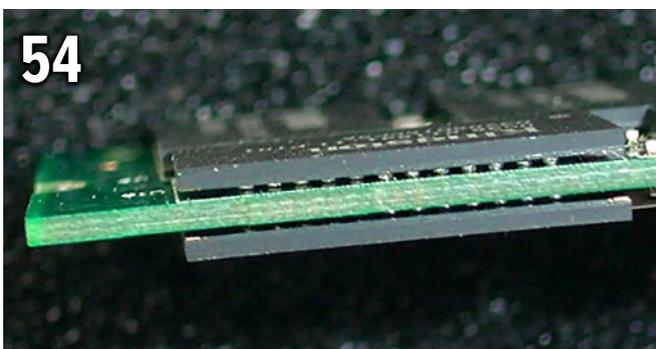
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The Trade Show Is Over: Now What Do You Do?

Nolan's Notes

by Nolan Johnson, I-CONNECT007

When you're new to your career, your role, or even new to the industry, the pressure can be immense. Then you find yourself at a trade show representing your company, tasked with bringing information back to your organization. But take heart, at least you're not Harrison "Jack" Schmitt. Jack really understood pressure.

Schmitt is a retired NASA astronaut from the Apollo era but let me take a step back and explain some of the history. The U.S. space program, as you may recall, went to the moon with a science-based agenda; astronauts brought back lunar samples to study. But the earliest astronauts, understandably, weren't scientists; they were pilots with elite military backgrounds, so their skill sets were skewed toward successfully operating the complex equipment to get there and back safely with a moonrock payload. At first, it seemed, everyone was willing to sacrifice the quality of the samples for the sake of having any samples at all.

By the time NASA got to the Apollo 15 mission, the astronaut crews were becoming more comfortable with the flight systems. They weren't any simpler, but there was now a sizeable body of knowledge to share regarding how the Apollo spacecraft actually performed. The flying of Apollo seemed to become almost, well, routine. This was fortunate because scientists started exerting greater pressure on the astronauts to bring back something greater than they had.



It wasn't enough to simply come home safe with a bag of gravel; now the science community demanded that the astronauts slake their thirst for knowledge about the moon's origins. Not just any rock could do that, after all. This is where we circle back to Schmitt.

Jack Schmitt started as a trained geologist who followed test pilots into the astronaut program. He was scheduled to fly the Apollo 18 mission but was moved up to the Apollo 17 crew instead. There were a variety of reasons that shifted Schmitt to the earlier mission. One of them, ostensibly, was as a response to the call for more expertise in science.

In HBO's 1998 mini-series, "From the Earth to the Moon," Schmitt plays a prominent role in the episode titled, "Galileo Was Right." The story follows Schmitt's role influencing Lee Silver, a Caltech geology professor, to train the astronauts in how to spot scientifically interesting rock samples. Thanks to this training, the Apollo 15 crew was able to identify and return with a rock more than four billion years old. This rock has been dubbed the "Genesis Rock" and has contributed immensely to our understanding of the moon's geology.

Can you imagine the pressure that was put on Schmitt to train and prepare the astronauts to get the right kind of rocks? This wasn't just a trip across town. It was a trip to the moon and all that entails. Now that's pressure to get it right.

Pressure comes in many different forms. Pressure to meet expectations is immense. Your new role may even feel as pressure-filled as attending a trade show for the first time, especially when you have to report back to your team, department, or company.

What are the expectations you've been tasked with? How will your company take what you've brought back and advance your knowledge and technical knowhow? How can you be like Jack Schmitt, and mentor other teams based on what you learned?

We took that idea to heart while planning this issue. We wondered, "I've gone to the

show (or conference), so now what? Where do I go from here?" In this issue, you'll find a roadmap of key steps to take after the show. We offer some practical tips to effect real change armed with conference information.

Some highlights: Barry Matties discusses how to make the most of your post-show activities; Dan Beaulieu offers 10 key tips for what to do while you're at the show to ensure you have what you need. We also look a little deeper into an equipment manufacturer's perspective in our interview with Koh Young. In another interview with Alpha Circuit, we investigate what goes into building out a greenfield facility. Even if your post-show shopping endeavor is for a single piece of equipment, it's the greenfield buildouts like Alpha's and Rocket EMS's that have figured out what to do. Finally, Kris Moyer provides guidance on how best to share the knowledge you picked up with others.

And, as a supplemental idea, I suggest downloading Happy Holden's book, *24 Essential Skills for Engineers*. Happy shares soft skills to help you be effective in communicating and/or persuading once you're back in the office.

On our cover, we showcase a mass of LEGO® Bricks because it represents the pieces of separate bits of information gleaned from networking with other industry professionals that we must then assemble into a cohesive strategy afterward. For us engineer types, the compulsion to make order out of those bricks is very real. Turning your conference and trade show knowledge into action in the factory should feel just the same. I'm sure Harrison Schmitt would understand. **SMT007**



Nolan Johnson is managing editor of *SMT007 Magazine*. Nolan brings 30 years of career experience focused almost entirely on electronics design and manufacturing. To contact Johnson, [click here](#).



Santa Clara, CA
Carson City, NV



Michael Kottke: Growing With Greenfield Sites

Interview by Nolan Johnson

I-CONNECT007

About a year ago, we interviewed Michael Kottke, CEO at Rocket EMS. That interview paid close attention to how Rocket EMS's in-house software suite named Voyager improved processes across the company. Now we're checking in to get Michael's perspective on the current market's shifting dynamics, and what he's got his eye on as Rocket EMS moves into 2023.

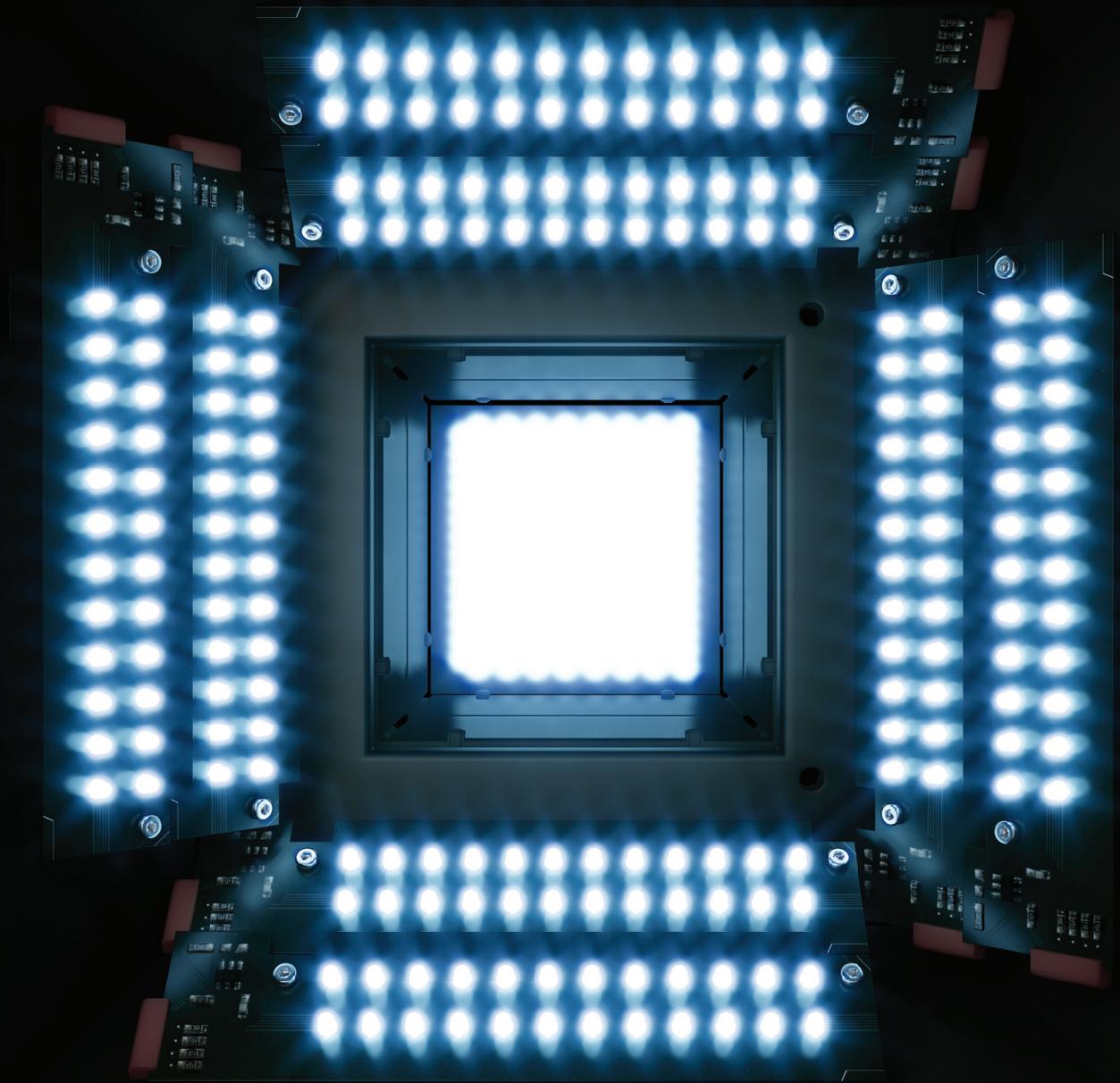
Nolan Johnson: Michael, as a growing EMS provider, what's most on your mind these days?

Michael Kottke: If you look at our agenda, and ask about what markets we are supporting, you'll see we're doing a lot of stuff in space, as well as high-end networking, and high-end computing. We're seeing a lot of security-

driven devices. Who knew that China could be a security risk? I've been shocked at how often I'm approached about building product in the U.S.—product that they used to build in China or Taiwan. We're seeing the more complicated, more traceability- and more process-driven stuff, so that's what we're going after. With all that, I think we'll have another good growth year.

Johnson: A while ago, you mentioned that there was a regional rather than global geographic effect as well.

Kottke: I'm surprised at how many people want to do business in [Rocket EMS's] Carson City [Nevada facility] as a cost-savings measure. The cost savings from here in California to Nevada



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Michael Kottke

is significant; the building is one-fifth the cost, power is 30–35% cheaper, and as you go down the list, you'll find that almost everything is cheaper on the overhead side.

The labor is a little bit cheaper, but because of the way that Carson City will

be structured, we'll have most of the expensive overhead here in San Jose. Carson City will be more of a production facility that relies heavily on automation as well as reduced overhead to achieve a very attractive cost model for our customers. I'm shocked at how many people are interested in moving business from the Bay Area to Carson City .

Johnson: You're talking about having more complex work coming into your facility. Is that something that you are actively pursuing with sales and marketing?

Kottke: I actually don't have a marketing team or a sales team. Currently, we get about one new customer request a week, and we're probably only taking on one or two a month. If we wanted, we could get 10 new customers a month, but we want to be careful about where we're putting our resources for customers. A lot of prospective customers want engineering support alongside program management support; some customers have a difficult time paying for all that extra work. We have great resources that enable us to take on those high-maintenance customers, the kind of people who don't have good systems or tools and need that kind of hand-holding—those are great customers, provided they have the budget to pay for those additional services.

Johnson: Am I correct in presuming that part of your ability to move into these higher com-

plexities is because of the business operations software that you've developed at Rocket EMS over the years?

Kottke: Yeah, we are continuing to make significant investments in automation and systems. The Voyager software team has tripled in size over the last two years and the resulting capabilities and data collection power probably close 90% of the customers when we have a customer come through for a tour. If they get the Voyager demo, it's a "close the deal" kind of scenario. Every three months or so there are major revision changes to it, and at least once a month we have a list of updates and improvements. The Voyager software has gotten so good. Now that we have the engineering guys, production, and the quality group working closely with the Voyager team, we're generating very specific reports and tools. That move has improved efficiency by a crazy amount; it's mind boggling.

Johnson: Add that to the other efficiencies in operation in Carson City , Nevada, and your operations really start to change.

Kottke: In 2023, we will be investing in systems and automation capital equipment. If everything goes correctly, that building will have two to three times the capacity of Santa Clara and probably 50–60% of the personnel. That changes my cost model; it changes what business I go after; it changes everything.

Johnson: You're pointing out that Carson City is a critical investment for you.

Kottke: It is by far. For the last couple of years, everyone has accused me of working on the Carson City facility just so I can grow the Voyager team. There's a little bit of truth in that, but as manufacturing gets bigger and better, we can add more to the programming side of the Voyager team.

The cool thing about Rocket is that we love science projects, so we're working with mul-

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tiple companies who are trying to develop an artificial intelligence (AI) system that works with the automated optical inspection (AOI) or X-ray inspection to eliminate the human operator in defect reviews. Currently, we've hired two companies to develop something to remove the human element. They call this PLR, or paperless repair.

Removing that human inspection step should make it much more accurate because if you have the mathematical data from the machines that do the solder joint evaluation alongside the optical images, then an AI machine should be able to build a database that says, "This joint is right, this one is good, and this joint is bad." Using an AI to execute that process will be better than relying on a human because the AI makes those determinations based on both the mathematical data and the optical data.

We'll see where it goes, but if that happens, that's game-changing for us.

Johnson: Let me make sure I have my numbers right. In the Carson City greenfield facility, you're looking at potentially two to three times the output of the Bay Area with about half the staff. Does that put Voyager at the center of it? How is that changing your staffing?

Kottke: Three things are in play here. First, we have a blank slate building to layout for maximum efficiency and automation in nearly every operation. Second, we've leveraged Voyager. We have 35 engineers on our India team, and that allows us to do much of the prebuild—the build readiness stuff—in Voyager so that with all the programs, the manufacturing process instructions (MPI), they can have everything done. We can just drop it in place in Carson City.

Finally, Carson City will not be doing the five-piece NPI jobs. That is probably the biggest reason for the reduced labor cost. If I'm running higher quantities, I don't need the crazy headcount like I do for the five-piece jobs that I run through Santa Clara. The auto-

mation and the Voyager improvements are the major factors in why Carson City is different.

Johnson: That makes a lot of sense, optimizing Carson City to its strengths.

Kottke: Yes. One of the basic changes is a double-sided line set up in Carson City to run larger production. There are no carts, no people moving boards back and forth, and that allows a lot more throughput. If we had to, we could still break them off and run them as two separate lines. I guess it's more like 90% of the rest of the world for production, right?

One of the basic changes is a double-sided line set up in Carson City to run larger production.

In Santa Clara, the lines are single-sided, meaning I run the job, flip it, bring it back to the front of the line, and run it back through. That's because I run a lot of NPI jobs, and I don't have enough parts to split for both a topside and a bottom side run. Overall, there might be 50–60% of the commonality between top and bottom so that you just run it on one double-sided line in Carson City.

We're unique here in Santa Clara; Carson City is more like the rest of the production CM world. With the addition of Voyager and some cool automation, we'll be even more efficient.

Johnson: It sounds to me like you're staffing up with well-trained engineering jobs rather than operator jobs.

Kottke: There's currently more engineering in Santa Clara because of the NPI focus, and then we move the work to Carson City. When we've proved out the process, when we've done all



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the engineering—that’s when we hand it off to Carson City to make it very smooth. Everyone that we’ve hired at Carson City has needed to be trained; it’s not like they have a ready labor pool for PCBs in Carson City .

It really is a different mentality in Carson City compared to the Bay Area. When we opened the Carson City facility, for example, we posted our job openings using the title “SMT operator” in the job description. Nobody applied. So, we changed the job title to “machine operator” and said we would provide training. We got 100 applicants. No one knew what an SMT machine was, so it’s been a bit of a learning curve.

No one knew what an SMT machine was, so it’s been a bit of a learning curve.

Johnson: Michael, you have a staff in India, and you have two facilities in the U.S., so where does cybersecurity fit into all this? You must do a lot of communicating with regard to electronics, which means balancing IP risks. I’m sure you have clients that are very careful about their IP.

Kottke: You’re right, cybersecurity is a big concern. Because our IT group is doing preliminary work for NIST, we did a cybersecurity audit and, overall, we did really well. There are areas to improve, but the auditors were impressed with our level of security. That has a lot to do with the Voyager software, but it controls who can see specific documents. Thanks to Voyager, we are extremely good at navigating that kind of scenario.

Johnson: Was that audit for CMMC compliance?

Kottke: Yes, the assessment was for CMMC Level 2. I think May 2023 is the deadline for compliance, but this audit says we’re ready. Thankfully, my security/IT guy is very paranoid.

Johnson: That’s a good trait for that job.

Kottke: It is, right? If he walks around with a tin-foil hat and covers his phone in a Faraday cage bag, then you’ve got the right guy (laughs). We’re constantly going through different scenarios and upgrades; I would say at least once a year he breaks something by making it too secure.

Johnson: Obviously, you see cybersecurity and the CMMC certifications as important to your business. It follows that, given the kinds of customers you’re talking to, it’s important to them as well. Have any of them been pushing you to do this?

Kottke: We’ve had three or four that have been gently nudging us. Luckily, we’ve been ahead of most of the requirements they’ve asked for, which has been cool. We have two customers that want to engage with us in May, but for the most part, we’ve done pretty good on our security audits. I expect that we will get much better in Q1 and Q2 of 2023.

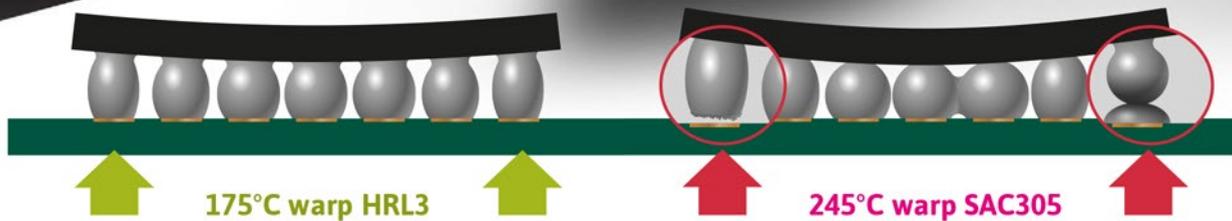
Johnson: Is it fair to say that pursuing these security audits and your audit results are helping you win new business?

Kottke: I wouldn’t say that exactly, but it is helping us secure our business. That goes back to what you asked earlier about sales and marketing. We’re not winning business because we market our security levels. We’ll engage with a potential customer, and usually we start at the NPI level. Once they see our service and quality, they start exploring projects with us. That’s when the customer starts pulling in their security people and running audits.

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Johnson: Can you scope out how much resource investment—time and energy, in other words—was required to get you to Level 2 CMMC? When did you start? How long did it take?

Kottke: We started about a year and a half ago, when we first contacted somebody for an audit. It's probably been a full year of effort.

Johnson: Do you think you could have done it faster? Other companies may not be as far along, and May isn't that far off.

Kottke: Yes, we probably could have done it faster if we had wanted to, but we were maxed out in 2022. We're a \$100 million company; that kind of growth is crazy. CMMC has not been something I've pushed hard on. Right now, I have one customer pushing a little bit harder; it's not so much, "You have to get this done," but more like, "It would be great to get ahead of this."

People are starting to realize China is a risk, and there is a real possibility that Taiwan could become part of China.

Johnson: What dynamics do you see with regard to the global geopolitical situation, and what has the effect been on Rocket's business?

Kottke: People are starting to realize China is a risk, and there is a real possibility that Taiwan could become part of China. It's a risk they're very concerned about. After 20 years of pushing production to China and Taiwan as fast as we could, the supply chain can't come back in just a couple years. That's too short, yet at least

a dozen of my top 20 customers are pushing to bring it back to the U.S.

The changes in tariffs and overall government restrictions and regulations mean that a lot of customers want to move their business back to the United States so they can better control it, yet 90% of the BOM is still in China. I understand the assembly part—that's great. But 90% of your supply chain is still in Asia, so what can you do?

I'm worried, like everyone else, that we are headed toward a global recession or that the supply chain might get worse—although it's hard to believe that the supply chain issues could get worse. But I do think we'll see more manufacturing move back here.

Johnson: Do you see any new markets on the horizon for Rocket EMS, such as different market sectors, or even products, services, or manufacturing?

Kottke: I'm positive that nobody our size has as many active customers or as many different market segments as we do. I know all our competitors here in California, and I know they have about 20 customers each. I had 87 customers last month, and typically, I have about 100 active customers. We are pretty diverse.

My top five customers are in five different sectors. That has always been part of our plan—to have a very diverse base so that when a recession hits, we always have one or two that carry us. In the past I've been extremely blessed to have a great home-run customer during a recession. Right now, we have a couple of great customers whose forecasts are rising while everyone else is cutting, so that's cool. It's a crazy world right now.

Johnson: Michael, thank you so much.

Kottke: You're welcome, anytime. SMT007

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Making the Most of Trade Show Leads

Feature Article by Barry Matties

I-CONNECT007

The show is over and it's time to count the leads. We all know that a tall stack of trade show leads can feel like a sugar high. For many, that tall stack is proof that your trade show investment was well worth it, and if leads are the measure, then you'll aim to collect as many as possible. However, the true ROI measure is new business, so more important than the number of leads is identifying the quality of leads in the stack.

Of course, your leads will need to be sorted, preferably into different groups ranging from "ready to sign a deal" to "will never sign a deal," or from hot to not. Once sorted, they can bring your initial focus to the low hanging fruit. It's the other groups that will require your team to be a bit more strategic.

You can expect your competitors to be chasing the same leads. After all, the prospect visited the show to look at all their options, so a smart marketing approach as a follow-up will give you an advantage. Your immediate action should be to contact your prospects with a simple thank-you note expressing your appreciation for taking the time to visit your booth and meet with your team. While this is a good first step, you should have a specific follow-up process beyond the thank-you note.

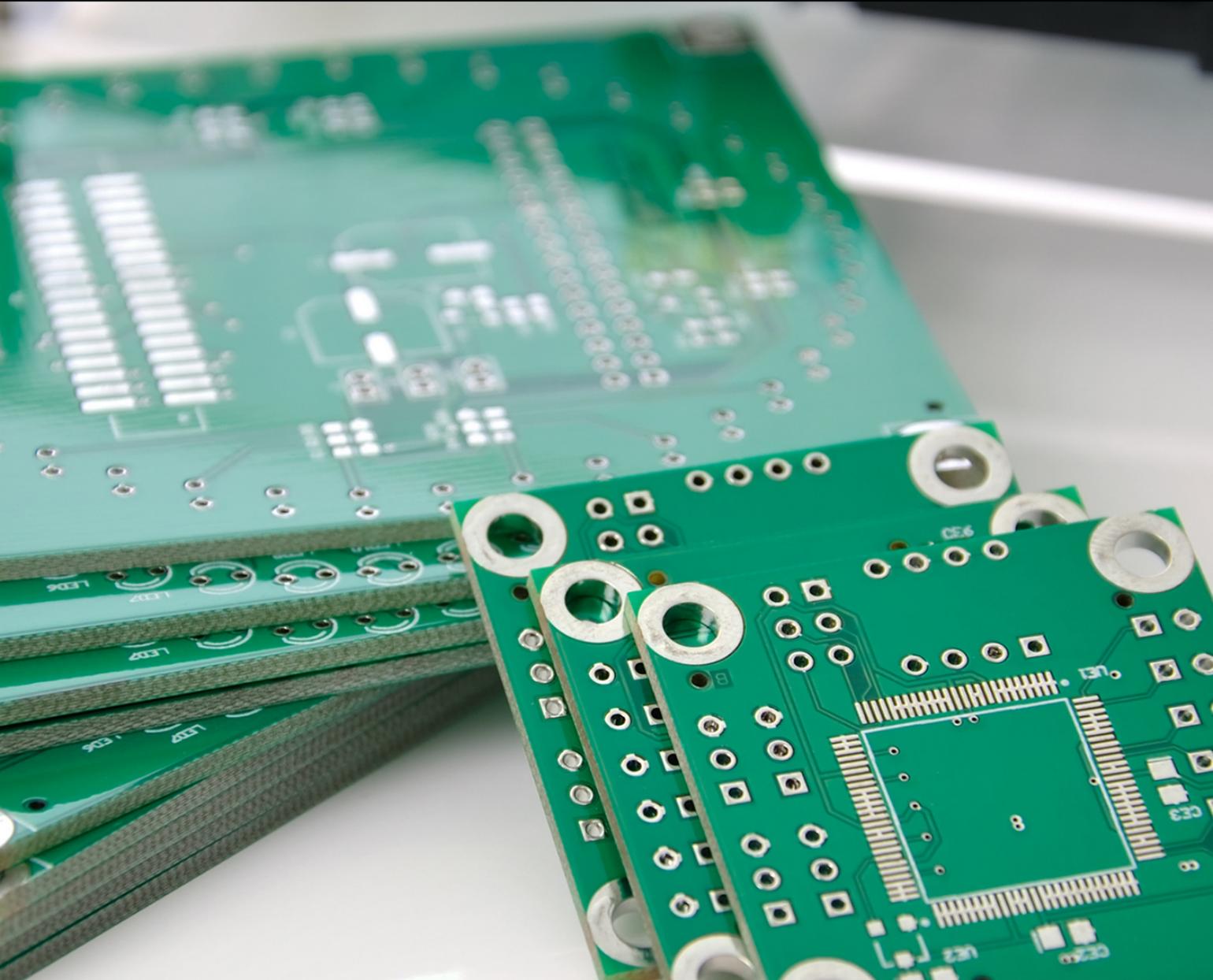


When you sort your leads from hot to not, also consider where each prospect fits into your sales process or funnel. It's important to note if they are a current or past customer; if they aren't or haven't been a customer, sort by whether they are a current prospect in your sales process or a completely new contact. Your follow-up strategy will vary depending on the prospect type. Regardless, follow-ups should be personalized; be sure to avoid generic form letters or mass emails. Let each prospect know that you appreciate the time that they spent with you and your team.

Here are some additional suggestions based on the type of prospect you've identified:

Current customer: If they are a current customer, you have a clear advantage over your competitors because a customer should have a good working relationship with your company. In your follow-up, you want to make sure they know and feel like you have really listened to their needs. It's too easy to make assumptions and miss this part.

Past customer: If they are a past customer, determining why they stopped doing business with you is important.



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If they left due to disappointment, this may be your chance to re-establish a working relationship. After all, their stop at your booth indicates that there is at least some interest in re-engaging on their end. As with current customers, the most important part of the follow-up is making sure they feel heard and that you understand their needs. Beyond that, if you can identify any past issues that may have impacted their decision to stop working with you and directly address those with demonstrable solutions, this will help strengthen your relationship. Keep in mind that a prospect that is a past customer is a current customer of your competitor, so to win this business, you will need to be on your “A game.”

As with current customers, the most important part of the follow-up is making sure they feel heard and that you understand their needs.

Already a prospect: If you have a visit at your booth by someone who is already in your sales process, you will likely advance them to the next step of the process—but this is not guaranteed. They may have found some competing products at the show that gained their attention, or perhaps their needs have shifted. Your follow-up should verify that their needs have not changed and that your products still meet that need. As we know, with any sales funnel, a prospect can fall out at any point.

New prospect: If they are a new prospect, they—just like any other prospect—must feel like you have really listened to their needs, that you have solid solutions available, and that you

have expert answers to their questions. In addition, you need to make sure they understand who you are, what you stand for, and the value you bring to them. They need to feel confident that you are the kind of company that they want to do business with. From the moment they stepped into your booth, they began to form an impression of you. If they went as far as giving you their contact info, they must feel comfortable exploring the next step.

Regardless of the prospect’s category, it’s important for you to present yourself as a thorough and technical leader. This is where your post-show marketing voice is critical. Be sure to take part in highly visible trade show coverage in trade journals. This can be in the form of press releases announcing activities from the show, interviews with your team, or ads promoting the technology your prospects have just seen at your booth. Ads with third party testimonials are especially powerful here. Ideally, you should do all the above.

Social media is also an important tool in follow-up. One of the first questions to ask is if your prospect is already connected to you at some level. If they are, connect with them through that platform. Invite them to see your coverage in the trade journals, read a technical blog, or download your whitepaper. If they are not connected, reach out and invite them to connect.

Arranging a personal visit is arguably the strongest form of follow-up. It gives you a chance to spend focused time without the noise of the trade show in the prospect’s own environment. It also is an indication that this prospect is very serious about moving to the next step in the process.

Now that the trade show is over, it’s time to put all the pieces together. It’s good practice to have a detailed and documented follow-up plan. The plan should include all the above steps, as well as a specific timeline attached to each activity. Your timeline should be fast-moving with key metrics. Time is of the essence; if you are not

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well prepared, your trade show investment will be nothing more than a sugar high.

To my point about generic or mass emails, I just received the following email from a company that I have never done business with—even though they say I am their customer:

Dear Barry,

Looking back on the past year, we realize we have a lot of reasons to be grateful for.

You are one of them.

We would like to take this opportunity to say thank you for the business you have given us throughout the year. We hope you will continue being one of our valued customers in 2023.

All the best for the holiday season and see you in 2023!

Best wishes,

(I have removed their name, as there is no reason to embarrass them further.)

Generic messages are transparent, and the above email tells me that this company does not understand their selling process. I appreciate the well wishes, but this email feels less than sincere.

Don't leave your own prospects feeling like this—take the time to do your research and follow up with personalized communications that make them feel valued and understood. **SMT007**

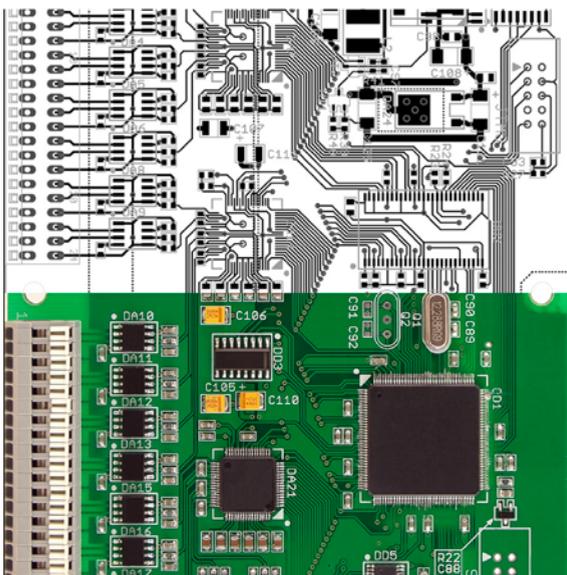
BOOK EXCERPT:

The Electronics Industry's Guide to... The Evolving PCB NPI, Chapter 4



Chapter 4: Optimizing Stencil Design and the Inspection Phase

Typical inspection methodologies used during PCB manufacturing are solder paste inspection (SPI), automated optical inspection (AOI), and automated X-ray inspection (AXI). These have traditionally been performed manually, but as we're discussing improving the efficiency of NPI, we will focus on automated methods.



SPI is traditionally performed with the Gerber file of the stencil. Here, we have two areas that can be optimized for a comprehensive and improved NPI flow. The stencil data is usually created by a stencil vendor based on the rules provided to them by the PCB assembler. Because it can be difficult to cover every eventuality, there will be some amount of back and forth between the two groups until the final stencil is complete. This takes time and impacts the overall production and release schedule. Once complete, the final stencil data forms the foundation of the SPI program.

When using Gerber data, the connection to component names and pin names is lost and only x,y locations are available. So, to address this issue, a component placement list (CPL) file is imported along with the Gerber file. Then, any pads in proximity to the paste pads can be associated with each component or pin reference. Because there is no guarantee that the Gerber paste file and the CPL data were created based on the same origin, this process adds time and extra work that could be eliminated by using a single unified and standardized product model.

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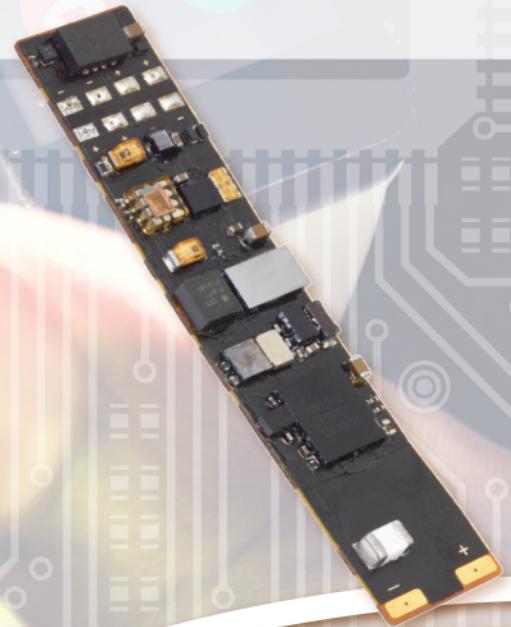
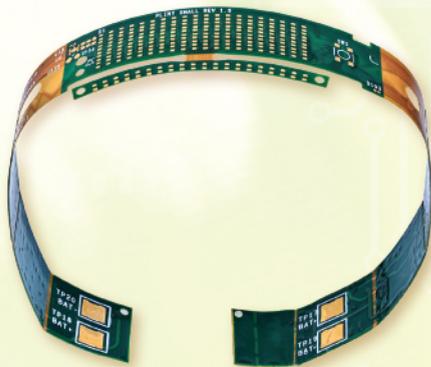
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Alpha Takes the Greenfield Route

Feature Interview by Nolan Johnson

I-CONNECT007

Alpha Circuit is a PCB fabricator located in Elmhurst, Illinois. Given that the launch of a new PCB fab is a rare occasion these days, we caught up with the senior team—Prashant Patel, president and CEO; Steve Smith, general manager; Steve Ryan, sales and direct support—guiding the buildout of Alpha Circuit’s brand new 44,000 square foot facility. They discuss what goes into equipment selection and line design, and the timing couldn’t have been better. At press time, the new facility was on schedule for test production by the end of January.

Throughout the conversation, the Alpha team shared its methods for designing the facility, the parts of the fabrication process that are critical to get exactly right, and where the surprises were in the process.

Nolan Johnson: Gentlemen, welcome, and congratulations on your new facility. Let’s start with a little background about the company.

Steve Ryan: Alpha Circuit started in 1981, as a single-sided and double-sided board shop. Zenith was one of our big customers early on. We did a lot of punching and crunching back then and it is what really catapulted the revenue stream for us. When I joined the company in 2009, we were comfortably an eight to 12-layer multilayer and double-sided manufacturer. In 2013, we started doing flex and rigid-flex, increased our multilayers up to 28 layers, and started manufacturing copper-based pedestal-type design work.

Prashant Patel: When I acquired the company in 2020, my vision was to continue Alpha Circuit

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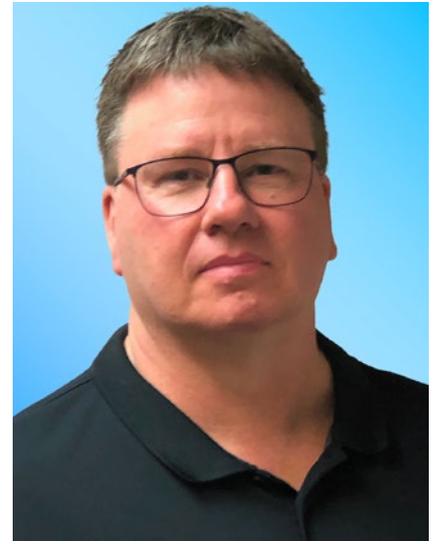




Prashant Patel



Steve Smith



Steve Ryan

the way it was, while building a new facility to meet the higher technology demands. We purchased and renovated a 44,000 square foot facility, then ordered the equipment. It takes a long time to source equipment—you get the quotes, have it installed, and then get it running up to speed. That process has taken us over three years.

Steve Smith: I joined the company a few months ago. My background is HDI: stacked microvias, staggered microvias, along with high-speed digital materials, low-loss materials. I was hired to put the technology part of it together, getting the proper people and processes in place, so we can handle microelectronics down to 25-micron line and space and down to 3-mil pads.

Johnson: Great, thank you for that. Now, I want to talk today about your recent equipment purchases.

Smith: We have purchased a laser drill, and we have brand-new 200,000 RPM drill machines in place to do high aspect ratio holes. We also have a brand-new plating line with state-of-the-art chemistries to be able to do copper fill and through-hole plating in the same process along with being able to manufacture stacked

vias starting with a 2-mil core substrate and stacking up to seven or eight lamination cycles.

Johnson: Why a greenfield facility, especially in an industry where it seems like it's shrinking more than growing?

Patel: We feel there is enough demand for prototypes and quick-turns in the United States at the higher level technology that we want achieve. We feel confident that we can fill that facility very quickly.

Johnson: What are some of the market drivers making that business available?

Smith: A lot of it is microelectronics. As technology increases, you will see much more blind and buried via work, as well as sub-2-mil line and space. Currently there are not many North American manufacturers capable of producing that type of product. With our shop catering to this niche, it would be a very good business model, especially for the high-end customer. Right now, there is a lack of capacity for this technology in the industry, yet the demand is constantly growing.

Ryan: We are ISO9001:2015, AS 9100, and IATF 16949 certified, and ITAR registered.

We're also a nationally certified minority business, so we're looking for businesses that are coming back to the North American market. I just met with some people who are trying to get the U.S. Congress on board helping to get some of the business back to North America.

Johnson: Let's talk through how your new facility went together. Where did you start, and how did you map out what you wanted for capabilities?

Patel: We definitely mapped out which direction we wanted to go, we then went out and sourced the equipment that would fit our needs. Every single piece of equipment in that building is brand new, from drilling to imaging, wet process, plating, and etching lines, the AOI and LPI spray coaters—everything is brand new.

Johnson: How did you go about deciding what equipment you would source?

Patel: Our team is a mix of newer members with those who have been in the business for more than 30 years, so it was their understanding of the manufacturers out there as well as getting quotations on what we needed. The team at Alpha customized a lot of our wet process equipment, meaning they would give us a template, and we would make the changes that we needed, based on the expertise that we have on our team. As far as sourcing the manufacturers, it was a long process; we narrowed it down to the top two to three manufacturers in a specific area. Before making a final decision, everything had to be accounted for. We had to consider who had the best service and technicians,



Wet process area showing IPS Plating line, Deburr and MacDermid Alpha Eclipse direct metallization line.

and the impact of downtimes. Price played a part but was not the driving force behind our decisions; dependability and service were the key factors.

Johnson: As you were setting up the facility, what part of the manufacturing process was the most critical, pivotal part, where you had to make sure to get that one part right?

Patel: I would have to say it was our plating line, which is made locally within the United States. It literally took more than a year and a half to get the line built. However, it has the capacity for many functions that maybe only three or four different factories in the United States would have.

Smith: The plating line is set up to run high aspect ratio—thick panels with small holes. It's



Custom Integrated Process Systems plating line with insoluble anodes for copper via fill technology.

also set up to do microvias. A lot of it is set up for copper fill. We have the advantage of doing both technologies.

We can do it, whether it's backplanes with many layers or stacked and staggered microvias that might be only an eight-layer. We might be starting with a three- or four-layer in the center and then stacking off that. The line has full capability to do different processes. We've gone to the state-of-the-art chemistries in the line with insoluble anodes and side inductors on copper fill—everything it takes to do the state-of-the-art printed circuit boards in the future.

Johnson: You started working with your plating supplier and there's 18 months' worth of back and forth designing your solution?

Patel: No, the 18 months was strictly the manufacturing time; the designing was at least four additional months, as well as six weeks to install the line.

Johnson: While you're waiting for your wet processes to be built out and delivered, what were you working on?

Patel: The shutdowns due to the pandemic played a big factor. The plating line was six to eight months late. All our other wet process equipment was in the range of three to four months late. At that point, we didn't have a choice because you can't start a line with some key pieces missing. But in the next two to three weeks, we will be operating at 70%, and will be starting the testing phase.

Smith: This is also a facility that will reuse its own water, so it will be environmentally friendly. We will generate probably one-tenth of the wastewater of a normal circuit board shop. We are planning for the future.

Johnson: Who served as your lead project manager?

Patel: I did. My background is in healthcare; I only have about two and a half years in this manufacturing business. But I have managed multiple businesses, started them from scratch, run them successfully, and then sold them off. My strength is management and vision.

Johnson: And you're surrounded by a team that understands the technology very well. From a technical expert point of view, what were the surprises in setting up a facility like this?

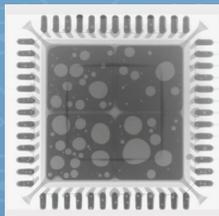
Smith: Since I've set up facilities and worked in engineering manufacturing for so long, I tend to understand this. But one of the things that surprised me a little bit was the type of equipment that we've brought in. We've brought in the best equipment that really can sustain us into the future and allow us to keep up with technology. The costs that it takes to do this were never an issue. We looked at what it actually takes to perform well into the future and to have a sustainable business for North America.

Pyramax Technology to Eliminate Solder Voids

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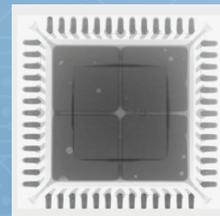


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Johnson: What did you see as the critical capabilities to add?

Smith: Wet process, but it's also imaging. You must be able to image with the best equipment in order to get down to these lines and spaces. Then you've got to have the right laser drill. We have a combo laser that is capable of going down to 4-mil and 3-mil laser holes. To be able to metallize those types of holes, the older lasers are very limited as to what they can do. So, I think laser drilling, imaging, and having the proper test equipment will be the key areas to drive this. We will be testing 8-mil pads and smaller, so you must have testing equipment that is capable of doing this type of technology, and doing it quickly. To me that is very important.

Johnson: Based on the experience that you've just had, what's your advice for others in the industry who might be looking to put in a new line or a new facility like you did?

Patel: My advice is to buy a facility that is currently operational, gut it down, and put in all the equipment you want because the regulatory requirements and inspections from the city, and the state, as well as the EPA licenses, the wastewater treatment applications—it's horrific. If I had it to do over again, I would have bought another facility and upgraded; I could have been operational in a year.

Johnson: Any advice in how to go about selecting equipment?

Patel: Have a team that can think five to 10 years in the future. Nobody can predict the future, but at least they have an idea about the direction the future is headed. Build out a management team that has a lot of experience and understanding about where the technology is going. That is crucial because it dictates the kind of equipment you buy and what its capabilities are.

Ryan: We also have to look at how well the supplier is going to support you after the install. For example, we chose our wastewater treatment system based on the fact that when we are closed, they will still monitor the system. Once the install is done, who will support you long term? Who has a reputation in the industry? Who stands behind their equipment? If we need repairs, how will we do it? Where is your parts warehouse? Are we flying in parts from Germany every time something breaks down?

Johnson: That sounds like general advice for anyone looking to do this: don't just focus on getting the right equipment but consider other factors like guaranteeing uptime so that your factory is not taken down by a key piece of equipment. Any cautionary tales from this whole experience?

Ryan: You need to consider all the regulatory work to start a fresh building. That has probably been the biggest headache. It wasn't so



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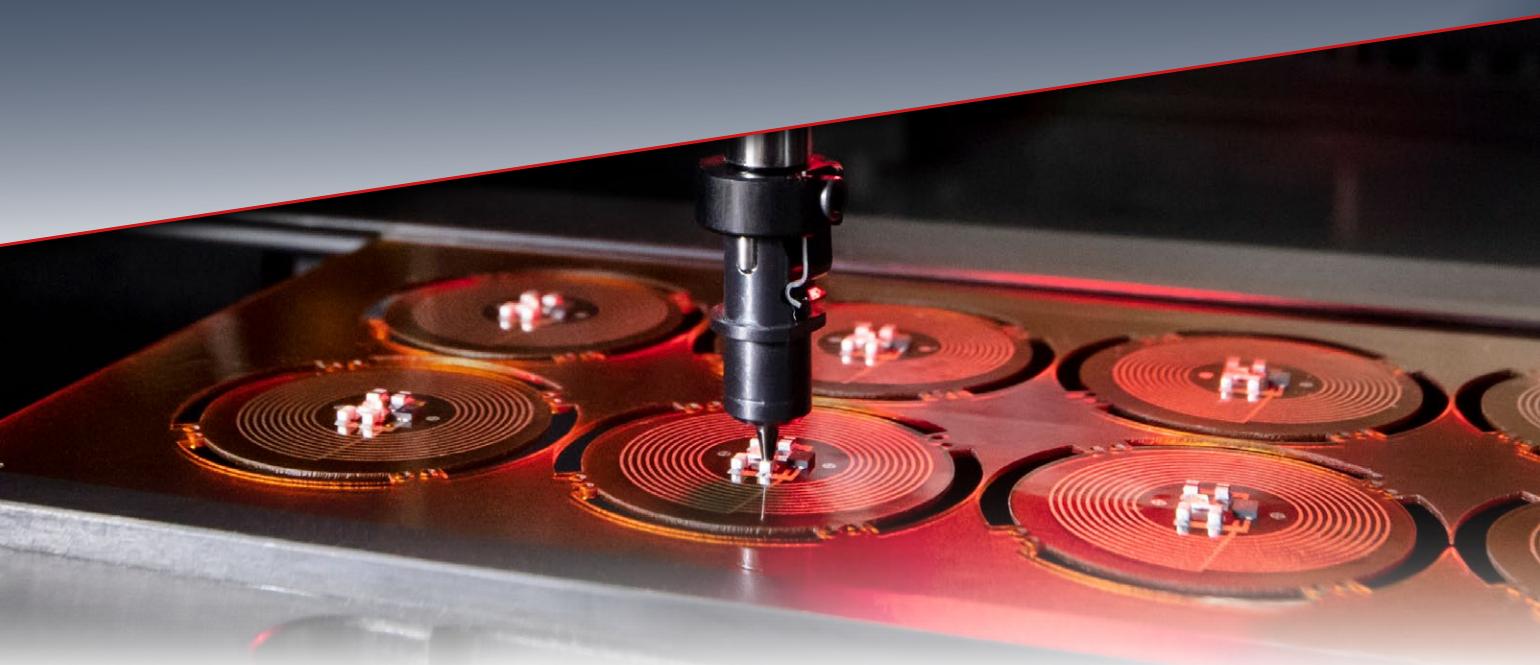
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much equipment, the install, or even when we had the logistics issue. Those played a role in delaying the opening of the business, but the regulatory issues have been a major hurdle.

Patel: Wherever you decide to put in a facility, make sure the city is somewhat friendly toward the chemical processes. If they're not, you will have a nightmare on your hands. We went through a lot of challenges with our city to get approvals. The inspectors probably won't understand what your waste treatment or your equipment can do, or how much you can purify. It's an education process for them, so it's helpful to locate where there are at least one or two other fabrication facilities in the area. That way they know what is expected vs. going somewhere where there's nobody else like you.

Johnson: As we look ahead, what should we expect to see at the new Alpha Circuit facility?

Smith: We're focused on the larger OEMs as their technology and boards get more difficult.

The future of printed circuit boards and substrates is in telecommunications, high speed digital, and really low loss materials. We're targeting that niche because we think signal speed will be everything in the future.

Patel: Everybody has their own different niches within the board industry, but we want to be in the top three to five in our niche.

Johnson: What are your sales currently?

Patel: We're currently at about \$10 million.

Johnson: Building out a greenfield facility certainly shows that you don't have to be a large shop to make that kind of investment. Is this financed or cash?

Patel: This is all self-funded.

Johnson: There aren't that many facilities that are putting in a greenfield fab. Why do you think that is?

Patel: This is a niche industry with businesses passed down within the family, and at some point, the new generations stopped coming into it. The new talent is pretty hard to find and that's a chance for us to step in and make our mark. Some people on my team have 30 years plus experience, but they'll retire at some point. How do we get the next generation? How do we keep this going for the next 30 years? That's a challenge.

Johnson: Yes, agreed. Thank you all for this very enlightening conversation. **SMT007**



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Ten Expert Reasons to **Walk** a Trade Show

Feature Article by Dan Beaulieu
D.B. MANAGEMENT GROUP

Just because you haven't exhibited at a trade show or conference you still can find plenty of value for being there. From the technical conference sessions to professional development, the keynote speakers and myriad receptions, there's so much to keep you busy once you get back home.

You see, if you're spending your company's money to be at a show, you want to be sure you spend quality time on the show floor. Management back at home will want to know what you saw, what you learned, and what you think your company should do based on that information. Be sure you're clear on your "why," and it will make all the difference.

Are you ready? Here are my top 10 trade show action strategies based on years of trade show experience:

- 1. Find customers.** Meet with potential customers who might buy your products. This is a perfect time to meet and spend quality time with them, educate them about your products and hopefully convert them.
- 2. Check out new equipment.** A show is literally a showcase of all the new equipment on the market today. It's a great time to check what is being introduced, and an even better time to buy. Tip: You can get great deals on show demo models. Equipment manufacturers would love

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to send the equipment straight from the show to a customer's factory, at the customer's expense, rather than send it back to headquarters at their expense.

3. Look for strategic partners. Create synergistic, strategic partnerships of all kinds, ranging from offshore suppliers for global sourcing, to designers if you're a board shop or an assembly partner—all aimed at offering a complete solution in the future.

4. Mergers and acquisitions. With all the company representatives gathered together, it's a great time to meet up with companies you might be negotiating with, or to be introduced to companies of interest. It is the perfect arena for these kinds of meetups.

5. Classes and presentations. This is the best place to find out what is going on in the industry. Just about everything new is being talked about. Take a crash course in technology updates. You'll be better for it.

6. Find and hire key people. One of the biggest challenges we're all having right now is finding and hiring key personnel. Conferences and expos provide an excellent opportunity to meet, interview, and hire that perfect team member.

7. Find a new job. On the other side of that proverbial coin, this can be a great time to find a new position. Almost every major company in our industry will be at the show so it's a fantastic time to spread your resumé by meeting and talking with as many folks as possible—especially those who might be looking for you.

8. Check out your competition. What are others up to? What products do they have and what are they introducing? How are they selling it? Look at their sample products. It's that one time of the year when you get a front-row seat to what's in your competitors' portfolios.

9. Old friends. Catch up with old friends and acquaintances, see what they are up to, and always keep yours—and theirs—businesses in mind. What can you do for each other?

10. Scout for next year. Finally, make some decisions about whether it would be a good venue for your company to become an exhibitor the next time around. Ask good questions of the exhibitors, get a feel for why they are there, and be direct about understanding the benefits of having a booth.

As always, be intentional. Treat your time and money with respect. Before you go to the show, prepare by making a working task list of what you want to accomplish. Set up the meetings in advance. Use your time productively, making every minute count toward delivering a high impact show report—with recommendations—to your management in the home office upon your return.

Take careful notes when meeting with people. It is always better if you are the notetaker, the person who lists the action items, who they are assigned to, and when the action needs to be completed. Of course, make sure you are the person responsible for getting things done. Keep the ball moving on whatever project you launched at the show.

I'm sure you already did some of these activities. If there are some that you missed, that you now realize you could be more intentional, then that's where my bonus tip comes in. **SMT007**

My last tip: Follow up, follow up, follow up. The more efficiently and diligently you follow up after any networking event—not just trade shows—the more successful you will be.



Dan Beaulieu is president of D.B. Management Group, and an I-Connect007 columnist. To read past columns, [click here](#).



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MilAero007 Highlights



DARPA Kicks Off JUMP 2.0 Consortium Aimed at Microelectronics Revolution ▶

DARPA, along with the Semiconductor Research Corporation (SRC) and industry and academic stakeholders, is kicking off the Joint University Microelectronics Program 2.0 (JUMP 2.0). The SRC-led effort expands on the original JUMP collaboration aimed at accelerating U.S. advances in information and communications technologies.

Northrop Grumman, NASA to Shape Future Integration of Uncrewed Autonomous Systems ▶

Northrop Grumman Corporation is collaborating with NASA to develop and test solutions for integrating large, uncrewed aircraft systems into the National Airspace System (NAS). The effort will focus on air cargo operations and is part of NASA's Air Traffic Management-eXploration (ATM-X) Pathfinding for Airspace with Autonomous Vehicles (PAAV) subproject

Happy's Tech Talk #15: Printed Electronics Using Flex ▶

The printed electronics sector is presently an area of great interest to many in the electronics manufacturing industry. Because of their incredible utility, printed electronics are poised to generate tens of billions of dollars in the coming years.

Pentagon, Lockheed Martin Finalize Lot 15-17 Agreement, Capping A Year of International Growth ▶

The F-35 Joint Program Office and Lockheed Martin have finalized the contract for the

production and delivery for up to 398 F-35s for \$30 billion, including U.S., international partners and Foreign Military Sales (FMS) aircraft in Lots 15 and 16, with the option for Lot 17.

MBDA, BAE Systems Hägglunds Demonstrate AKERON and CV90 Firepower ▶

MBDA's AKERON MP missile has been fired from the BAE Systems Hägglunds CV90 infantry combat vehicle at a test range in Northern Sweden, in the presence of representatives of the Swedish Armed Forces.

Durability and Cost Benefits Drive Mil-Aero Demand for OCPP ▶

Ceramic packages were, for many years, the option of choice for semiconductor prototype assembly, particularly in military-aerospace applications. They can withstand high temperatures and can be hermetically sealed. However, they can be costly and, while they allow for rapid assembly of first samples, the final product is typically a plastic package, so the ceramic prototype doesn't offer an accurate representation.

Heart Aerospace Selects Siemens Xcelerator for New Electric Airplane ▶

Electric airplane maker Heart Aerospace has selected Capital from the Siemens Xcelerator portfolio to support its E/E system design, development, and certification of zero emission electric aircraft. The Capital tool's strong compliance functionality can help Heart Aerospace to leverage automation and digital data continuity to facilitate faster regulatory compliance. This was a key reason for selecting Capital software from Siemens.

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Koh Young: Getting Equipment In-Line and Customers Online

Feature Interview by Nolan Johnson

I-CONNECT007

With machine installs somewhere in the range of 500 new annually and award-winning customer and field service, Koh Young has a commanding perspective on the evaluation, purchase, and installation processes for new equipment. We spoke with Mitchell Kim, applications engineer manager; Brent Fischthal, senior manager of Americas marketing and regional sales; and David Nemeth, Koh Young's service manager for the U.S. and Canada, on what they see as the best practices for acquiring the right capital equipment.

Nolan Johnson: As experts in designing, manufacturing, selling, and servicing capital equipment for PCB manufacturing, what's your best advice for customers? How should they move from the decision to purchase a piece of equipment to installing it?

Mitchell Kim: The biggest thing that customers need to oversee is having dedicated resources to implement these systems. People are short-handed as is, but that kind of planning really benefits any system. You need to have qualified personnel and resources to be part of the implementation process, so that should get developed early on. From there, you move into internal screening and try to keep information flowing internally so that the process can be sustainable.

Johnson: On the application side, how often is Koh Young involved in guiding a customer through what they need to do?

Kim: Most of the time, the decision-making process is taking place on the front end. Afterward, there's a follow-up on the process





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improvement side, because after the purchase, there's a phase of installation and training that's along the lines of, "Just how do I utilize the system?" From there you can move to the bigger picture; you take that training and you apply it from a process improvement standpoint.



Mitchell Kim

David Nemeth: It's fair to say that the applications team is very heavily involved in the pre-sales. After a trade show, the customer might want to see some action on their own product. Mitchell's team will often receive boards and data, then use those to create board reports to show what our machine can do for the customer. That might be one of the first steps after a trade show. The customer wants to see something more on their product without doing a full-blown evaluation on site. Mitchell and his team will do quite a bit of that work, and then maybe do a virtual meeting to discuss how to utilize the equipment.

Brent Fischthal: Usually, before the show, they've done all their paper benchmarking and have spec'd all the machines; at the show, they've actually seen them all. The next step is to run some sort of product, either a benchmark test board or something similar. I'll elaborate later about the boards we created and the benefit of those to actually running on their own product. It's just a quick demo, maybe at one of our demo facilities, or something in Korea if it's demanding enough, or even just something online like a webinar.

Johnson: The process starts with the customer realizing that they probably need some new equipment, so they start "paper benchmarking," as you said. I assume that's looking up datasheets, that sort of "seeing that what's out there" for their application, the vendors, the models, etc. They figure out what they want and

then see that equipment, which is where something like a trade show comes into play. What are some of the alternatives? If you know a prospective customer is looking at this mid-year and it's still six to eight months until you get to a big show where they can see the "big iron," what do they do then?

Kim: They can always reach out to us at any time. The doors in our office here in Atlanta are always open to host anybody who's able to come. We have partner sites that have our equipment as well, so if logistically it makes more sense to go to Chicago, or the San Jose area, we can make that happen. We have equipment there and can have somebody onsite to support them there as well.

Johnson: So, customers could visit one of your demo centers in lieu of going to a show?

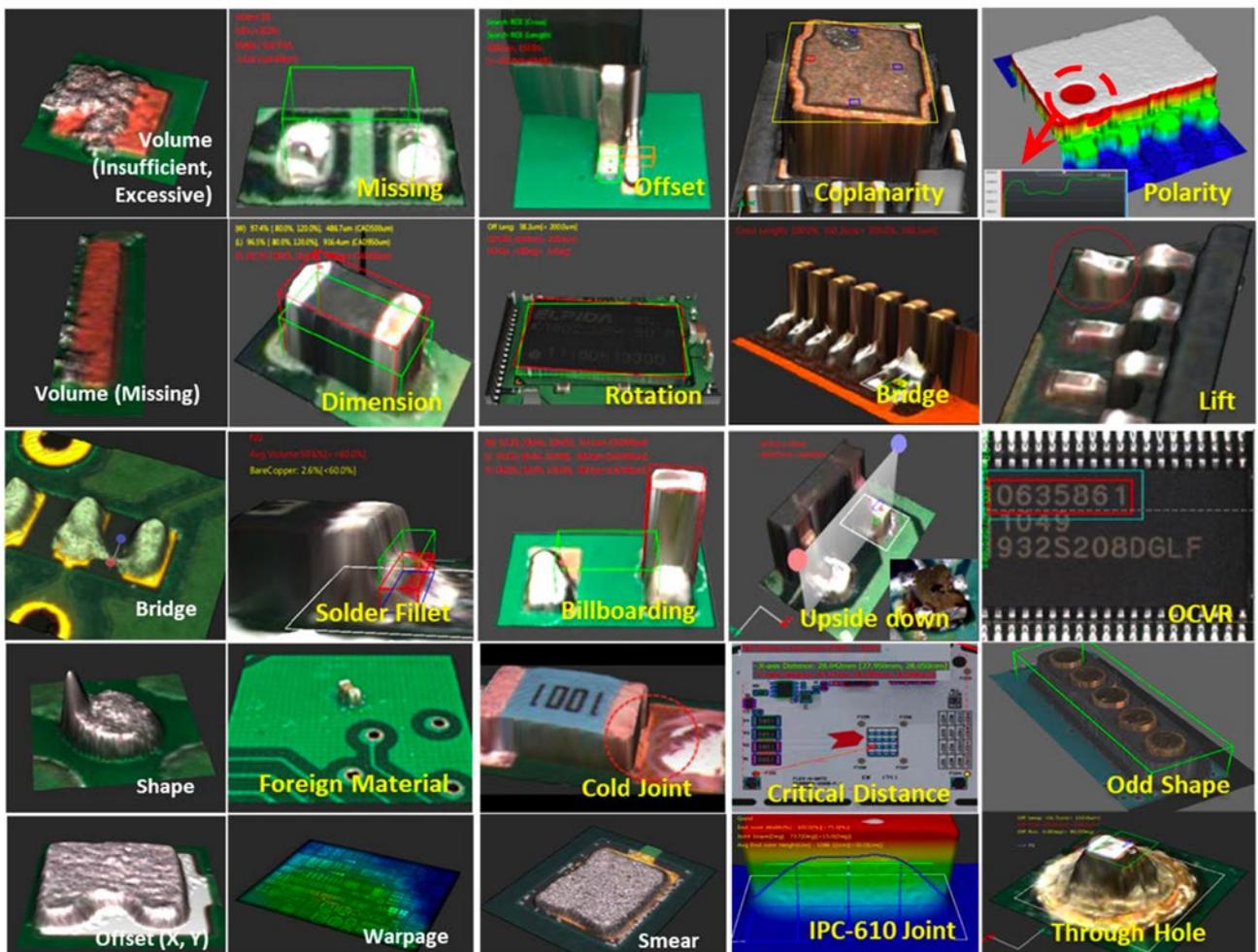
Fischthal: Yes, I think there are a couple aspects to what Mitchell is talking about here. Instead of the show, going to a Koh Young demo facility is absolutely an option. We've got them in Atlanta and in Guadalajara, plus many of our sales partners have a demo room with our gear onsite. You can go to one of our industry partners that has our gear in their facility, like Panasonic, Fuji, Universal, and ITW EAE. ASYS has gear as well. You can check out different machines at these facilities almost anytime. We have some equipment at universities like Binghamton University where we are focused on smart factory initiatives and at the Rochester Institute of Technology (or RIT) where we are helping the next generation of engineers. We even have gear at solder paste and materials suppliers too, so if needed we could take them into a materials company and show the machine there. Our customers have lots of options; they don't need to wait for a show to see our machine, to touch it and feel it.

Johnson: All right, so they've had a chance to see the machines either on the show floor or onsite in an application environment, and the next step is, "Let's see how it works." Customers want to know how it works with their own projects and their own product. That's where you start getting test cases from them, right? Let's dive into that a little bit deeper, Mitchell. What makes for a successful test run and benchmark? What do you need to make that work?

Kim: We obviously need some samples and their respective files, everything to put a program together that will let the customer know, "Here's what we should expect to need to

move forward with this system." On the front end, you need to do the necessary preparation. Oftentimes, it's very beneficial to the customer to have a test plan where they say, "We want to run these specific tests," and they provide their reasoning behind those decisions. It's not just pulling things out of the air, but some sort of gauge, preferably something that they've created around whatever system it is that they're looking for, because the gauge will vary depending on what product you're looking at. Having somebody on the inside who's familiar with that product is also very beneficial. That way, that person can oversee and understand what's happening throughout the entire process.

Component Defect Examples



Johnson: Is it a requirement for you to have somebody from the company onsite to assist with that, or is this something you can usually do on your own?

Kim: Most of the work takes place remotely. They'll essentially send us their samples and files, and then we'll set up a virtual meeting where we can do a live demo of the system. They aren't physically seeing the system, but they are seeing what's happening on the system. I'd say that's at least 90% of the interaction at that stage.

Johnson: Getting customers to give you the pieces and parts you need, as well as a test plan or some objectives to accomplish, is pretty critical to deciding whether you've got what they want.

Kim: It also makes it fair, especially if they're looking at other vendors. They can hold everybody to the same standards.

Johnson: How do you handle a situation (if you've even experienced this) where your customer really doesn't quite know what they want? Say they're a little unsure about their goals, but they've reached out to get a sample test done anyway. How do you guide them through that?

Kim: We always try to help educate the customer. For example, in the measurements world, there are certain standards used to gauge how you verify how reliable or repeatable a system is. Things like running a Gauge R&R, for example, as that can be performed on all the equipment, which makes things a little more binary—you know which system is performing better than the other systems.

Fischthal: There are a couple different options here. The customer brings their own board



Brent Fischthal

that they could use against multiple companies, or you could use something more objective, some sort of Gauge R&R test to make things a little more objective.

Johnson: What's your overall advice for a prospective customer interested in working with you on this? We've just talked through what they should do

here, but do you have a sense for how much pre-work this really is?

Fischthal: The amount of work they must do is tied directly to how dedicated they are to putting the machine through its paces. They could walk in, take a look, kick the tires, and feel like it's good to go. Or they could really go through it and have their own evaluation criteria prepared, where they add weights and values to everything from user friendliness to accuracy and repeatability.

Each of these aspects has the potential to affect their process, so what they want to accomplish determines how much work they will need to do. I think this goes back to what Mitchell said earlier: You've got to have somebody dedicated to this project. You can't "share" it as a committee; you need one person driving it, and they must put in the work to really figure out how in-depth they want to go. They could do it in a couple of hours, or spend a couple of weeks deciding whether they want to bring a machine on site for a larger evaluation or whether they want to make an investment.

Johnson: Let's say they've selected you and now it's time to prep the system, get it delivered, uncrated, and installed. Is there a correlation between the amount of detail in the evaluation process and the ease of installation later?

Kim: From the programming aspect, we can provide a lot of the work we do during the eval-

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uation directly to the customers, so all that data isn't wasted and it puts them a little bit ahead of the game when they first get the system. So, yes, there's some added benefit there.

Johnson: Is that true whether it's done with test cases or Gauge R&R?



David Nemeth

Kim: I would say so. With the test cases, they have those product programs and libraries already built, so some of that work is already done with any other gauge testing. It's one way they can validate that the system they received is performing equally to the system that the original testing was conducted on. I think you can see benefits all around in that.

Johnson: How much time do you typically set aside to install a piece of Koh Young equipment?

Nemeth: The answer to that is: It depends. Is it a single machine install? Is it a first install? Is it a new customer? Are we adding to existing machines? Assuming it's a new customer, the installation part is fairly straightforward, but again, it depends on the system. A single SPI purchase is quite simple; it's three to four hours to actually install the machine, assuming it's uncrated, has been moved to the location, and all the facilities are ready—we provide all that information up front to a customer. We like to give them facilities requirements and what they need for data for programming. Even if they didn't go through that phase with Mitchell so they already know, I always provide that information: "This is what we need, and these are our network requirements. This is what you can expect when it comes to how we work with antivirus. Here are all those our policy documents and expectations." All that is shared with the customer prior to getting the machine. Then we put in a good half of the first

day after travel to install the system, and get it connected and talking to the network. Assuming everything is there and good to go, after that, we spend most of our time training and helping the customer get ready to utilize the equipment.

Johnson: What's typical for post-install training?

Nemeth: For an SPI, it takes about two and a half days to go through the programming operations and basic maintenance, depending on how deep they want to dive into the SPI plus tool. We give them the whole overview of all those areas, but the majority of time is spent on programming and operation with the AOI.

We give them the whole overview of all those areas, but the majority of time is spent on programming and operation with the AOI.

There's quite a bit more to that, so a new AOI installation generally comes with a two-week training plan. For the first week, we give them the raw level-one programming course and operations so that they can walk away and be able to program and utilize the equipment. Their operators know how to use the review station, how to classify defects; their programmers know how to create a solid program. After that, we give them some time to really get to know the system and do some programming. They generate a lot of questions as they go about this; they will run into some difficulties, and they'll have questions about things that we hadn't covered yet, because there's just

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so many options. That's why we come back several weeks later, go through their questions, and help them dive deeper into the algorithms that we didn't get into before. We give them the skills up front so they can drive it. When we come back later they can really put it around the track. That's the plan. It's about a two-week implementation for an AOI, but for most of our SPI customers, we're done after that week and they're good to go. They may have some additional questions later, but that's generally the plan for those two platforms.

Johnson: It sounds like, especially for a new customer, that set of documentation you prepare for them—the pre-installed worksheets, checklists, and such—is extremely valuable for them.

Nemeth: It is, but it still generates a lot of questions. Sometimes it might be multiple

machines and offline programming station, or multiple review stations. I want to have a meeting with the customer to ask, “What do you really want to do? How do you want to go about this?” You're not going to just buy a brand new AOI and replace your existing one the same week you take the old one offline. Generally, you want to do some programming, build your library, get your people familiar and comfortable with the tools so that you can move it in line and then utilize it for production. SPI doesn't normally require that; we can usually get that machine in line with them, get them comfortable with it. We can leave it. We put it in line, walk away, and they're functional. AOI can be that way too, but it requires a lot more commitment from the customer. That's where it comes down to having a champion, having someone or two people really focused on learning the system and taking ownership.

Koh Young Programmer Requirements

○ Preferred

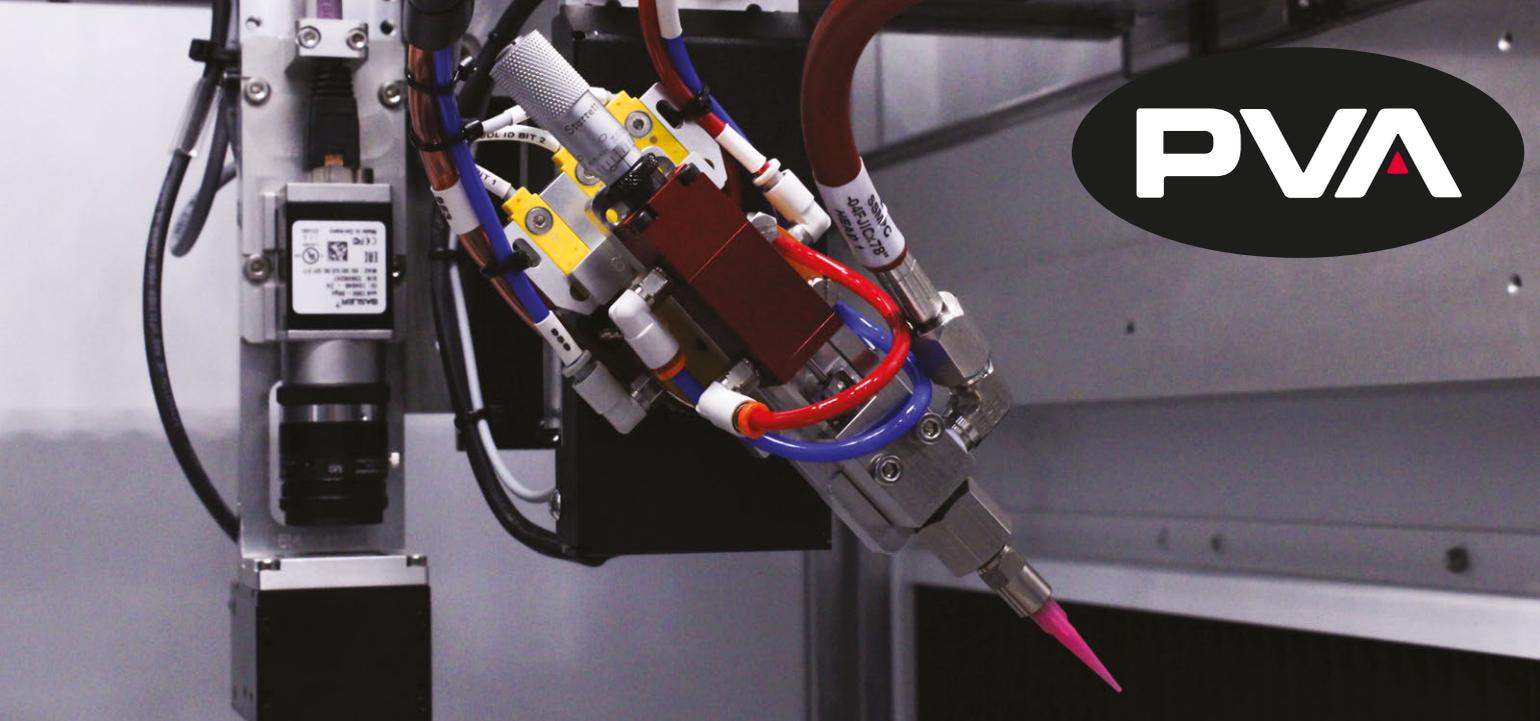
- Engineer or Technician level
- Previous SPI/AOI Programming Experience
- SMT Certified Engineer or Process Experience

○ Minimum

- Windows OS Computer Skills
- English Proficiency
- Basic Math Skills
- Experience with IPC-based SMT Defects and Classifications
- Knowledge of SMT Component Types



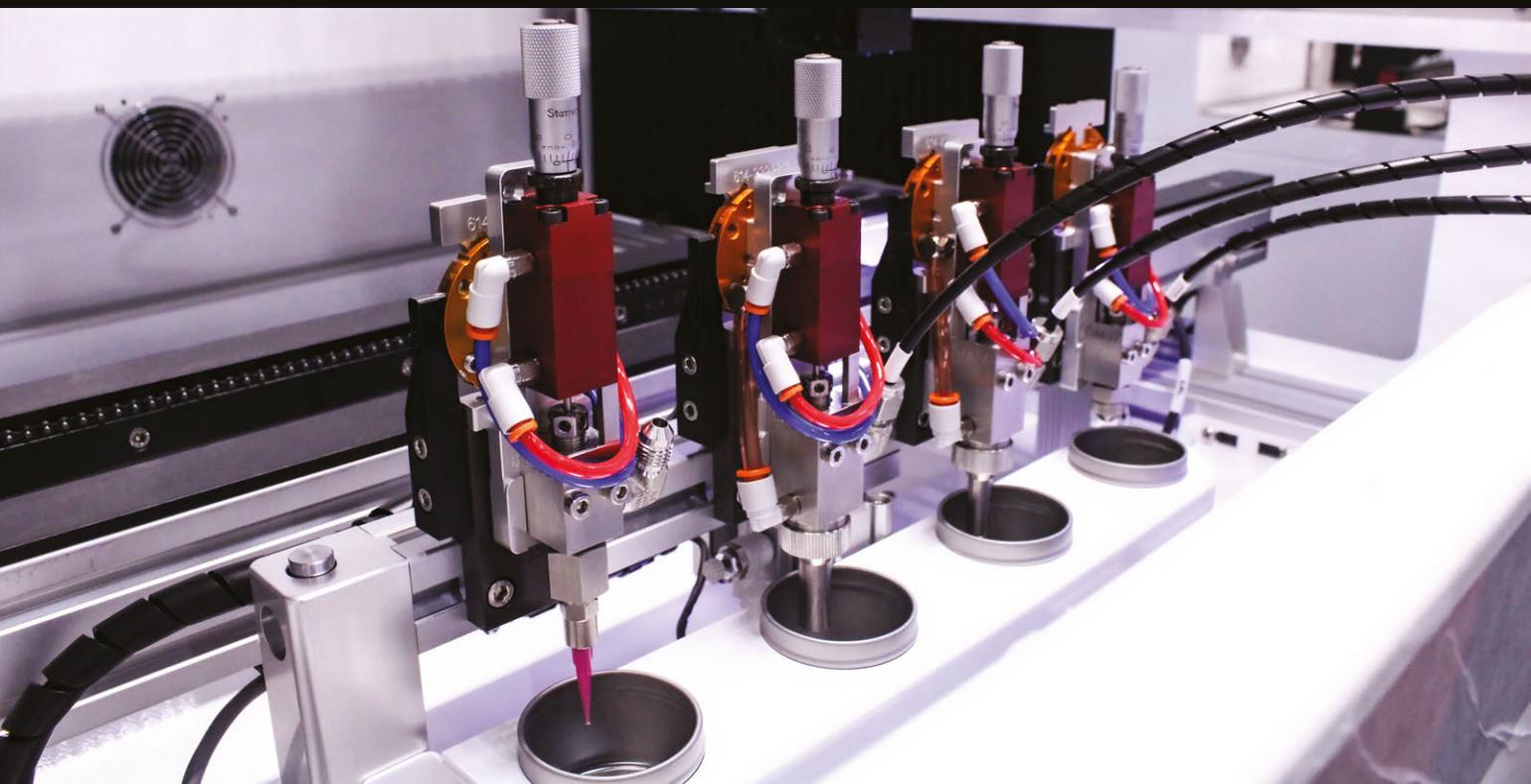
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Johnson: Is it effective to have some of the staff start training on specifics, particularly AOI? If the customer wants to start training on that before it arrives, can they get training from you while they're waiting for the machine to be delivered?

Nemeth: Sometimes we do that, but it's not as common; if they want to come to us for a week or two of training, maybe. For the install, that's possible. We've done that. We don't want the time to be too long between when the machine arrives and when it's installed, because it's easy to forget things.

Sometimes customers will have the machine installed and they'll come for training the week after. We've done some of that as well. They don't want to do it on site because of the things that happen in manufacturing, where the people that are dedicated to it get pulled away. Training onsite can be a challenge, but the overwhelming majority of the training that we do is onsite, so we have to find a way to deal with those challenges.

Johnson: In that case, do you have a preference? Is it better overall for the customer if the training is done on at your facility vs. at the customer site?

Nemeth: I always think that it's better for the technicians and engineers to be at one of our facilities so they're able to retain what they

learn and have the chance to really dive into the work without distractions. Normally, it's not logistically possible to do that with most of our customers, though, so we have to deal with the challenges of onsite training. Some places are good at it; for other places it's a real challenge. It's a mixed bag, but most of the work is done onsite.

Sometimes customers want to come later for that second week of training, or they may have some additional training that they want to do with other programmers or technicians. In that case, we suggest that they come to us if they can; the training classes run every month,

but we can only accommodate so many people. There are only so many classes in a year or in each quarter so, like I said, the majority is done onsite, but we like to do it in-house when we can.

Johnson: The ongoing in-house training gives your customers a chance to send staff later. If, for example, the person that received the equipment and the initial training got promoted or shifted to a different job or something like that, customers can still train somebody new by sending them to your course.

Nemeth: We train people all the time that move on or move up; it's one of the biggest challenges. The number one request we get on a regular basis is about additional training for new people. We'd like them to come to the office for those classes when they can.



Koh Young IPC-610 Measurement

Fillet height can be measured based on the 3D profilometry.

8.2.2.6 Chip Components – Rectangular or Square End Components – 1, 3 or 5 Side Termination, Minimum Fillet Height (F)

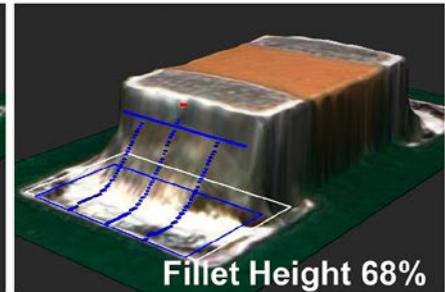
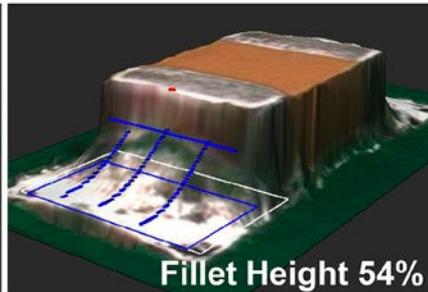
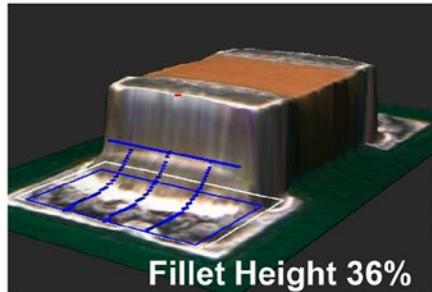
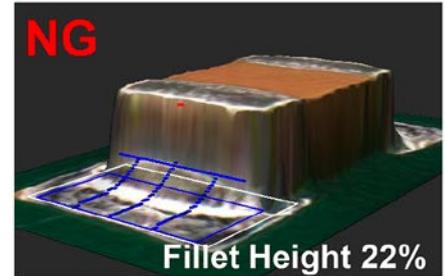


Acceptable: Class 1, 2

- Wetting is evident on the vertical surface(s) of the component termination

Acceptable: Class 3

- Minimum fillet height (F) is solder thickness (G) plus 25% termination height (H), or 0.05 mm [0.02 in], whichever is less



Johnson: Is training free?

Fischthal: At the end of the day, the customer invested in a relationship with Koh Young, so we want them to succeed. As Dave mentioned, when a customer buys an SPI or AOI, we will train them. We'll be onsite for installation and training that first week, and then we will come back. We can provide a second session to answer questions that arise after using the equipment. Of course, they have access to our help desk whenever needed to answer questions. Additionally, we offer advanced training classes either onsite or in one of our locations. But if somebody just needs to get new hires brought up on board, then we like to bring in a trainer and have that be a paid class. The paid model ensures that they'll engage with the material, that they have some skin in the game. If we just constantly give hand-outs, a free training that they know they can get anytime they need it, they don't pay that much attention. We want to make sure they understand that there's value in what we're

doing, and it costs us money to get a guy out there. We're asking folks to please be invested in it.

Nemeth: This also highlights the need for there to be a real subject matter champion. You really want a few people onsite that are ready to own this process. If we just move people around and no one really cares that much about it, it becomes costly having to retrain established people or train new people.

Johnson: Finding a way to train a trainer at the customer facility is cost-effective for everyone.

Fischthal: Yes, the "train the trainer" approach is always helpful, especially if the customer is going to have multiple lines. **SMT007**

2023's Top Challenges in BGA Rework

Knocking Down the Bone Pile

by Bob Wettermann, BEST INC.

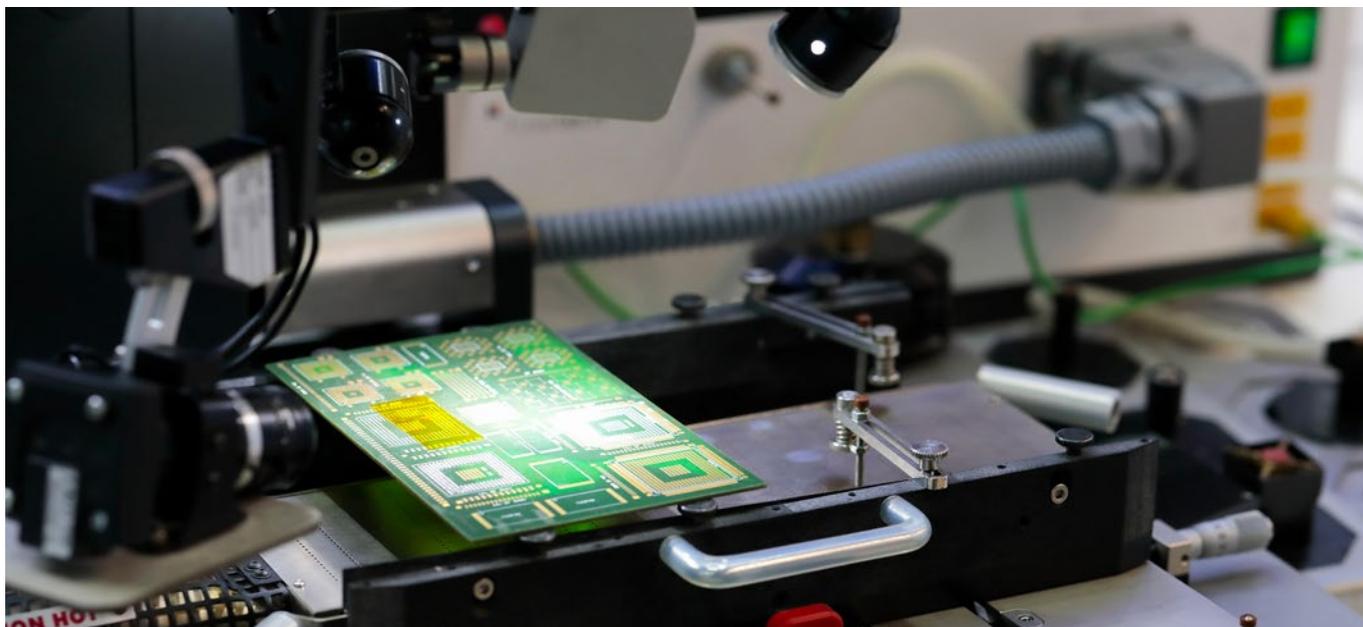
Over seven years ago, I put pen to paper to enumerate the top challenges needing to be overcome for a successful BGA rework. With the continued advancement of BGA technology, it's time to apply a fresh coat of paint to that list. Read on to find out my revised take on today's top BGA rework challenges (in no particular order).

Challenge #1: Very Large BGAs

As devices become more complex and computing power requirements increase, the maximum physical size of BGA packages has continued to increase. Currently, some devices in development are planned to be 125 mm x 125 mm in size. These large package sizes present some very challenging scenarios for rework process technicians.

Today, the placement systems for such large packages are limited by the split vision prism systems that align the components during placement. To successfully handle such large packages, BGA rework equipment vision systems will need to be upgraded.

Bottom heaters, which ensure that the board onto which the package is placed is uniformly heated, need to be upgraded to handle these large component package sizes. Undersized underside heating sources may cause an inconsistent temperature gradient from the top of the component to the underlying area, thereby sending different areas of the component into reflow at different times. This results in component balls that are stretched or elongated; "cold peels" due to improper temperature profiles can also damage BGA pads on the board.





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Maintaining a consistent temperature over the entire component surface area presents another challenge in reworking these large packages. Air flow turbulence in the hot air rework nozzles can make it difficult to maintain a consistent reflow temperature coming out of the nozzle, which limits its ability to uniformly reflow and remove these large packages. Similarly, many commercially available IR rework systems do not have a spot size which can cover the entire size of these packages heat the component uniformly.

Custom-machined board supports for these larger packages, stay-in-place stencils to open the process window through solder paste printing, and a thorough understanding of proper thermal profiling can all be used to allow older machines to accommodate these larger packages—albeit only to a certain extent.

Challenge #2: Neighboring Device Damage

Components in and around the rework area can be damaged during the rework process, as the heat sources typically used—both IR and hot air—can thermally damage neighboring components. Nearby components such as aluminum, tantalum and ceramic capacitors, crystals, oscillators, plastic-bodied components, and others need to be properly thermally shielded. LEDs and cameras can also be damaged at reflow temperatures.

Not only can these neighboring components be damaged when exposed to heat, they can also be sent into reflow if heating areas and temperature cycles are improperly controlled. This can cause heavier components to fall off the underside of the PCB during BGA rework. Furthermore, when solder is reflowed, the intermetallic formed in the solder fillet can grow, causing the component to form a weaker mechanical bond to the PCB.

With the use of the proper thermal shielding materials, these problems can be avoided¹. Newer materials are now available to help protect components from both damage and reach-

ing reflow temperatures. Thermal shielding materials such as water-absorbing cool gels, as well as ceramic non-wovens, are the most effective thermal shields.

Challenge #3: Underfilled BGA Rework

Underfill has made its way into a variety of industries, including automotive, military, and aerospace applications. Underfill boosts the reliability of the component, which is subject to mechanical impacts and shocks by distributing the forces. Thermal stresses caused by the coefficient of thermal expansion mismatch between the component and the PCB are also lessened by using underfill. However, the proliferation of underfills has increased the need for solutions to underfill component rework. With underfill usage expected to grow over 5% per year through the next five years, finding appropriate solutions for underfill component rework issues will remain challenging².

BGA rework locations neighboring the same or opposite side of the PCB can be damaged during the rework process. Since the underfill softens before reaching the solder's liquidus temperature, underfills near the rework location can “push out” solder from its desired location, thereby creating soldering anomalies such as shorts or other soldering defects.

Another major rework challenge is breaking the BGA free from the underfill during the

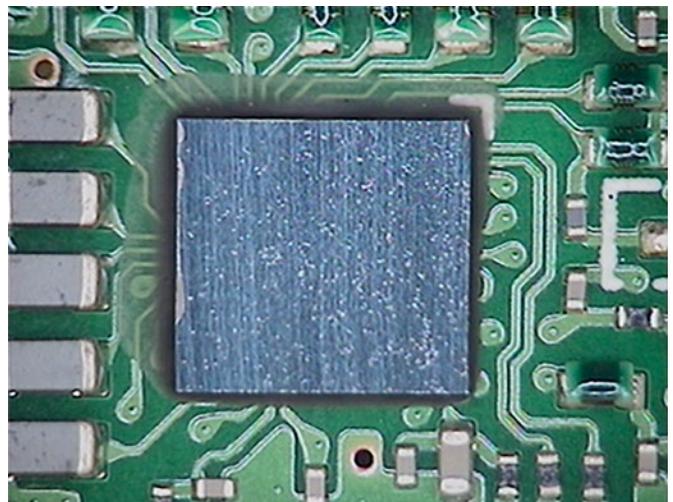
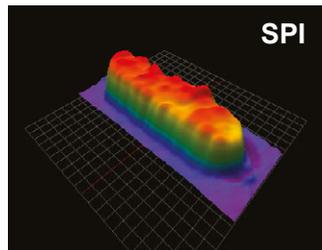
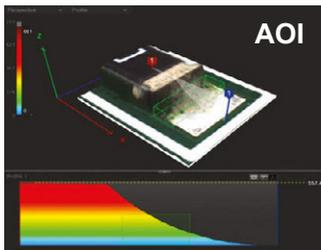


Figure 1: An underfilled BGA.



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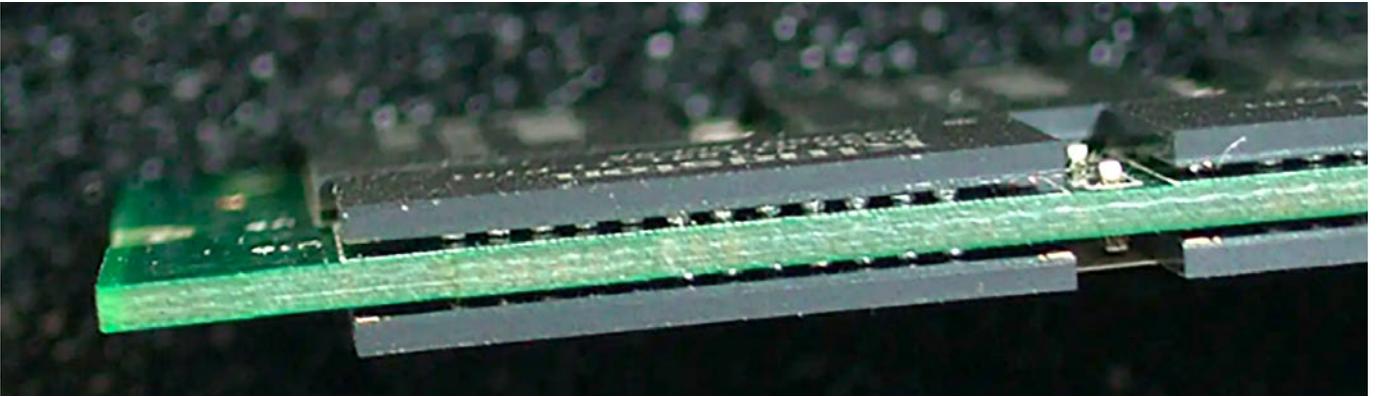


Figure 2: Example of mirrored BGAs.

component removal process. During reflow, the tack of the underfill holds the BGA tightly to the PCB. Removing the BGA requires the rework technician to either “cut through” the underfill using a knife or to use specially designed nozzles to pull the BGA off the board. Either of these operations can result in damage to the PCB pads or solder mask. Once the BGA has been removed, this underfill material, as well as the remnant solder, needs to be manually cleaned from the board. This labor-intensive process is necessary to ensure that the site is adequately cleaned prior to replacement of the BGA.

Newer methods such as cold removal using a highly controlled milling process or laser ablation of the component can overcome some of these rework challenges. These advanced methods, while faster and repeatable, require both capital and higher-end programming and processing skills on the part of the rework supplier.

Challenge #4: Mirrored BGAs

When BGAs are placed “back-to-back” directly opposite one another on both sides of a double-sided PCB, the configuration is known as “mirroring” (Figure 2). This is a continuing challenge in BGA rework as board densities increase. In BGA rework, it is necessary to preheat the PCB from the opposite side of where the BGA is to be removed and replaced. This necessitates heating the BGA underneath the rework location causing the underside BGA to be exposed to a minimum of 125°C. In

addition, this causes the underside BGA to be exposed to a longer duration heat cycle, which increases the potential for damaging or warping the BGA. It may also cause the underside component to go into reflow resulting in soldering anomalies and solder joint embrittlement. Another danger is the potential for larger more massive BGA components to “fall off” the oppositely located BGAs as the surface tension may no longer be able to overcome gravity, which is pulling down on the component.

Summary

The challenges for BGA rework will continue to evolve. Large BGA packages, BGAs in close proximity to neighboring devices, underfilled BGAs, and mirrored BGAs currently present the greatest challenges in BGA rework today. **SMT007**

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1. “Shielding Effectiveness of Polyimide Tape During Rework,” by Adam Gaynor and Bob Wettermann, *Circuits Assembly Magazine*, Oct. 1, 2014.
2. “Electronic Board Level Underfill Material Market,” by Future Market Insights Global Consulting, 2022.



Bob Wettermann is the principal of BEST Inc., a contract rework and repair facility in Chicago. For more information, contact info@solder.net. To read past columns, [click here](#).



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After the Show: Share What You've Learned

Feature Interview by Nolan Johnson

I-CONNECT007

You've just attended a trade show, spending time in conference classes, seeing some new ideas that you think could help your company. What's your next step? I asked IPC design instructor Kris Moyer to share his thoughts, and he explained how to best share your new-found information, convince management to adopt what you've learned, and build on this momentum.

Nolan Johnson: Kris, staff members have attended conference classes at the trade show, learned some new techniques and processes, so what's next?

Kris Moyer: It's simple: You present and disseminate it to your co-workers. First, the individual who learned that technique at the trade show

might have a small get-together with senior design engineers and say, "Here's what I saw. This is my understanding of it. Does this look like something that would be useful to us?"

Then you have a working lunch. Maybe you contact the company or the individual who presented the new information, and see about bringing them in as a consultant to teach the technique to your company. In some bigger companies, management may have to approve in-house training. But a lot of times you just go to the show, get the information, bring it back, and you disseminate it.

Johnson: I'm sure it would help to have a prep meeting with management before the show so you could set expectations about what to look for and pay attention to.

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Moyer: Exactly. Have a prep meeting with your manager before the show. I worked with a fairly large company once, and they basically said, “As soon as you get back, give us a write-up of what you saw, and what you thought would be beneficial to the company.” Then management would have their own meeting and hopefully say, “Oh yeah, this does sound cool; we want more information on this kind of thing.”

But sometimes, the information may not be as applicable to your company as you thought. You think, “This is really more for a fabricator. They would be more interested in this than we are. I’ll talk to my fabricator about it, but it’s not really something I need to analyze now.”

Johnson: Exactly. Let’s say you’re a designer and you’ve been speaking about the design side. Compare and contrast how this works on the manufacturing side. How does the process differ?

Moyer: On the fabrication side of things, as well as for assembly companies, materials providers, and so on, it’s really the same.

Maybe you learned a newer technique for calculating the intermetallic bond strength of ENIG, or gold bond. Maybe you took a course on reduction of glass fracturing during the lamination process. Whatever you learned, present it.

If the course you took is a fit for your niche, you just take it back to your company. After that, you might consider online courses on this topic, or bring the presenter in as a consultant to give you more hands-on specifics for manufacturers.

Johnson: Now, you may have junior-level people who are going back home and presenting this content to managers two or three levels higher at their company, trying to convince them to adopt this new technique or process. How does one handle that?



Kris Moyer

Moyer: Junior-level people usually have a little bit more of an uphill battle convincing management. But overall, even with them, it’s been my experience that as long as they can demonstrate how this process would be beneficial to the company, most managers are pretty good about paying attention, depending on what you’re asking for. Does this new process reduce the number of respins? Maybe management doesn’t want you to take four months off to take a college course, but they would be more than happy to have you come in and take in-house training or online classes.

One of the things I’ve heard from every company I’ve ever worked with: The junior-level people come in and say, “I saw this cool, new thing!” You have to get past the “new and cool” and provide a technical rationale for why this is beneficial. It can’t be just because it’s new and cool.

Johnson: Thanks for your time, Kris.

Moyer: I enjoyed it. Thank you. SMT007



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Slow and Steady Is Still Progress

Maggie Benson's Journey

by Dr. Ronald C. Lasky, INDIUM CORPORATION

Editor's note: Indium Corporation's Ron Lasky continues this series of columns about Maggie Benson, a fictional character, to demonstrate continuous improvement and education in SMT assembly.

We continue to look in on Andy Connors, Sue March, and Chuck Tower at Castellanos Electronics after Maggie and John's decision to buy the company. Sue is working on minimizing defects that have been categorized in a Pareto chart¹, whereas Andy is working on a training program to develop some process engineers, and Chuck is performing an audit to identify and improve uptime and profitability.

Chuck has called a meeting with Andy and Sue to assess their progress.

"Well, the audit I performed went quite well," Chuck began. "As

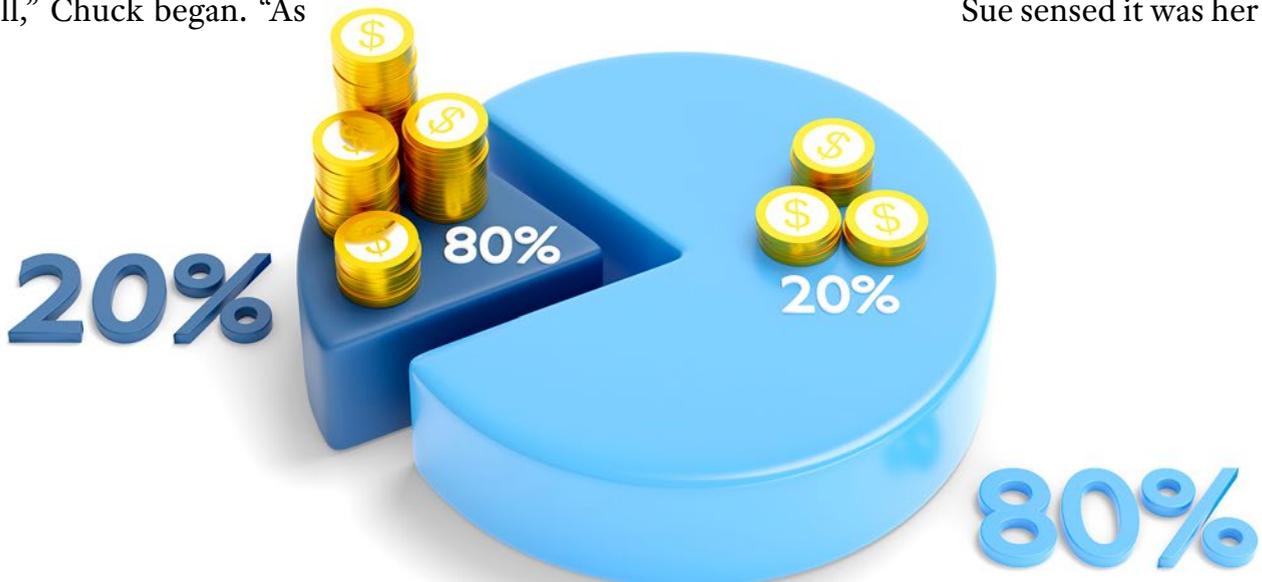
we thought, there are possible improvements in uptime. I'm also suggesting a different solder paste, as the one they have has poor response-to-pause²."

"It always surprises me that there are people who choose to use a paste that hurts uptime and yields just to save a few pennies per gram," Andy commented.

"Yeah, then they lose tens of thousands of dollars in productivity and yields," Chuck said. "So that's something to address. I have to admit, though, that as José and I worked on developing an action plan to improve other aspects of the processes, I was quite impressed with their starting point. Unfortunately, I'm going home tomorrow, so Andy, could you work with José on the action plan?"

"Sure thing, boss!" Andy replied jokingly.

Sue sensed it was her turn





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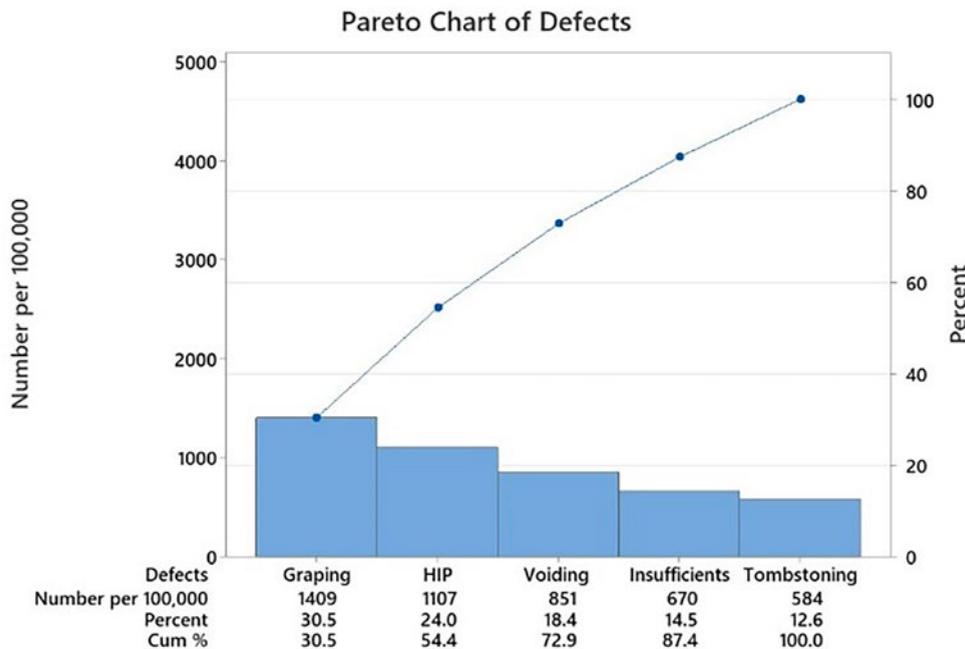


Figure 1: A Pareto chart of the defects at Castellanos Electronics.

to share. “Well, Carlos and I developed a Pareto chart of the defects (Figure 1). We started working on the graping issue first. They were using circular apertures for BGAs, so I recommended switching to square apertures. Fortunately, their stencil vendor is in town, so they got new stencils and we already have quite a bit of data. It looks like the square apertures have significantly reduced graping, but I don’t know the details yet. Next, we are going to work on the head-in-pillow (HIP) defect.”

Satisfied with Sue’s progress, Chuck then turned to Andy and asked, “What about the training plan to help some of the workers become process engineers?”

“José identified four potential candidates,” he replied. “After discussing it, we think the people should become SMTA-certified process engineers³. They will need a lot of preparation, so I am developing a workshop using the *Handbook of Electronic Assembly* (Figure 2)⁴. I plan to give them a lot of exercises to improve their

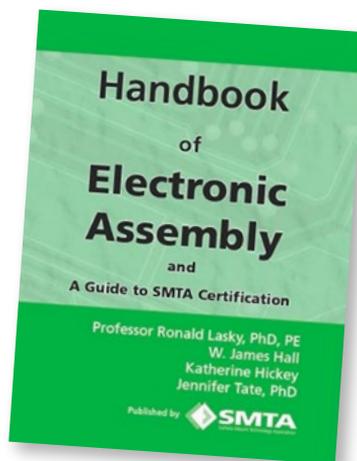


Figure 2: The book Andy is using for the SMTA certification preparation classes.

confidence. This teaching project and the process improvement action plan will keep me busy for the rest of the time Sue and I are here.”

“Sue, I can see you have your hands full working through the defects identified in the Pareto chart,” Chuck said, and with that, the meeting was over. Sue decided to tackle her project right away, so she went to find Carlos to start working on reducing HIP defects.

“Carlos, let’s find Miguel and discuss

a plan to reduce HIP defects,” Sue said. José had appointed Miguel to be the point person on working on defect minimization. They soon found him and got to work.

“Señorita Sue, can you tell us what typically causes the HIP defect?” Miguel asked.

“Absolutely,” Sue said. “The basic failure mechanism occurs in predominantly ball grid array packages. During the assembly process, as the circuit board and ball grid array go through the reflow oven, they can often move relative to each other because of thermal warping of the circuit board and ball grid array package. Sometimes, they’ll separate during the reflow process: the solder paste will reflow separately from the ball and a solder connection will not be formed.” (Figure 3).

“So, what can we do to minimize HIP defects?” Miguel asked.

“We want to assure that we have a nice, tall stencil-printed solder paste deposit so that we’re getting good definition in our printing



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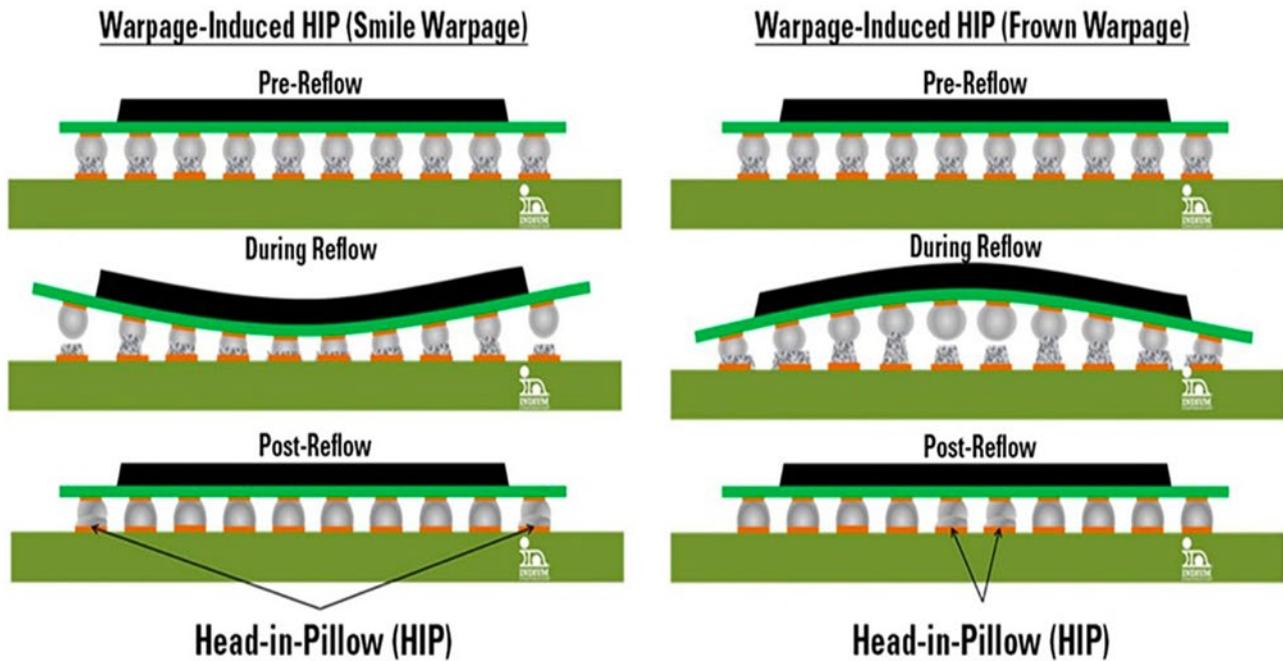


Figure 3: The mechanism of the head-in-pillow defect.

rather than having hot slump during reflow, which can also be an issue,” Sue said. “We want to make sure that the pick-and-place machine is placing the ball squarely on the pad, not off to the side. It helps to have a solder paste that has a little stringiness to it, so that if the circuit board pad and solder ball do separate, the solder paste will still stick them back together. In these types of situations, an “oxidation barrier” in the solder paste helps in the reflow process, too. The new solder paste that we will be buying to reduce response-to-pause issues also has good HIP resistance. So, that should help a lot.”

“Will the new square apertures also help?” Carlos asked.

“That’s a good point. Having more solder paste in the print is definitely a good thing,” Sue answered.

“Miguel, can you check the printing to make sure we don’t have hot slump, and that the placement machines are placing the BGAs squarely?” Sue asked, as he replied, “Sí, señorita Sue.”

As they were wrapping up, Sue asked, “Carlos, do we have any data on graping since we switched to square apertures?”

“Sí, señorita Sue, graping defects are down by 95%,” Carlos answered.

“Terrific,” said Sue and Miguel in unison.

At the end of the meeting, Sue gave each man a chaste hug. They both turned red and looked like they might swoon...

Will the HIP decrease? What will Andy teach in his SMTA certification preparation classes? Will you be able to answer some of Andy’s quiz questions? Stay tuned to find out. **SMT007**

References

1. “Pareto chart,” Wikipedia.org, Sept. 17, 2022.
2. “Response to Pause: A Critical Solder Paste Parameter,” by Ron Lasky, Indium Corporation, Indium.com, Aug. 21, 2019.
3. “SMTA: Certification,” SMTA.org.
4. *Handbook of Electronic Assembly and A Guide to SMTA Certification*, by Ron Lasky et. al, SMTA Publishing.



Ronald C. Lasky is an instructional professor of engineering for the Thayer School of Engineering at Dartmouth College, and senior technologist at Indium Corporation. To read past columns, [click here](#).



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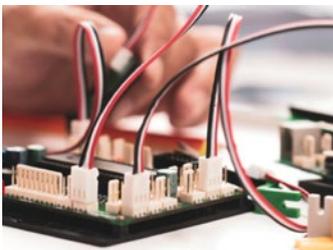


IPC Education Foundation Announces New Website Launch

The electronics manufacturing industry offers a wide range of career opportunities for all levels of education and experience. To make career searches easier, the IPC Education Foundation (IPCEF) launched a new, industry-focused career website www.careersinelectronics.com.

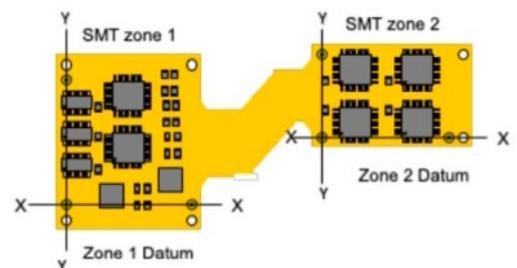
STEM Program: Evolving and Growing

IPC has a responsibility to its current members but also in attracting and retaining new talent to the electronics manufacturing industry. This is no more evident than in the STEM event hosted by the IPC Education Foundation at IPC APEX EXPO.



Designers Notebook: Flexible Circuits for In-line SMT Assembly Processing

To maximize robotic assembly efficiency and increase throughput of the flexible circuit the circuit design engineer will need to provide a format that includes all features required for in-line assembly processing.



Blackfox Training Institute Officially Expanding Into Minnesota With a New Training Center

Blackfox Training Institute reports that it officially expands its electronics manufacturing training and certification services to a third location in the United States with a new facility in the Minneapolis/St. Paul region of Minnesota. Headquartered in Longmont, Colorado, Blackfox now has a total of seven worldwide Training Centers.



Smart Factory Insights: An Unblinkered View

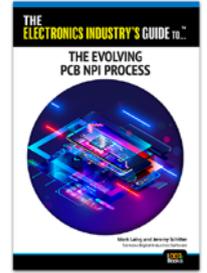


For many, blindly going where no one has gone before is just a normal day in the factory.

As new products are introduced, manufacturing is expected to provide perfect products based primarily on assumptions and reverse engineering.

Book Excerpt: 'The Electronics Industry's Guide to... The Evolving PCB NPI', Chapter 3

With the need to move design data efficiently into manufacturing for assembly and test purposes, starting from a single source of intelligent data seems to be obvious. However, with different applications with different capabilities this can be difficult to achieve. Real-world support for any format can vary between machine and software vendors.



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Nolan's Notes: Advanced Packaging

Over the past two years, we've written about the heterogenous integration roadmap, as well as reported on the October 2022 IPC Advanced Packaging Symposium in Washington, D.C.



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4. Provide consultative sales solutions to customer's technical issues
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6. Conduct technical audits
7. Conduct product evaluations

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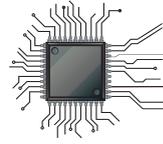


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Qualifications and skills

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- Background in electronics manufacturing
- Soldering and/or electronics/cable assembly experience
- IPC certification a plus, but will certify the right candidate

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American Standard Circuits
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CAD/CAM Engineer

Summary of Functions

The CAD/CAM engineer is responsible for reviewing customer supplied data and drawings, performing design rule checks and creating manufacturing data, programs, and tools required for the manufacture of PCB.

Essential Duties and Responsibilities

- Import customer data into various CAM systems.
- Perform design rule checks and edit data to comply with manufacturing guidelines.
- Create array configurations, route, and test programs, penalization and output data for production use.
- Work with process engineers to evaluate and provide strategy for advanced processing as needed.
- Itemize and correspond to design issues with customers.
- Other duties as assigned.

Organizational Relationship

Reports to the engineering manager. Coordinates activities with all departments, especially manufacturing.

Qualifications

- A college degree or 5 years' experience is required. Good communication skills and the ability to work well with people is essential.
- Printed circuit board manufacturing knowledge.
- Experience using CAM tooling software, Orbotech GenFlex®.

Physical Demands

Ability to communicate verbally with management and coworkers is crucial. Regular use of the telephone and e-mail for communication is essential. Sitting for extended periods is common. Hearing and vision within normal ranges is helpful for normal conversations, to receive ordinary information and to prepare documents.

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Career Opportunities



U.S. CIRCUIT

Plating Supervisor

Escondido, California-based PCB fabricator U.S. Circuit is now hiring for the position of plating supervisor. Candidate must have a minimum of five years' experience working in a wet process environment. Must have good communication skills, bilingual is a plus. Must have working knowledge of a plating lab and hands-on experience running an electrolytic plating line. Responsibilities include, but are not limited to, scheduling work, enforcing safety rules, scheduling/maintaining equipment and maintenance of records.

Competitive benefits package.

Pay will be commensurate with experience.

Mail to:
mfariba@uscircuit.com

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APCT, Printed Circuit Board Solutions: Opportunities Await

APCT, a leading manufacturer of printed circuit boards, has experienced rapid growth over the past year and has multiple opportunities for highly skilled individuals looking to join a progressive and growing company. APCT is always eager to speak with professionals who understand the value of hard work, quality craftsmanship, and being part of a culture that not only serves the customer but one another.

APCT currently has opportunities in Santa Clara, CA; Orange County, CA; Anaheim, CA; Wallingford, CT; and Austin, TX. Positions available range from manufacturing to quality control, sales, and finance.

We invite you to read about APCT at APCT.com and encourage you to understand our core values of passion, commitment, and trust. If you can embrace these principles and what they entail, then you may be a great match to join our team! Peruse the opportunities by clicking the link below.

Thank you, and we look forward to hearing from you soon.

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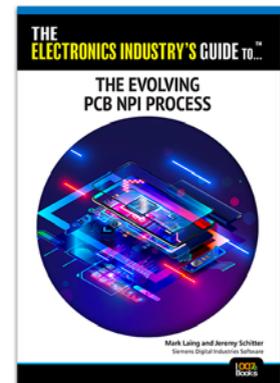
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The Electronics Industry's Guide to... The Evolving PCB NPI Process

by Mark Laing and Jeremy Schitter, Siemens Digital Industries Software

In this book, the authors look at how market changes in the past 15 years, plus the slowdown of production and delivery of materials and components in recent years, have affected the process for new product introduction (NPI) in the global marketplace. As a result, we feel that PCB production companies need to adapt and take a new direction to navigate and thrive in an uncertain and rapidly evolving future.



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Books

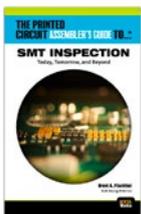
The Printed Circuit Assembler's Guide to...



Solder Defects

by Christopher Nash and Dr. Ronald C. Lasky, Indium Corporation

This book is specifically dedicated to educating the printed circuit board assembly sector and serves as a valuable resource for people seeking the most relevant information available.



SMT Inspection: Today, Tomorrow, and Beyond

by Brent Fischthal, Koh Young America

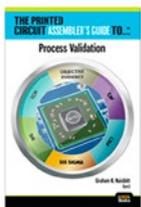
An in-depth insight into new and exciting true 3D inspection technology is provided in this book, along with a look into the future of leveraging big data management and autonomous manufacturing for a smarter factory.



Smart Data: Using Data to Improve Manufacturing

by Sagi Reuven and Zac Elliott, Siemens Digital Industries Software

Manufacturers need to ensure their factory operations work properly, but analyzing data is simply not enough. Companies must take efficiency and waste-reduction efforts to the next phase using big data and advanced analytics to diagnose and correct process flaws.



Process Validation

by Graham K. Naisbitt, Gen3

This book explores how establishing acceptable electrochemical reliability can be achieved by using both CAF and SIR testing. This is a must-read for those in the industry who are concerned about ECM and want to adopt a better and more rigorous approach to ensuring electrochemical reliability.



Advanced Manufacturing in the Digital Age

by Oren Manor, Siemens Digital Industries Software

A must-read for anyone looking for a holistic, systematic approach to leverage new and emerging technologies. The benefits are clear: fewer machine failures, reduced scrap and downtime issues, and improved throughput and productivity.

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PUBLISHER: BARRY MATTIES

barry@iconnect007.com

MANAGING EDITOR: NOLAN JOHNSON

(503) 597-8037; nolan@iconnect007.com

ASSOCIATE EDITOR: MICHELLE TE

michelle@iconnect007.com

TECHNICAL EDITOR: PETE STARKEY

+44 (0) 1455 293333; pete@iconnect007.com

TECHNICAL EDITOR: PATTY GOLDMAN

CONTRIBUTING TECHNICAL EDITOR: HAPPY HOLDEN

(616) 741-9213; happy@iconnect007.com

CONTRIBUTING TECHNICAL EDITOR: DAN FEINBERG

baer@iconnect007.com

SALES MANAGER: BARB HOCKADAY

(916) 365-1727; barb@iconnect007.com

MARKETING SERVICES: TOBEY MARSICOVETERE

(916) 266-9160; tobey@iconnect007.com

PRODUCTION MANAGER: SHELLY STEIN

shelly@iconnect007.com

MAGAZINE LAYOUT: RON MEOGROSSI

AD DESIGN: SHELLY STEIN, MIKE RADOGNA,

TOBEY MARSICOVETERE

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