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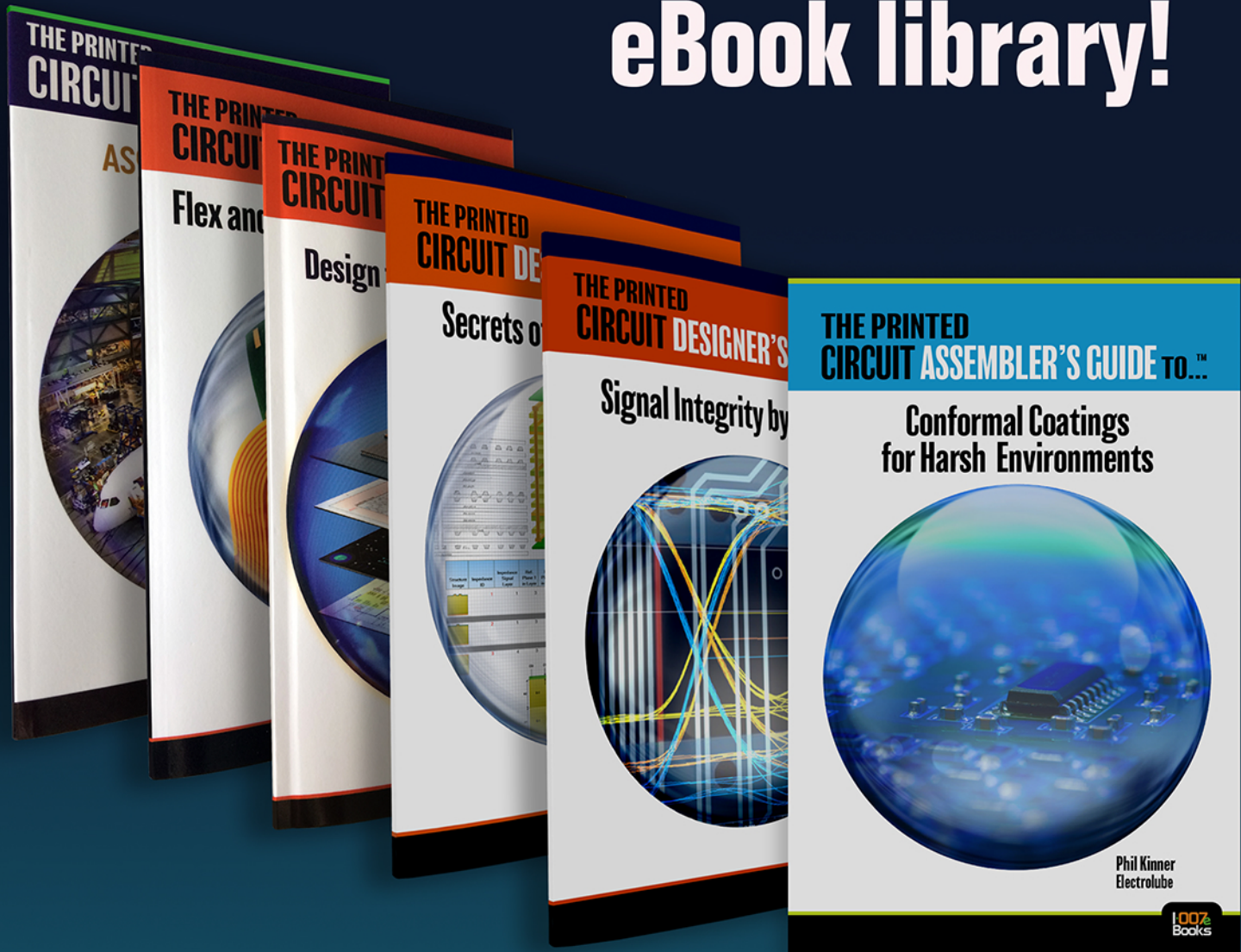
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Judy Warner

Director of community engagement, Altium

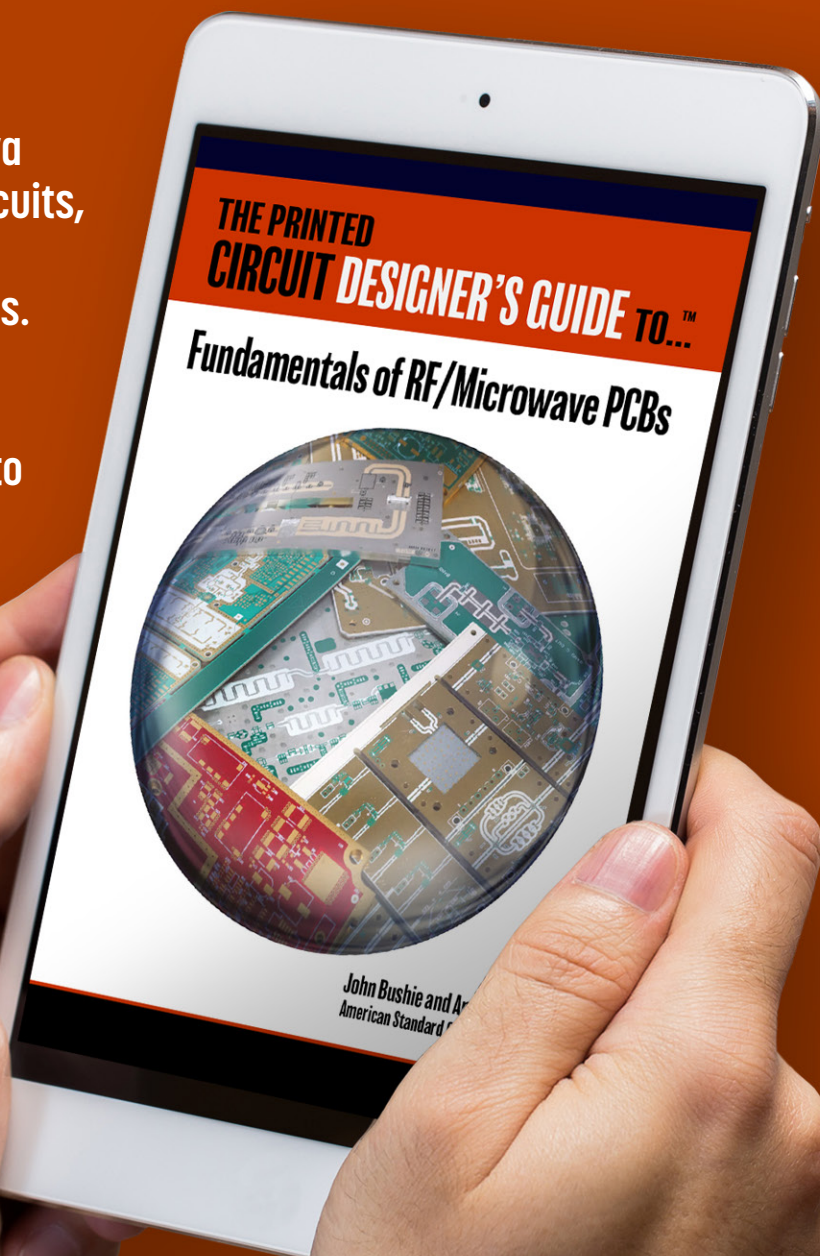
Written by John Bushie and Anaya Vardya of American Standard Circuits, this book describes the unique challenges of RF/microwave PCBs.

Readers will gain a better understanding of issues related to the design and manufacture of these devices from a fabricator's perspective.



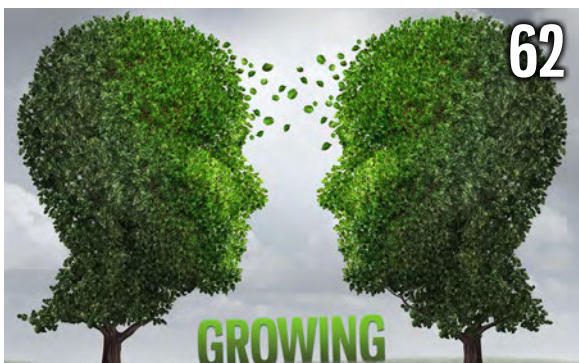
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Communicating with Your Customers

Working closely with your customers is critical, now more than ever. Nothing is more reassuring to customers than your willingness to listen and communicate with them in whatever water they are swimming in.

This month's issue of *SMT007 Magazine* highlights the challenges of the customer-supplier relationship, the feedback that matters, and how electronics assemblers ensure 100% customer satisfaction.

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by Andy Shaughnessy, Patty Goldman, and Stephen Las Marias

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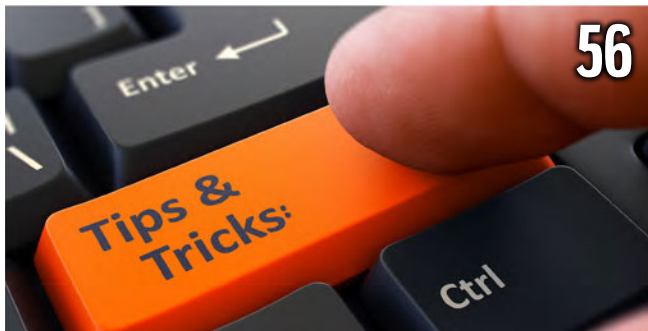


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Talk to Your Customers

Editor's Note

by Stephen Las Marias, I-CONNECT007

Whatever industry we are in, we are a customer and a supplier at the same time. For instance, my suppliers are the technical article contributors, as well as those experts who speak with me about critical challenges in electronics assembly and provide their insights on strategies that would help manufacturers address these issues. (Well, they are supplying me with their insights.) Down the chain, my customers are our production guys—those who lay out the articles in a nice, clean, continuous format that will eventually become the *SMT007 Magazine*. (Speaking of which, I hope you're enjoying the fresh new look of our publications here at I-Connect007.)

Of course, the goal is always 100% customer satisfaction—and the majority of the respondents in our recent survey agree. Interestingly, some say more than 90% is fine, while one says his company is striving for 98%.

Be that as it may, dissatisfaction in your customer side will eventually result in problems. According to the results of our survey, the loss of business and reputation can be the consequences of not meeting your customers' needs.

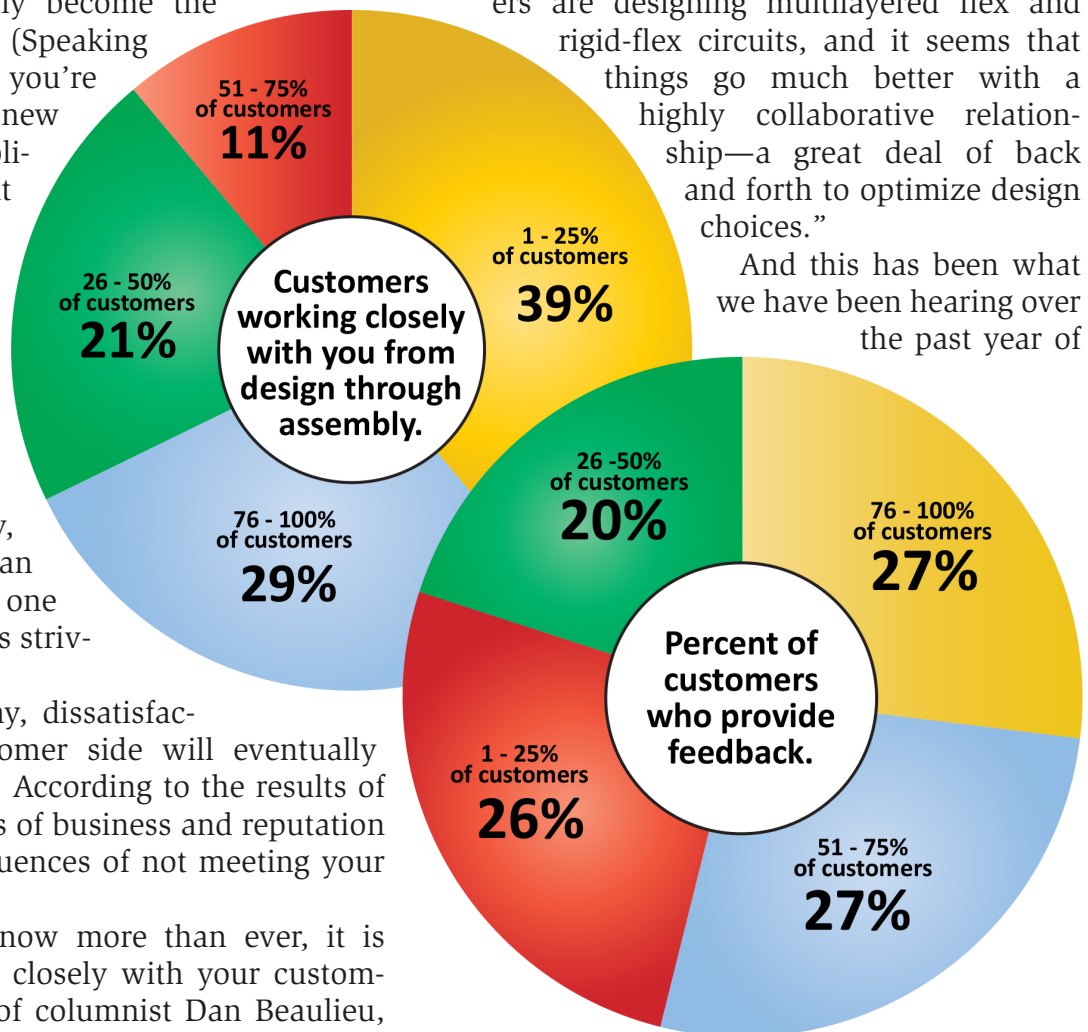
Which is why, now more than ever, it is important to work closely with your customers. In the words of columnist Dan Beaulieu, "When you start dealing with companies that

are literally building products that the world has never seen, including circuit boards with technology that the world has never seen, it's time that somebody talks to somebody."

Even though you have trusted supplier partners, working closely with them will ensure seamless manufacture and high-quality output. And most of our respondents agree, with more than a third or 40% closely working with at least 50% of their customers.

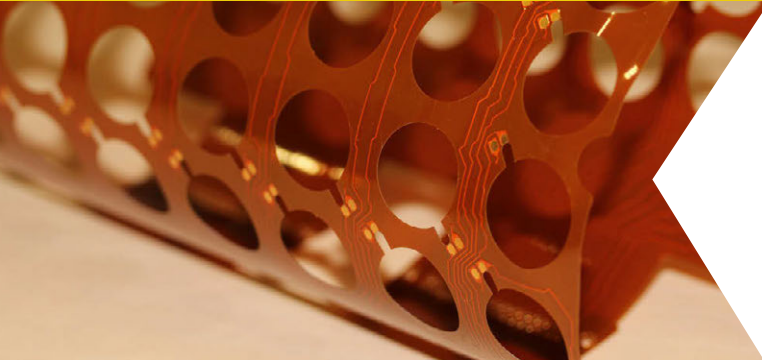
One respondent commented, "Our customers are designing multilayered flex and rigid-flex circuits, and it seems that things go much better with a highly collaborative relationship—a great deal of back and forth to optimize design choices."

And this has been what we have been hearing over the past year of



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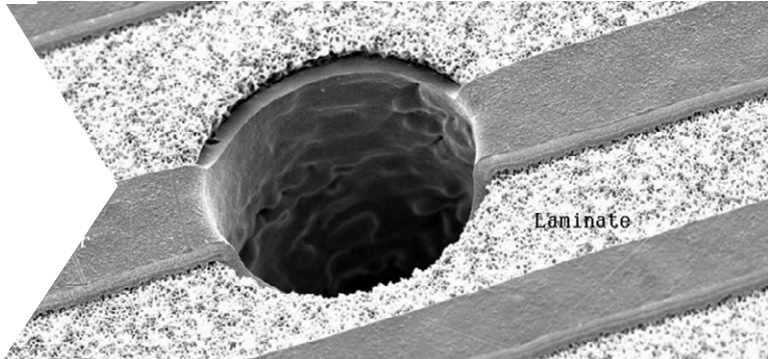
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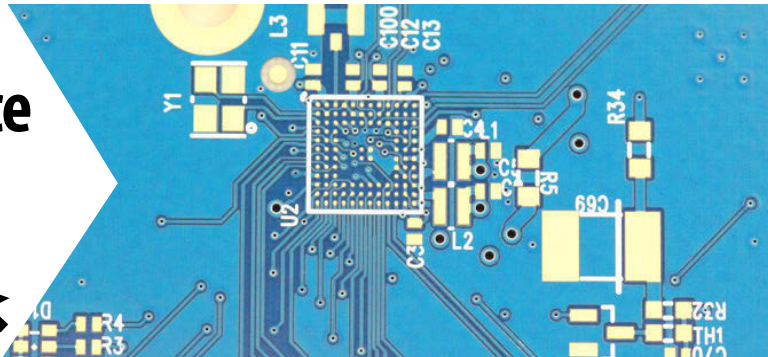
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speaking with experts in our industry—communication. Working together—whether you’re in the design, fabrication, or assembly industry. In fact, a few of our respondents say communication is among the top important attributes for customer service. Other key attributes include fast response, quality, transparency, and caring about the customers’ needs.

Speaking of caring about those needs, respondents in our survey say they are all in when it comes to ensuring customer satisfaction. Cross-functional resources are being channeled to ensure their customers’ needs are being attended to.

One respondent said, “Our entire quality department is constantly working on improving our customer satisfaction. Our office staff works hard on the front end to make sure our customers are happy and comfortable.”

Another one said it is an ongoing process, adding that all sales personnel should have the vision to respond to clients quickly on their quotes and follow up quickly if there is a quality issue in the order. He said it takes the sales team, the technical team, as well as the logistics team working together to ship out quality products on time, to reach 100% customer satisfaction.

And how do they know they are doing a good job? Through feedback. And what is the most important feedback they could get? Repeat orders and being included in their customers’ future design-ins.

But of course, one respondent said any feedback is good feedback, whether it is good or bad. “If we are told how we are doing, we can improve—and we are always looking to improve ourselves. The problem is, customers do not give us feedback,” he said.

In our survey, a quarter of the respondents echo the same sentiment, saying that only 25% of their customers provide them with feedbacks. They even noted that customers only give feedback when it is negative.

Thus, the need for communications in the supply chain. This ensures that wherever the

product is—be it in the design stage, fabrication, or assembly—everyone knows what’s happening in the process right now. Of course, there are already systems, including traceability, that provide visibility on the factory floor. But more often than not, the human touch, the human aspect of it—the physical presence of the customer or supplier in

the factory—can build stronger collaboration and higher-quality production outputs.

Which brings me to this month’s issue of *SMT007 Magazine*. We have Dan Beaulieu; Nolan Johnson of Sunstone Circuits; industry veteran Steve Williams; Chrys Shea; Greg Hebson of EMS firm

Vexos; and Edward Hughes of Aculon, who provided their take on knowing your customers and ensuring customer satisfaction.

Ken Horky of Peterson Manufacturing, meanwhile, provided his tips and tricks when dealing with machine assist time.

We also have a case study about Rauland-Borg, a division of AMETEK Inc. and an integrated communications technology company, on how it was able to reduce its SMT-related defects by 50%, increase throughput by over 20%, and save \$1 million per year for its three SMT lines.

This month, we will again be at the IPC APEX Expo 2018 event in San Diego, California. (If you haven’t yet, please check out our [Pre-Show Coverage](#) of the IPC APEX Expo in the January 2018 issue of *SMT007 Magazine* to have an idea on exciting things to expect and developments to be announced at this year’s show.)

Please do drop by our booth to say hi or for a short interview. I look forward to seeing you at the event! **SMT007**

“Our office staff works hard on the front end to make sure our customers are happy and comfortable.”

-Survey Respondent

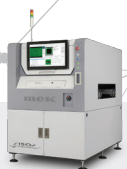


Stephen Las Marias is managing editor of *SMT007 Magazine*. He has been a technology editor for more than 14 years covering electronics, components, and industrial automation systems.

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New Year Resolutions and Best Wishes

SMT Prospects & Perspectives

by Dr. Jennie S. Hwang, CEO, H-TECHNOLOGIES GROUP

Happy New Year to all! I hope each of us, whether or not we resolve to do something new in the New Year, will have a fantastic 2018! As the New Year is moving ahead, some of us are accustomed to thinking about new goals, personally or professionally, and resolving to achieve them.

This custom of New Year's resolutions, according to *The Economist*, dates to the Babylonian festival of Akitu, which occurred around 2000 B.C., and celebrated the renewal of life. It marked the beginning of the agrarian year. During Akitu, people keen to curry favors with the Gods would promise to repay their debts and to return borrowed objects they had in their possession. Since then, individuals and groups from various cultures have resolved to renew allegiances or set new goals each New Year. According to polls, around half the population of Britain and America make resolutions—though fewer than 10% keep them. Well, with that, are you in that 50% and then the subsequent 10%?

In the context of New Year's resolutions, I particularly appreciated some wise words from

The Wall Street Journal's column (December 30-31, 2017) entitled, "Set the Bar High for Your 2018 Resolutions." "Listening to what someone else is saying without hearing what you already think is one of the hardest challenges for human mind. When you listen, listen as if your life depends on it. Otherwise, you will just hear your own words coming out of someone else's mouth."

These words couldn't be truer! I wholeheartedly concur. The article refreshes and energizes the mind, as well as offers some humble tonic—a good start of a new year!

A book on the same topic, *When: The Scientific Secrets of Perfect Timing*, is also thought-provoking. It explains how we can keep our New Year's resolutions to be healthier, happier and more productive. New research on timing can help, from when to exercise to the best time to do focused work.

Timing is really a science. Researchers in various fields have been unearthing the hidden science of timing. In randomized controlled experiments, field studies, and the analysis of massive data sets, the select questions that



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span the human experience are explored (e.g., how do beginnings, midpoints and endings alter our actions and memories?). Time, the studies have discovered, shapes our productivity, health and well-being in powerful but often invisible ways. From big data analyses of 500 million tweets, research has shown that we generally experience the day in three acts: a peak, a trough and a rebound. Most of us experience the pattern in that order. But roughly one in five of us are night owls and tend to proceed in reverse order. The study illustrates the scientific measures of the effect of the time of day on human brain power, in turn the brain performance and productivity.

Indeed, as life is finite, time is of the essence; productivity is a key to life.

Indeed, as life is finite, time is of the essence; productivity is a key to life.

The New Year stands before us, like a chapter in a book, waiting to be written. We can help write that story by setting goals. We are the authors of our destinies. Among the many and diverse New Year's resolutions, the most popular one, "lose weight," is statistically way up on the top. I found the most interesting and pragmatic ones included in the book were: save money, exercise, learn something new, get organized, spice up the mundane, develop a positive approach to life, terminate the tantrums, enrich vocabulary, be sincere about punctuality and commitments, live each day with zest, grow empathy, work towards a goal, own your mistakes, lend your successes, celebrate successes, and call you mom!

As the goals are set, the true challenge is to keep these goals from falling into a wish list and to know how to stick to those goals and when. I hope that in this year to come, goals give us direction in whatever we do, be it on AI, 5G, mixed reality and quantum computing or the next chip design.

My New Year greetings and best wishes to all:

May the New Year see you in the best of health as the old saying goes, "Health is the best wealth that a person can have."

For you who are recently affiliated with new ventures, I wish you an ever-growing and profitable business.

For you who are associated with established enterprises, I wish you the accomplishment of personal and organizational goals.

For you who are seeking new challenging opportunities, I wish the road may rise to meet you.

For you who have family illness or discomfort, I send you get-well thoughts and prayers.

For you who have joyful family news, accept my congratulations and good wishes.

For all who are broadening their horizons, I wish your vista remains ever-bright, wonderful and rewarding in 2018. SMT007



Dr. Hwang, an international businesswoman, international speaker, and business and technology advisor, is a pioneer and long-standing contributor to SMT manufacturing since its inception

as well as to the global lead-free electronics implementation. Among her many awards/honors are induction into the International Hall of Fame-Women in Technology and National Academy of Engineering, an R&D-Stars-to-Watch and YWCA Achievement Award. Having held senior executive positions with Lockheed Martin Corp., and others, she is CEO of H-Technologies Group and serves as Chairman of Assessment Board of DoD Army Research Laboratory, Commerce Department's Export Council, National Materials and Manufacturing Board, Board of DoD Army Science & Technology, Assessment Board of NIST, various national panels/committees, international leadership positions, and the board of Fortune-500 NYSE companies and civic and university boards. Author of 500+ publications and several books, and a speaker and author on trade, business, education, and social issues. Her formal education includes four academic degrees as well as Harvard Business School Executive Program and Columbia University Corporate Governance Program. Further info: www.JennieHwang.com.

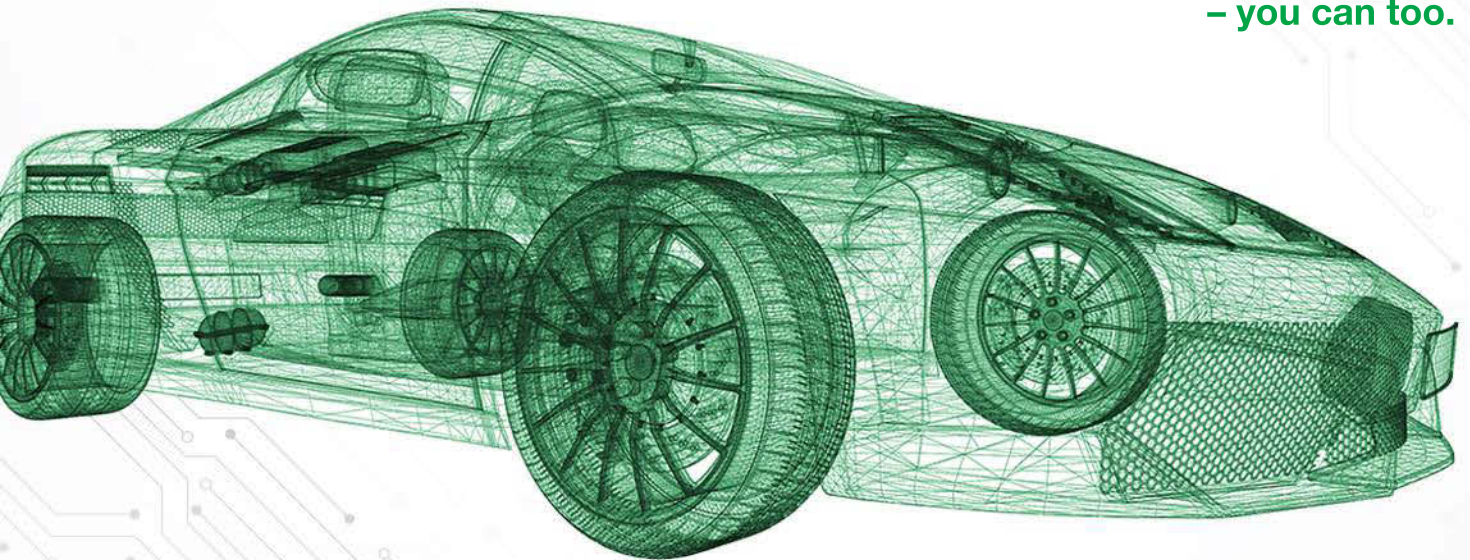


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**Feature Article by Andy Shaughnessy,
Patty Goldman, and Stephen Las Marias,
I-CONNECT007**

For the upcoming issue of our I-Connect007 magazines, we interviewed Nolan Johnson of Sunstone Circuits, and Dan Beaulieu of DB Management—our regular columnist—on the topics of knowing your customers, the challenges in dealing with customers, and providing excellent customer satisfaction.

Johnson has been with Sunstone for about 12 years now. His background is in computer science and then in capital equipment and display technologies, as well as PCB manufacturing. Currently, he is a project marketing manager at Sunstone. He's also on special assignment to their in-house sales team and doing some special projects around for that.

Beaulieu, meanwhile, has been in the consulting business for 20 years now. He works with PCB companies and contract manufacturers, helping them with their strategies, and sales and marketing, primarily for growth.

Patty Goldman: One of the things we hear in our ongoing expert meetings is that there is

not enough communication between the different parts of the supply chain—the supplier and customer. There is a lack of communication; working together is not what it should be.

Beaulieu: It's very interesting because what's going on lately is that even my customer's customers are starting to come to me. I've had a few calls where a long-time buyer at Draper Labs, which is one of the highest technology buyers in the country, told me he has such a problem with board shops. And I told him it's because he doesn't communicate with them as well as he should. Going back to the old days when our customers, the Martin-Mariettas and the Raytheons, used to literally move into a board shop and work side-by-side with us on products that "no one" could build. And that's kind of gone by the wayside as we get into the no-touch stuff, which I picture as a kind of counter communication, if you will. And it's not the fault of the people that offer the no-touch service, it's kind of the fault of the corporations.

This is the way I envision it: it's almost like down in the basement of one of the large companies are designers and engineers who don't want to go upstairs to the traditional



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buying channels and go through all the bureaucracy of buying boards. So, they simply whip out their credit cards and buy boards online or use design services online. And there's nothing wrong with that. But what happens is as that board is elevated and goes upstairs to the traditional buying systems, the people who end up building the boards, the more traditional board shops, have not gone through the development phase with the customer. That's where the communication breaks down. That's an aspect I'm working on a lot right now. When you start dealing with companies that are literally building products that the world has never seen, including circuit boards with technology that the world has never seen, it's time that somebody talks to somebody.



Nolan Johnson, Sunstone Circuits

Johnson: Well, this gets to be kind of fun because I do live and breathe in the area that Dan is calling the no-touch. We tended to find that this area is where the prototypers are doing their work, and Dan touches on something that's particularly important. If you're a prototyper, you're looking for a shop that can get you your prototype in a couple of days, quickly, in small quantities, and can be nimble and make changes alongside you to keep your design team moving forward until you get your prototype ready to go and to optimize it for production. Then once you've optimized it for production, maybe you've taken it from a 4-layer prototype down to a 2-layer prototype where you changed the dimensions or cleaned up the DFM warnings and you are ready to go into production and get some good deals out of your overseas production shop or your major production shop in the U.S.

Once you're there, it does change and there's information that we have established as the prototype partner that needs to be transferred over to the production shop to keep everything flowing properly. That's something that we see with our customers on a regular basis.

We see it from the other way. We start handing things off, moving things over, trying to help the customers get their designs moved over into production and have things fall down on their face for the first couple of runs while they're getting up and going. So Dan's point is exactly right. How do we get that key step from helping with the prototype, all that knowledge

we've built up because we're spinning that board with the customer and then getting it over into production where it can stay put and be stable with high yield and high profit for a long time for this customer? That's a key thought.

We've been working to develop some relationships with some production houses in order to be able to create a communication channel to do that. It's interesting from our

perspective that it's difficult to get the attention of the production houses to do that. We're in a place where we're working with a lot of prototypers on a lot of different levels. Everything from the breakers that Dan mentioned, and down to university teams, individual entrepreneurs, and hobbyists and makers. Many of these projects are turning into production products at some level, maybe small, maybe huge, but that transfer over into production is an area where we're struggling to get that information passed over consistently and heard. I think there's some room for some protocols around that.

Stephen Las Marias: How is it in the contract manufacturer or EMS space, Dan?

Beaulieu: There is more conversation there by far. But for the most part, it's a longer quote cycle with parts and putting the package together, and there is much more conversation going on there. You just have to be closer. I work with one right now, for example, where I watch the project managers go back and forth for literally two or three days with the customer. Especially as you've got the quote cycle, which

needs the customer to be at the table; and once wherever it will be placed, then a great deal more conversation takes place.

Two things are key on a contract manufacturing level. They actually measure their sales people on the number of NDAs they bring in to get signed—that's number one. And then number two is plant tours. Plant tours to contract manufacturers are far more important. They're important to board shops, but they're far more important to contract manufacturers—because on the board side, you're literally building one part of a product, whereas the contract manufacturer is going to build the entire product. So, it is a much closer relationship. Several of my friends own quick-turn CM shops and I know they do a great job. They do things faster. They're much more streamlined but there are things like understood parts—part substitutions that are understood—because of speed. It's like they'll settle, they'll build the first pieces, but they don't always stay there. After the prototype is done, they might go to a part that's harder to get, that has a longer lead time but is a better part for it; but they wanted to see that the first builds work. But I find there's less of this breakdown in communications, if that's the shorter answer.

Goldman: What we're all hearing here is that regardless of who your customer is—and customer can be defined rather broadly, internal, external down the stream a bit—but the big thing is communication. Would that be true?

Beaulieu: Absolutely. And also, in what Nolan was talking about, I understand the need for that type of enclosed no-touch business. I've talked to one of the presidents of our country's largest no-touch and he told me that a lot of his business comes, believe it or not, on Christmas Eve, and on Christmas Day. Because that's what a lot of designers do. Not at the higher level, but at the NPI and hobbyist level; they really do not want to communicate, you know? I worked with one company—that we all know as a traditional company—that's got a call center and also has no-touch. I was running its

sales force. I asked why my sales guys couldn't have the list of the no-touch customers. And the boss said, "Are you kidding? Those people would go berserk if somebody called them up. They don't want to be called up." It was very interesting.

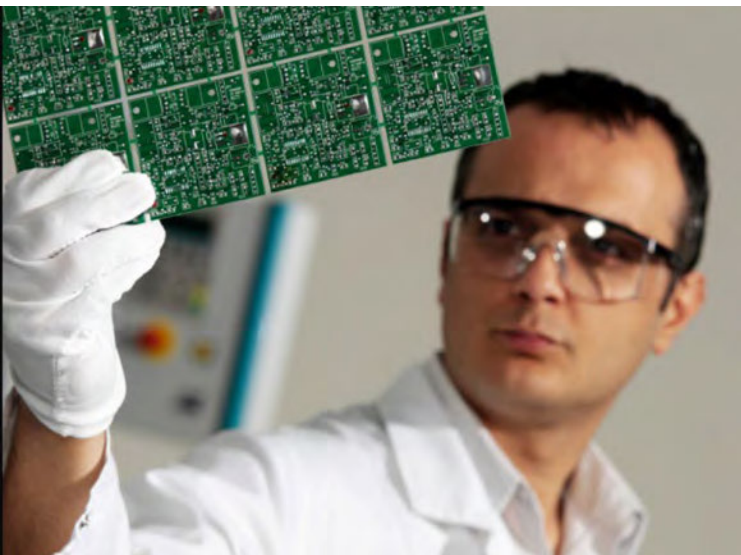
I managed designers for years and I know the sales guy that I am. One of my friends advised me to tone it down when talking to designers because they're just a much more methodical group who doesn't want some backslapping sales guy talking to them.

Johnson: I think you're right Dan. We have plenty of customers who just don't even want to be contacted, and then we have other customers who are perfectly willing to start having that conversation. For me, what I'm discovering is that if they're thinking production, they're more likely to want to talk to us and keep the information flowing. There's a reason that Sunstone also keeps a 24/7/365 customer support line going. We have our

**There's a reason that
Sunstone also keeps a 24/7/365
customer support line going.**

customers who are placing orders on holidays. You know, introvert type designers hiding out from their family on Thanksgiving; while the turkey is being cooked, they are making their design order. We see this all the time, which is a key part of how this business operates. But it's interesting, what I was hearing from this whole communications bit, the further downstream you are, closer to production, the more likely communication is to happen.

We're in a unique spot. We're at the very front of that whole manufacturing chain where there are a lot of things being sorted out. We do learn a lot of things, but the next step down doesn't necessarily mean that everybody's ready to hear from upstream. I think that's the point I'm trying to make there. The



further downstream you get, the more likely the communication is to settle in. We're living up in the spot where the BOM is changing, where the design is changing. There is a lot of flux going on, as you settle it out. And maybe there's too much noise there. But at the point that we're finished and handing it down, there should be enough signals to make it useful to the next step.

Beaulieu: Yes, I think you're right. The other extreme I see is this: a more traditional PCB prototype company that has a barrel full of testimonials from customers who praise them for calling them up and saying this is wrong and things like that. By the same token, they have an equal barrel full of customers who are furious, who say "just shut up and build a board, quit bothering me." The same group of salespeople went to one of the major fabricators located in New Mexico, and they had a group of designers there that said when they were trained, they were told never listen to the board shops, they don't know what they're doing, designers are what you want. This PCB company ended up doing a lunch and learn. Another PCB company I work with also ended up doing a lunch and learn, and they were very, very well-received. They both came up with rooms full of people anxious to understand what goes on in a circuit board shop. And don't forget, most of us around this table grew up when people visited circuit

board shops. But times have changed. When I managed designers for ASI, I had 30 designers. ASI had a board shop, and just three of them had ever been in that board shop. They were all 20-year people. That's the kind of communication that I'm really struggling to make happen—going to a PCB shop and understanding how a board is made. It's not a plastic card, you know?

Johnson: We have plenty of customers who are angry at us because we're calling them back to ask and not just making the part, and then we have other customers who are trying to figure out why we aren't talking to them more often. That's never going to go away for us. It's always about how to walk that line. And you're right, Dan. I have a customer that I've been working with here for the past year or so. Sunstone's done a case study on them; the company is Eagle Harbor Technologies, out of Seattle. When I first started talking with them, they were giving us designs that were effectively unmanufacturable, and I was digging into them about why. It took talking to the customer. What I learned from them was that they're a startup. They're a team of physicists. None of them are EEs. They're all high-end physicists and they're building very fast switching, high voltage power supplies. This is some really cutting-edge stuff that they're doing, and the boards that they're turning in look like they should be automated test equipment probe cards. They're circular, nothing's on an angle. They're all over the place as far as that goes, and the DFM rules are really stressed when you're checking on them to see if they're manufacturable.

And yet we talked it through. Helped them understand exactly what the chemistry is going on inside the facility. Got them so that they had a real-world vision of what's happening once they finish their design. It helped change their perspective. It's not just, "Well, if I can define it in the CAD tool, it's got to be manufacturable, right? The tolerances and precision on everything is perfectly infinite." No, it's not. And as they understood that more, they started changing their designs. As they changed their

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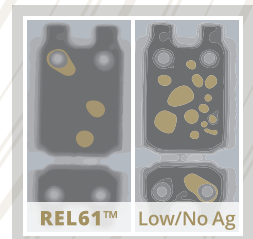
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designs, we were able to get them working prototypes with fewer turns and they were quicker to market. So, that part of the communication and education to our customers is huge. It is amazing how few designers even understand what's going on once they send an ODB++ file over to the manufacturer.

Beaulieu: I think there's a need for it, without a doubt. Based on the columns I did recently about customers. My friend Bob St. Pierre, who's a long-time buyer and now a consultant at Draper Labs, has agreed to work with me and put together some give-and-take columns on it because he was one of those people saying that.

So, in the spirit of getting at least the high-tech customers together with board shops, we're going to start conversations that hopefully you guys will publish and take it from there. Maybe even do a traveling road show with it. Because I think it's needed. Especially with the high-end guys like Lincoln Labs, and Draper, the guys who are committed to having to be in the United States, by the way. They can't go offshore with the stuff they build. So there's a desire there for us to get this solved and to get the vendor and the customer closer together.

Andy Shaughnessy: What are some of the lengths you guys would go to for a customer?

Beaulieu: I can talk to that on a personal basis. I'm just open day and night. That's my business. I had a family Christmas party and I was on the phone with two customers for an hour upstairs in my sister's house. That's just that personal advisor, trusted advisor part of my business. I worked with this supplier for a long time, I still do. One of the things that came out of it, and I think it applies to all vendors of frankly, the American circuit board industry, is that right now, the American circuit board industry is very nervous of their vendor base.

It's not a big secret, because you can sell 80 laser drills in China, whereas you might sell only three in the U.S. So who are you going to service?

One of the bases that I used with that company was that you're not just selling them a solder mask, you're selling them a complete service. Because the board houses just don't have the engineering base they used to have. Our suppliers in the circuit board industry have



Dan Beaulieu, DB Management

to engineer and they have to help us. All the good suppliers do. And we're going to need even more of that as time goes on because the vendors are our engineers, particularly in the \$5 – 10–15 million board shops. They rely on their vendors to support them and that means doing everything. If you're selling solder mask you need to be their solder mask expert. If you're selling drills, whether they be

mechanical or whatever, you have to be the expert. You have to do that service for them. It goes way beyond the selling. They are intimately involved now. All suppliers should be intimately involved with their customers. You could apply the exact same thing to people who are selling assembly equipment. It's really the ones that stay and service that do well. Not only service, but make that correlation, that synergy between putting this piece of equipment into the whole production line and making sure it all fits above and below where it lies in the production line.

Johnson: Yeah, at Sunstone we call that Lean. We call that 5S. And we actually have been doing a lot of work to do exactly that. Moving that expertise from the vendors into our shop to help out and make us more expert overall has been a side effect of lean and 5S.

Shaughnessy: What are some of the craziest things that people have asked you to do at Sunstone, Nolan? What are some of the horror stories?

Johnson: Being where we're at in the process, our challenge has a lot to do with how familiar is our customer with the actual jobs we do. I've shared this story before. I grew up here in the Portland, Oregon, area in the '60s and early '70s, and that's when Tektronics employed 30,000 people and they manufactured everything in the Beaverton campus. Nuts and bolts, the ceramics to make the displays, they did everything on campus. And if you wanted to understand what was going on with a particular project that was under development, it was my grandma's house for Sunday night dinner. Because my dad worked in the warehouse and then moved over to Electro Cam. My mom worked as a secretary watching what was going through procurement. My grandmother was an assembler. My uncle was an engineer. My aunt was another assembler. I mean, we had family members spread out through the departments of the company.

And the status report on the product went around the table with the mashed potatoes. If we didn't have an answer there, just walk down the street because some neighbor actually worked in the department you were looking for. If you were a designer and you wanted to know if this board was going to be manufacturable, you walked across the street into the fab clan and talked to the guys there. That was how you did it. That's how you had all that knowledge inside your company so you could do that.

As we streamlined and moved into the world we're in now, designers don't have that touch. They don't have that understanding of what's going on. They don't see it. They don't have the opportunity to figure out what goes on with that and work with the technology. So they end up sending stuff in that becomes unrealistic on the shop floor. And to answer your question Andy, the example I gave you with Eagle Harbor was one of the craziest examples of that. Because we were ready to lose that customer. They thought that we just couldn't build what they were doing at all. What it became was an ongoing conversation to help them understand what they were doing that was going to be a problem for anybody,

and to help bring up their sense of knowledge. Helping a team of theorists become engineers is really what was going on there. And it was an interesting conversation for all of us. Education is a big part of this. Helping people understand, in this world, where the designers just do not know what's going on with the chemistry and the dynamics of that.

One of the projects I've been working on the past couple of months is putting together a series of short videos that spends some time on each individual manufacturing step of the process at Sunstone. These are something we want to use to help do exactly what we learned with Eagle Harbor. We want to help all our customers be able to plug into the manufacturing steps. See it in action. Get a little information about what the context is, why the particular stuff is used, what we're doing, what that means to your board, and give some specs and some tolerances, and do all of that in 45 seconds.

We're spending quite a bit of time to get this boiled down to the essence of it, so our customers can spend 10–11 minutes, watch the videos and at least get a sense of it.

We're spending quite a bit of time to get this boiled down to the essence of it, so our customers can spend 10–11 minutes, watch the videos and at least get a sense of it. And then this goes right back to the comment that was made early in the whole conversation. I think getting a customer tour of your facility is an underrated milestone in the sales process, which is of course a challenge for those of us who specialize in no-touch.

Beaulieu: I agree with that. Even more than a planned tour, I mean go back to the way things were done before. I know a number of

programs that were worked on in my career, the lantern project for Marietta. Those people came from Florida and literally lived at ASI, which was the company I worked with years ago. Because nobody could build those boards, their engineers and our people worked side by side on the board.

Even going back further than that, Rockwell and Motorola worked on the Viking project with the same thing. I mean, I can go back so far that I was a kid when I watched them measure impedance for the first time. We were doing the 16-layer board and I would deliver them to these two guys. One was from Burroughs in Pennsylvania, the other was at Maine Electronics. And they would look at the boards, they'd check the boards and they'd say, "Nope, throw these away. They're no good." I didn't even know what they were doing. And it was the first time I heard of impedance and that was like early in the '80s.

But all these stories go back to one thing, and that's where the customer was in the shop with the people building the boards and had a complete understanding. And keep in mind, years ago our customers all had board shops. All the OEMs had their own board shops. So the people we dealt with knew something about boards. They built their own. And the people who were used in the support groups for buying boards were people who had built boards. Those are all gone. How long has it

been since there's been a captive board shop? The newer generation had never been in a board shop. They've never worked with a company that had a board shop, and that's what causes a disconnect.

Our technology stabilized for a long time, but in the last few years, it started taking off again and really taking off to the point where we can't get away with this gap any longer. The customer has to come to the shop. The engineer has to come to the shop, and I'm seeing a time when those customers are going to have to invest in the shop. I see that happening, where a lot of the companies, the smaller shops, just do not have the bandwidth financially to be buying the equipment that they're going to need to build the boards for these companies building products of the future.

So, I see right now a crossroads, a time where we're going to have to break through this thing. We're going to have to teach designers and we're going to have to invite designers into the board shops to give plant tours. Also, that's a two-sided thing. It's not all about that direction. There's also the direction of the board guys are going to have to open up their minds and listen to the designers and find out what they're trying to do. What the end product is and what they're trying to accomplish. We're going to have to do that as well. So that there's real give and take between the two. A true partnership that'll help the whole electronics industry move forward.



Johnson: Dan, I agree with you. I see that there are increasingly two communities emerging. There are the customers that are, just as you're speaking about, needing to get closer to the board shops and figure out how to do the designs they're doing. There is a definite statistical increase we're seeing in our customers for wanting to do HDI technologies, and at that point there's a lot more interactive discussion with the board shop to make that happen.

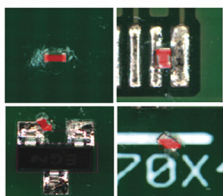
There is still though, a very large community of people who will back off that cutting edge who are doing very conservative work with basic SMT, or even still through-hole technology. Those customers tend to also be the ones

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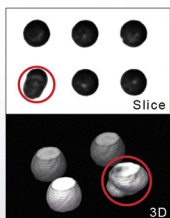


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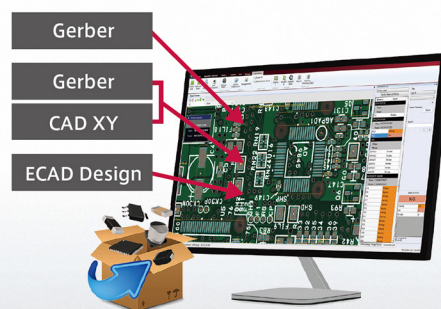


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who don't want to talk so much. So, depending on where they fall in the technology scale, you could be in a place where they need to reach out, we need to reach out; there needs to be plenty of conversations and plenty of work behind there that is basically commodity work. Not everybody necessarily needs to go work directly with their board shop on every project but that is on the increase, I will agree with that.

Beaulieu: I'll tell a story here I've run across. I'm helping a company out of Brooklyn, New York, NYU guys, who are building boards with 3D printers. And the interesting thing is I asked them why they're doing this. These are NYU graduate students who won a technology contest by building a neat device, which is controlling a keyboard with your eyes, if you can believe that. I asked, "Okay, you went off in that direction, why did you get involved in 3D printing of circuit boards?" And they said because while they were building their project, it was so darn hard to find circuit boards, and so hard to get good circuit boards, they

These are NYU graduate students who won a technology contest by building a neat device, which is controlling a keyboard with your eyes, if you can believe that.

decided there's got to be a better way. This, as you know, is a long way from 28-layer blind and buried via boards, but on the same token that was the perception of smart graduate students coming into an industry where they would make boards. Believe it or not, their educational gap was such that they're graduate students. I asked them what their biggest problem is, and they said the ink. They were

using stationery ink and I introduced them to Taiyo. They didn't even know about Taiyo. And I talked to my friend John Fix at Taiyo and he said he'd be there tomorrow. Because they're looking for that too, and you've got to realize, nothing against anybody here, it's just that people are working in a vacuum, in terms of circuit boards. I have a friend who's an instructor at British Columbia Institute of Technology and he uses Bob Tarzwell's PCB 101 handbook for his students, saying since he has a whole two-year course, these students might spend a day on circuit boards and then move on. So we've got to all work on that.

Las Marias: In some of our conversations with contract manufacturers, they're also saying that designers should also consider speaking with them because sometimes, what these designers are designing are just not manufacturable, and quite difficult to adapt to whatever SMT system they have set up in place. So, they're saying that it's also important for them to talk to the assemblers. In fact, when we ask some people, they're saying that in their 12–20 years, they've had only one designer that came to them and talk to them about the design that they're going to do. Just one in that many years. But it turned out that the final output of the product is quite good. So they're saying that's also important.

Beaulieu: Absolutely. I was at one last week and it was the same thing. Everything from basically ease of production to one of the important ones, which is component selection. Because there are certain parts that have longer lead times, that are more expensive, and they can be substituted with another part. And that drives the price up, it drives the lead time up, and it's much better when they coordinate. When I said they talk to each other, that's one of the things they're talking about.

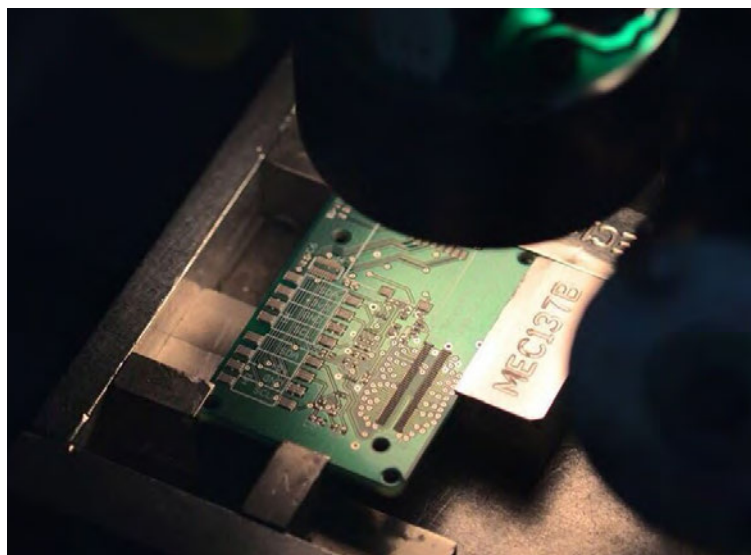
If you look at my friends who have quick-turn production manufacturing shops, that's what they're doing. They get trusted for component substitution, even have little matrices that point out this part can do the same as this part and they figure it out that way. But

if you think about it, when you're building a box or a product, there are things that happen when you're actually building it, such as if this screw was moved one eighth of an inch, they would be able to fit this in. That kind of stuff, that's important too.

I worked on a project years ago where it was a board part, but it was a part assembly with a copper core with two polyamide skins over it. The core was live, so the boards had to connect through the core. Those boards cost almost \$3,000. The designers called us in and asked why these boards cost so much, and what can we do. My partner simply went up to the boards, drew a picture of the core, drew a little slot in it, said "You put a connector over the top here and it won't hit the dimension of the board. And now these boards will cost like \$600 and you're getting everything you need." I've seen contract manufacturers doing a lot of that. That one necessarily is on boards, but they're doing a lot of that kind of insight to help the customer who's fighting for nickels and dimes, lead time, and time to market. It does apply as well to contract manufacturers. Sometimes even more.

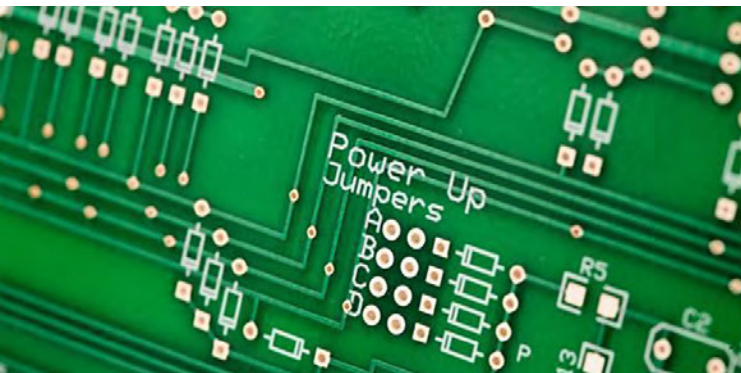
Johnson: That's a great point, Dan. That's why you're using contract manufacturer nowadays, because they are doing that sort of work. They have that experience. They have a lot of other jobs from a lot of other customers. They've done all of this before. They can often have the practical experience that can tell you how to do it better.

From my perspective. I'll just speak from my perspective on this one. I represent PCB123, at Sunstone as well, so that's the PCB schematic capture, physical layout, has an auto-place, autorouter in it. We just came out with a new version that connects to a startup called SnapEDA. And part of the whole part substitution issue is understanding if the part is a new part, or it has just been given a warning that it's going obsolete, or it is on a long lead time to get supply from the manufacturer. All the statuses for this and how it is going to affect your project. It's one thing to be having the conversation with the assembly houses and



sitting there with your bare board, and they're telling you that the part is on a 12-week delay; and the other one is actually knowing that information when you're designing your board. If you can get some of that information into the CAD tool, you can make adjustments to supply issues. If you can make the designers aware of that, then they can make some adjustment decisions while it's still cheap, while they're laying out the board, before they've committed to something.

And that's exactly what we've been trying to do at PCB123. I saw this years back when I started my career at Mentor Graphics, and we were working with PCB123. We have the bill of materials that we've built up as you're laying out your design and, right now, you've got one source. You can query DigiKey to get a sense of the pricing and availability of the parts in your bill of materials, right inside the CAD tool as you're designing. Just go over and click a button and it gives you some information about that. If you've got a serious issue, you could figure it out. One of the side effects for our customers, is when they come back to a design they did a year or two ago, it's a one click process to find out what things of their bill of materials have gone away. Sent to them in seconds. In September, we introduced support for SnapEDA, a great product in the sense that the SnapEDA team is out there building a cloud-based library of parts definitions for schematics, physical layouts, 3D, working with



the part manufacturers to supply their parts directly to the library, and crowd sourcing with engineers to get new parts in the library. We've got millions of parts and it's a couple of clicks to download them out of the library, out of SnapEDA, into your CAD tool. They're supporting most of the major CAD tools including PCB123. And that process means that it's like using iTunes to get your parts definitions and know that you've got good ones that have been certified and validated as correct. Giving me, the designer, up-to-date information as far as how available that part is and the peace of mind that you didn't just spend two days defining a brand-new footprint for your library that is wrong.

So those are some of the places where I think that's a little bit overlooked through the manufacturing supply chains. The more we can get those decisions to be made well in the CAD tool, the fewer conversations we have to have further down the street. At least that's one way that we've been approaching it with PCB123.

Las Marias: Dan, what is your advice for our readers when it comes to ensuring 100% customer satisfaction? Maybe you can talk from the perspective of PCB fabrication and the contract manufacturer's side.

Beaulieu: It's an understanding and it's listening. I like to tell my guys to make sure they not only understand the product they're building for, whether it be a box build or it be the board itself, but also understand the customer. What does the customer need for success? What is their market? Whether it is medical, defense or security, or commercial where it's

very competitive. Get the characteristics of the customer and apply those to the product in the end and it makes a lot more sense. I also like to encourage people, say it's a circuit board for example, to think what that circuit board is seeing when it enters the customer's facility. Even to the point of the receiving, because as you know, documentation has become more vital now than ever.

Put yourself in the customer's shoes. Seeing what the customer faces, what their challenges are, and what it takes for them to be successful in their marketplace. Because if you do that, you become completely valuable to your customer. And if you do that enough, after a while, that customer is going to give you leeway on pricing. I used to say when that hotshot accountant shows up and says that your solder mask is 20% more per kilo than the other guy, you'll want the guys in solder mask and engineering to tell him to shut up and talk about all the value they're getting with that product. And it's the same thing with circuit boards. Supercede the pricing with value.

Johnson: I think Dan's right on the money there. One of the things that I talk about with our team often is just pulling one of Steven Covey's seven highly effective methods, and that's "if you wish to be understood, seek first to understand." There needs to be a dialogue that we create in both directions. Not just us understanding our customers, but also helping our customers stop and step back and seek to understand what happens as soon as they've handed their design over. That dynamic, once you have that going on in your relationship with your customer, then everything that Dan was discussing starts to happen pretty organically.

Las Marias: Gentlemen, thank you very much for your time and insights. We greatly appreciate you speaking with us.

Beaulieu: Thank you.

Johnson: Thank you very much. SMT007

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MilAero Highlights

Nortech Systems Names Connie Beck CFO ▶

Nortech Systems has named Connie Beck as vice president and chief financial officer. She will oversee Nortech's relationships with its business partners, the financial community and shareholders.

Milwaukee Electronics Standardizes on Panasonic Platform for all SMT Lines ▶

Milwaukee Electronics has standardized on Panasonic equipment platform for all of its three facilities.

Libra Industries Sponsors 2018 Pan Pacific Microelectronics Symposium ▶

EMS firm Libra Industries is a corporate sponsor of the 2018 SMTA Pan Pacific Microelectronics Symposium.

Jochen Lipp is New COO of Firstronic ▶

Jochen Lipp has been named chief operating officer of Firstronic.

Nemco Achieves SC21 Silver Award for 3rd Year Running ▶

Nemco, one of the UK's contract manufacturing companies, recently made its way to the top of its industry and gained recognition as a leader in excellence and customer service.

Roop Lakkaraju is New Benchmark Electronics CFO ▶

Benchmark Electronics Inc. has announced the appointment of Roop K. Lakkaraju as executive vice president and chief financial officer. Lakkaraju replaces Don Adam, who will be retiring from the company at the end of the year.

Delta Group Electronics Names Mary Royal Acting General Manager ▶

Delta Group Electronics Inc. has promoted Mary Royal to acting general manager and James Lee to production manager for its Fayetteville, Arkansas facility.

Roscan Electronics Strengthens Production Capabilities ▶

EMS firm Roscan Electronics is strengthening its manufacturing capability with the recent addition of two new pick-and-place machines and two further AOI machines.

Libra Industries Names Mihalek Purchasing Manager ▶

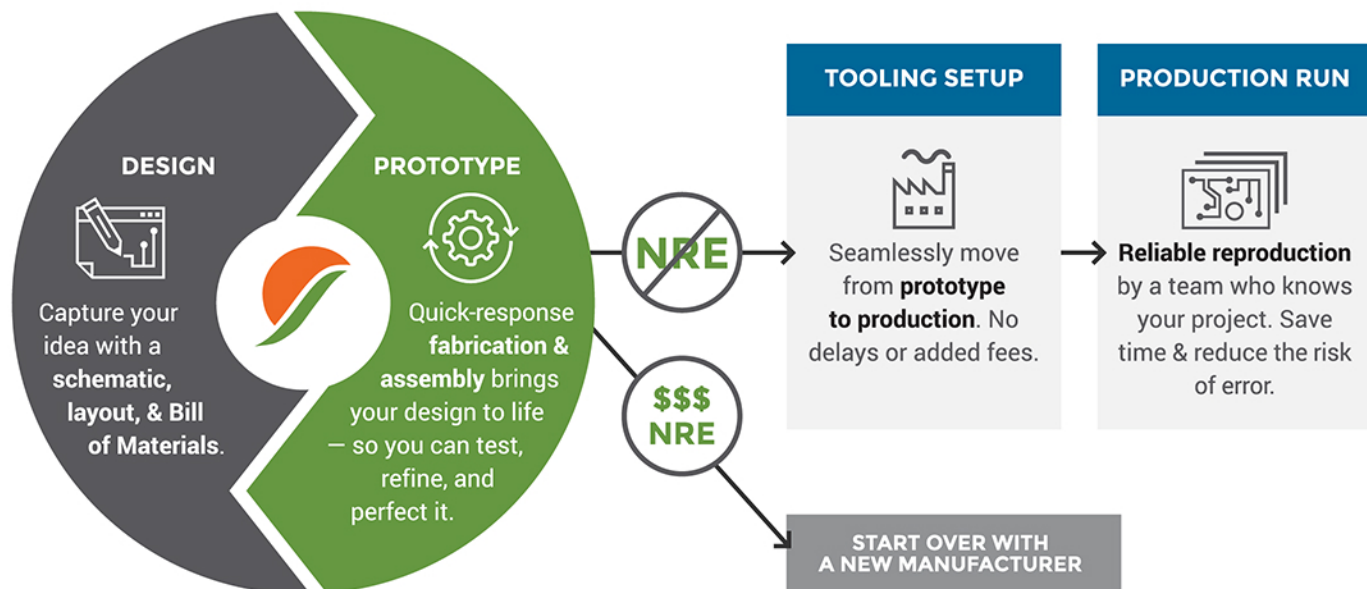
Libra Industries has appointed Vincent Mihalek to the position of purchasing manager, effective November 2017.

Celestica Expands Romania Operations ▶

EMS firm Celestica Inc. recently expanded its operation in Oradea, Romania, to increase its existing manufacturing services for customers from a strategic location in Eastern Europe.



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Defining Customer-Supplier Relationships and Customer Satisfaction

Feature Interview by the I-Connect007 Team

Steve Williams, president of The Right Approach Consulting LLC, and a veteran executive in the PCB and EMS industries, speaks with the I-Connect007 team about customer-supplier relationships, and how you can ensure customer satisfaction.

Stephen Las Marias: From your many years of industry experience, what are some of the challenges that you have seen when it comes to dealing with customers?

Steve Williams: Every company looks at their customers and they rank them, whether they use A, B, C, or the top 10 customers, whatever it is. They rank their customers based on revenue, ease of doing business, a whole bunch of attributes, and they do scale their service levels around where that customer falls in that ranking. The customers don't know about that. So, a lot of the challenge is keeping those customers satisfied, but still staying within the constraints of your organization and their expectations of how much time and effort you

put into the lower tier customers, if you will.

A lot of times, everybody says, "Well, the customer's always right," which we know is not true, but sometimes you make business decisions on whether you're going to keep this long-term customer happy as opposed to doing what's right for your organization. So, balancing that customer satisfaction versus what's in the best interest of the company, especially when you're talking about problems, quality issues, or product that may be suspect. If you're just watching out for your company, you think, "Well, the product is actually within specification." But knowing that this is an A customer or a top tier customer, you may treat that situation differently with those customers than you would a C level customer. Balancing that customer satisfaction versus keeping your business profitable is probably one of the biggest challenges.

Barry Matties: I think this analogy also applies to internal customers as well. Does the guy in the drill room realize he's a customer and is he going to the supplier proactively? And if they're not nice people in the drill room, the



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guy sliding the panels may not be as customer-centric as he could be or should be.

Williams: I think there's an aspect to that, in that scenario of the drill room. They're drilling panels and they're feeding the plating department. They've only got one customer. They have one internal customer that's going to get their product when they're done, but the dynamics between those two departments certainly influences that cooperation. That customer-supplier relationship is the same, whether you're talking about internal departments, raw material suppliers to your organization or between you and your external customer. I think the rules of engagement are the same with all those levels throughout the supply chain.

Andy Shaughnessy: How far would you go to please a customer?

Williams: It's interesting. I had that conversation recently with one of my PCB clients. They were talking about all this business they inherited and picked up when one of their competitors went out of business recently. The owner said, "You know, I guess we kind of know why they went out of business now." All these customers have low-level products, low technology, low quantities, but they're probably some of the most demanding customers of their entire customer base. The top customer, from a revenue standpoint, I mean they can be as nasty as they want to be and you're still going to treat them and bend over backwards to satisfy them. It all depends on how good of a fit they are for your organization, and what those rules are going to be in dealing with that customer.

And it all comes down to money, right? Right now, though we're coming off some decline in the industry, people were filling up their shops with whatever work they could find. Now that they're starting to get busier, a lot of the people I've talked to are starting to purge some

of those customers that they needed last year just to keep their head above water. And now that they've got some more preferred customers, they're no longer a good fit. So, I think that all kind of goes under the same bucket.

Matties: Being able to know how to define your customer, I think, is critically important.

Williams: Yes, that's a good point. Again, for the most part, a lot of companies know what a good fit is, but sometimes they're forced into taking business that they wouldn't otherwise take.



Steve Williams, The Right Approach Consulting LLC

Matties: What is your advice to our readers when it comes to customer service?

Williams: To me, if I'm reading something like we're talking about now, the takeaway I'd be looking for is how I will provide that service level that my customers are demanding. What's important to them? It's all about understanding what the customer's needs are and analyzing if we are currently

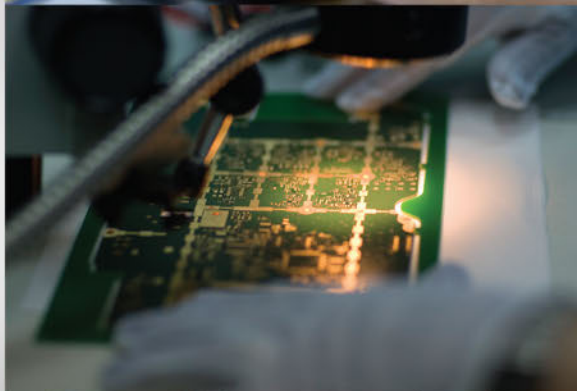
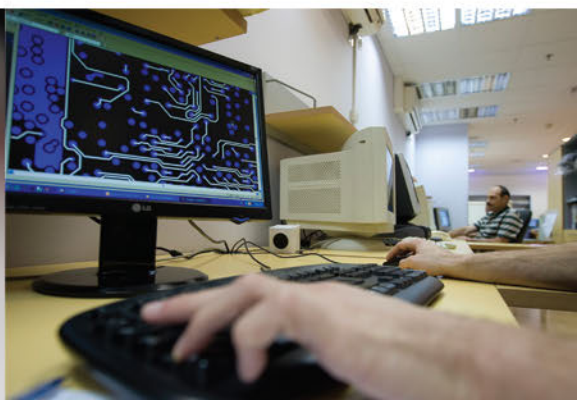
providing that or not—and how do we adjust if we're not? Whether that's an internal department hand-off, dealing with your supplier or your customer, it's understanding what they expect out of you as a supplier or a customer, and if you are giving it to them.

When I talk about customer service, I always use the automotive example. We've all gone into a dealership to have some work done, right? And you go to pick your vehicle up, and they tell you, "Hey, someone's going to call you in a day or so and ask you to take a quick on-the-phone survey." Then they tell you that, "You know what? It's going to look really bad for me if you don't give me a 10 all the way across the board." That kind of information makes you question all the customer service awards that the dealership has hanging in their lobby, because you know that they're influencing how customers are reacting. And they do

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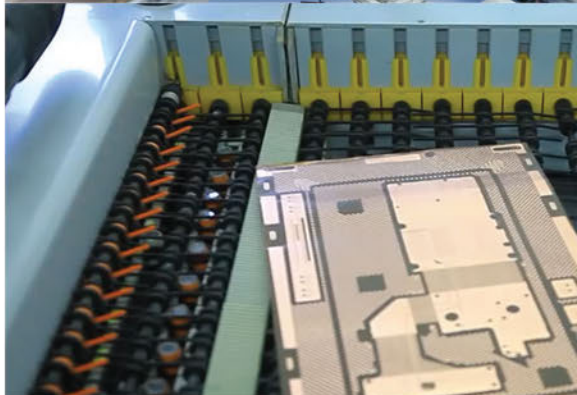
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that so they can announce that they've got the highest customer satisfaction ratings compared to their competitors, but it's not really information that's going to help the company get better. And that's what people want to know. How do you figure out what your customers really want from you in a meaningful way? That's what I think is missing from a lot of the customer analysis that we do. People tell you what you want to hear, or it's skewed by a recent experience and that's not always helpful to the business.

Matties: How much resource do you allocate to a customer? Is 10% of what a customer spends goes back to servicing that customer? What sorts of rules of thumb are out there?

Williams: I don't know if they allocate a particular level of service that way. You've got certain customers that it doesn't matter what they're asking for, or what they're expecting from you. The customer calls, you drop everything, and it doesn't matter how many other customers you've got waiting on you. That customer gets top priority no matter what the situation. It

That customer gets top priority no matter what the situation.

kind of filters down from there. There's always a bandwidth issue, and customer service is very segmented into who's most important and who's less important. A lot of times, if they're a big enough customer, they get their own person full-time. It all depends on how you're structured. To answer your question, I think 20% of spending is a solid number, where that's one of the top 10 customers for anybody. If they're 15 to 20% of your revenue, they are at the top tier. And then, now you've got to remember, the customer is going to be reading this too, it's not just us manufacturers that are going to be reading it. The people that we're trying to satisfy are going to be reading this, so you've got to be sensitive to that as well.

Shaughnessy: What do you think are some of the best methods for measuring customer satisfaction? We asked the board shops, and they said they don't worry about any customers unless they do one job and never come back. And then they call, "Hey! Why didn't you come back?" So, what do you think is the best or some of the better methods to measure customer satisfaction?

Williams: Well, right now, it's a bit unique for me as a consultant. If I get a referral from a customer to another client, that's a huge customer satisfaction bonus for me. A simple "Job well done" or "Our business is better, we're glad we hired you." Those kinds of things. It's a little different from a manufacturing customer, where they are constantly judged on product quality and response and service. In a past life, obviously, you're right. Customers, for the most part, don't put a lot of time and effort into demonstrating their satisfaction for the supplier unless it's bad. They don't go out of their way to call you and say, "Hey, great job," and "Keep up the good work." They'll call you in a heartbeat if you make a mistake. You know, I guess that's a good point in itself. One of the biggest problems in our industry is getting feedback from customers on how we're doing.

Matties: If they come back and order a second, third, fourth time, that is demonstrating a level of satisfaction.

Williams: Absolutely. A couple of my clients, we talk about that, and they say 'You know, if I don't hear from a customer, that's good news. If I don't hear from a customer, and they just keep placing orders then everything's great, I have no concerns, and it is business as usual.'

Las Marias: Alright! Thank you very much, Steve, for your insights.

Williams: Thank you! SMT007

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Supply Line Highlights

Koh Young Europe Ready for Next Year, and Beyond ►

Harald Eppinger, managing director of Koh Young Europe, speaks with I-Connect007 Managing Editor Andy Shaughnessy about the demands of the European market, the company's long-standing success with its solutions, and the future of Koh Young Europe.

Mirtec Succeeding Through Inspection Innovation ►

David Bennett, president of Mirtec Europe, discusses with I-Connect007 Technical Editor Pete Starkey the company's latest inspection technologies, the challenges that miniaturization can bring, and Mirtec's efforts to stay on the leading edge and never be a "me too" company.

Murray Percival Company to Distribute Vitronics Soltec Soldering Equipment ►

ITW EAE, the electronic assembly equipment division of Illinois Tool Works, announces a new partnership agreement with Murray Percival Company to represent and distribute Vitronics Soltec soldering equipment beginning

January 1, 2018 for the territory of Michigan, Indiana, Ohio and Kentucky.

PNC Inc. Invests in MIRTEC 3D AOI System ►

PNC Inc. has bolstered its state-of-the-art equipment list in its assembly division with the recent purchase of MIRTEC's MV-6 OMNI 3D AOI system.

Nordson Acquires Sonoscan ►

Nordson Corp. has acquired Sonoscan Inc., a designer and manufacturer of acoustic microscopes and sophisticated acoustic micro imaging systems used in a variety of microelectronic, automotive, aerospace and industrial electronics assembly applications.

KIC to Showcase Smart Factory Starter Kit at IPC APEX EXPO 2018 ►

KIC will showcase its Smart Factory Starter Kit for reflow ovens at the IPC APEX EXPO 2018, scheduled to take place February 27–March 1, 2018, at the San Diego Convention Center in California.

Ersa Names New Managing Director ►

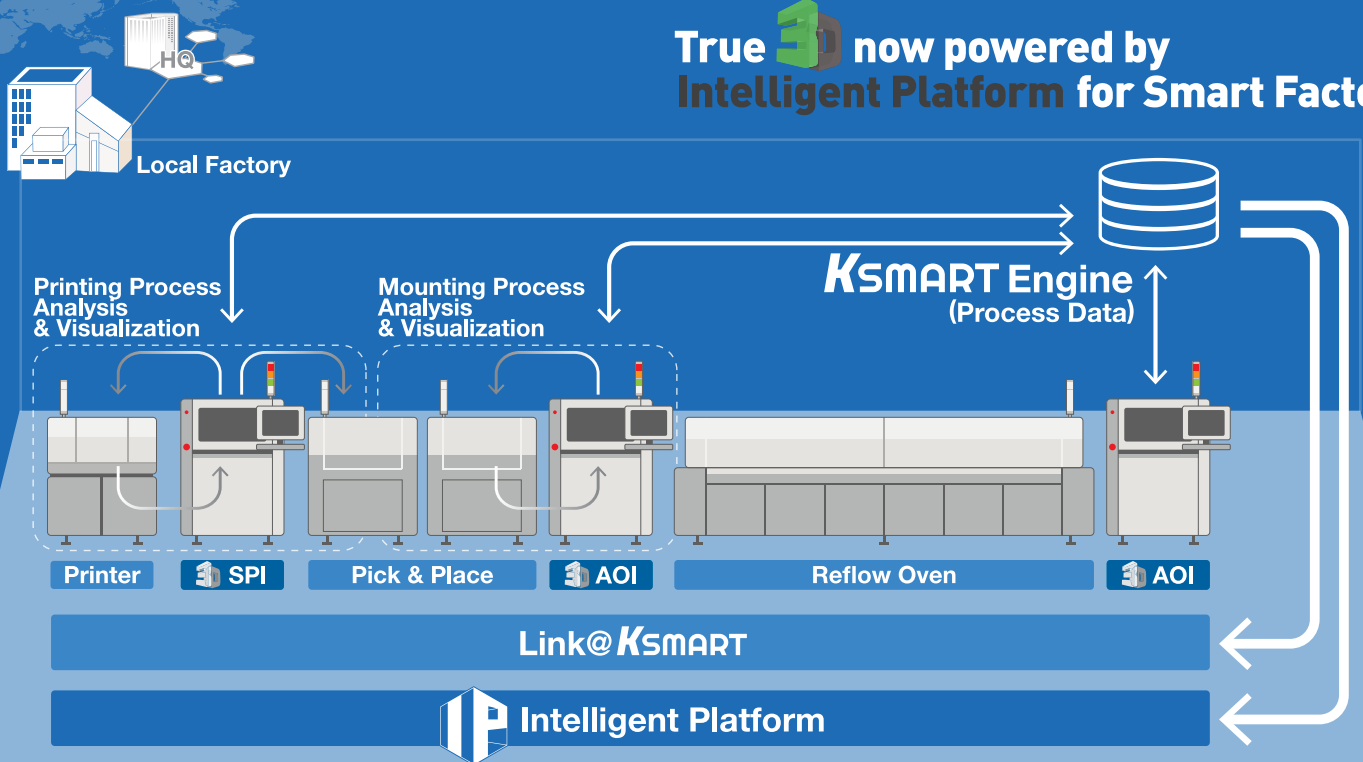
Ersa GmbH has strengthened its management team with the appointment of Ralph Knecht as the managing director of Ersa, effective October 1, 2017.

Competitive Edge Solutions to Represent Vitronics Soltec in New England ►

ITW EAE has announced a new partnership agreement with Competitive Edge Solutions LLC to represent and distribute Vitronics Soltec soldering equipment beginning January 1, 2018 for the territory of Maine, New Hampshire, Vermont, Massachusetts, Connecticut, and Rhode Island.



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Working with Customers: A Consultant's Perspective

Feature Article by Stephen Las Marias
I-CONNECT007

Industry veteran and expert Chrys Shea is in a unique position when it comes to her work for the electronics assembly industry. As president of consulting firm Shea Engineering Services, she helps suppliers test and bring new products to the market, and helps assemblers bring new processes or skills to their assembly lines.

"Most of my projects are joint efforts with suppliers and users or other suppliers," says Shea. "By working in partnership, everyone benefits from the expanded resource base and lower research costs. It's great to gather a group of subject matter experts who all bring their expertise to the

table to solve nagging problems or develop the next generation process."

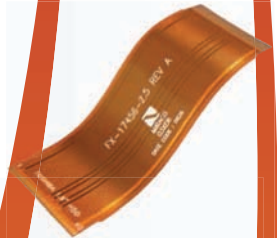
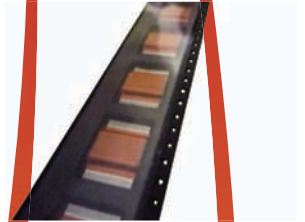
According to Shea, some of these challenges include the adoption of new solutions and technologies, scarcer engineering resources, and the skills gap in the manufacturing engineering community.

"On the supplier side, they have developed some exciting and innovative new products, but the market seems slow to try new technologies. Therefore, some of the new product volumes aren't growing at as fast a pace as they would have in the past," she explains. "On the user side, engineering resources are scarcer than ever. Business is coming back, and a lot of shops are running near capacity, but the staffing levels are not commensurate with the production volumes. I think



Chrys Shea,
Shea Engineering Services

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that's why the enabling technologies are slow to get tested and implemented. There's barely enough engineers to keep up with production demands, never mind trying out new tech.

"In general, we are facing an experience gap in the engineering sector of our industry. We've got seasoned engineers who have been on the job since SMT's boom in the '90s, and now we're seeing some bright young talent coming into the business. But there is a critical shortage of SMT engineers in that 10–20-year experience range. I think the talent shortage contributes to the slowed adoption rate of the new tech."

To address the experience gap, Shea is working together with the Surface Mount Technology Association (SMTA) to offer more free seminars, webinars and basic stencil printing courses so that the newer engineers can experience a faster learning curve.

Working with Customers

Shea works closely with approximately 20% of her customers, from design to assembly. But in her case, product design is not necessarily a circuit board. "It may be a new material, a connector or an IC package," she says. "Not

every new idea I test makes it to market, but it is always exciting when I can see one go from concept to customer."

For Shea, the most important attribute for customer service is responsiveness and flexibility. "That is rooted in my years as a shop floor engineer," she explains. "When a client's line (or their customer's line) is down, helping them fix the problem takes priority."

As Warren Buffett says, "It takes 20 years to build a reputation, and five minutes to ruin it." The same can be said when you do not meet your customers' needs. For Shea, the impact can be translated to losing their business, and potentially their colleagues' business, and compromising the reputation that she has worked so very hard to build. "I won't let that happen," she says.

And how does she ensure that customers are satisfied with her work? "With their delight, and willingness to hire me again and recommend my work to colleagues," Shea says. According to her, one of the most important pieces of customer feedback is when her training clients tell her how much their yields went up after she trained the people and assessed their processes.



Figure 1: Test kit contents.

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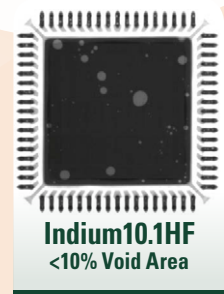
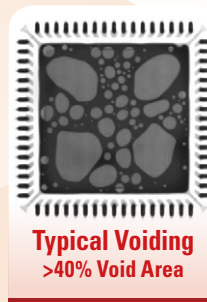
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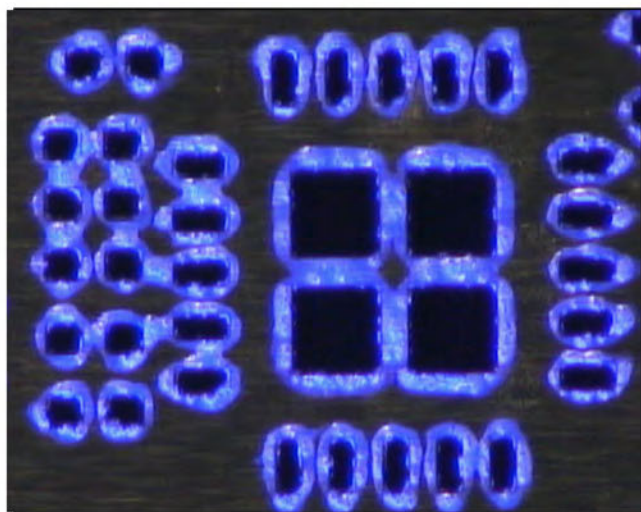
“I was working with a supplier who needed a beta site for a new solder paste test board, and a user who needed to upgrade his solder paste chemistry. It was a perfect match, and both organizations agreed to work in partnership,” she explains. “The project yielded a great deal of insight for the supplier on what was required to make the test board as production-friendly as possible, and for the user who had a data-driven method of identifying the best chemistry for his operation. Both were very happy with the outcome, with the user praising it as ‘the best money they ever spent.’ We presented the study at SMTA International last fall, where the conference attendees gave it the highest rating, and we won the ‘Rich Frieberger Best of Conference’ award. That’s a great honor that exceeded everyone’s expectations, including my own!”

That solder paste test board which will be formally introduced at the IPC APEX Expo trade show later this month. “We applied everything we learned in those beta runs of the solder paste test board to create a complete suite of tools that make solder paste testing as easy as

possible,” Shea explains. “The biggest step in taking it from the lab to the line was updating the CAD database, reducing the bare board layer count and integrating a BOM for easy programming. We also created a configurator that calculates sample sizes and BOM cost, designed the stencil and board support tooling, constructed a simple experiment with step-by-step directions, published a soldering reference manual, demonstrated a basic statistical reduction program to analyze the data, and developed a score card. Aculon is including a sample of their NanoClear stencil nanocoating in the package, as well. It is a turnkey kit, with the same documentation as a production PCB and decades’ worth of experience built into it.

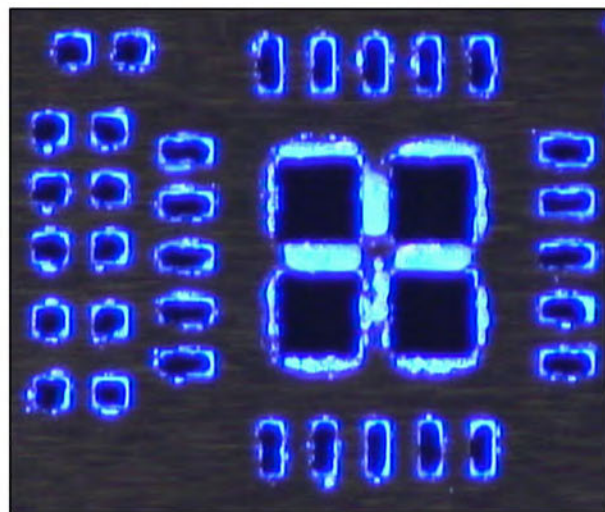
“Of all the elements of the kit, the key for assemblers is the score card. Every SMT operation is different and subject to varying demands. The kit is designed to be as plug-and-play as possible, but the score card lets the user customize solder paste performance requirements according to their specific needs. Using the kit, an engineer can evaluate up to 22 solder paste characteristics in about four

Flux Treated with UV Tracer Dye



Untreated stencil

Flux wicks out on the bottom surface away from the apertures



Treated stencil

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Figure 2: Flux repellency on stencils.



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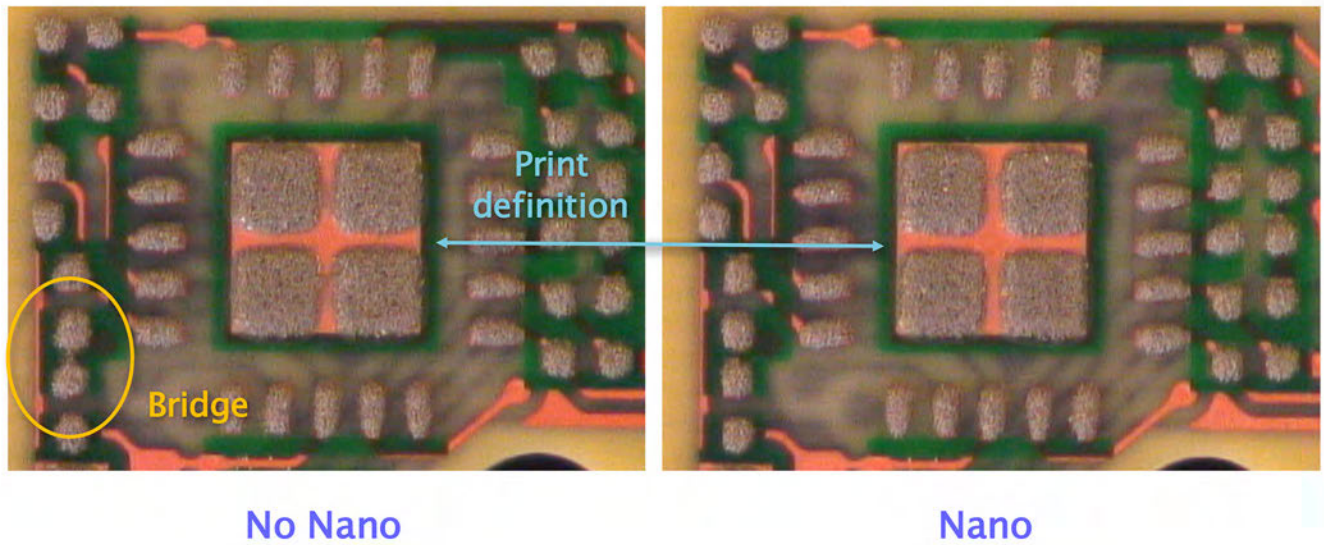


Figure 3: Print definition improvements.

hours of line time. They weigh the importance of each characteristic to their operation and rank the solder pastes' performance relative to each other. The scorecard mathematically calculates overall performance scores to help the engineer determine the best chemistry for their process.

"I will be presenting a paper on how we took the test vehicle from the lab to the line at the APEX conference, and Henkel and Practical Components will be featuring it in their booths on the show floor."

Best Practices

Shea is very involved in solder paste printing, because she says that's a pivotal area where money is made or lost on an SMT line. Having said that, one of the best practices that she sees in printing is the use of nanocoating, engineered solvent for under wiping, and coating-compatible wiper material.

"We call that combo the 'trifecta.' It is extremely effective and very cost efficient. I've done the research, published the numbers and posted the videos. And companies like Rauland-Borg have quantified the process improvements and cost savings they have real-

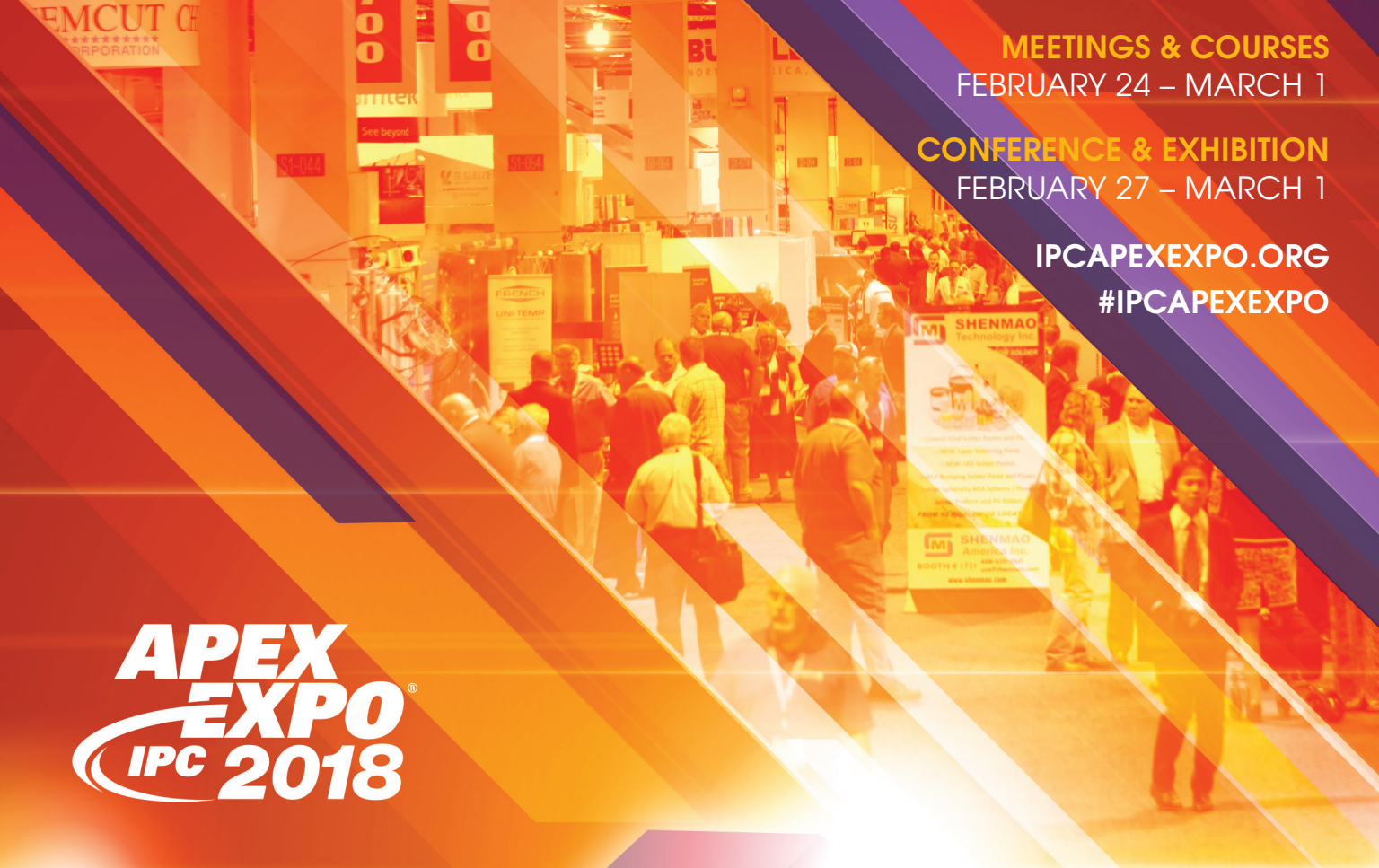
I tell people if there is only one automated inspection machine they can add to their line this year, it should be an SPI machine.

ized by deploying this 'tech trifecta' on their lines," she explains.

She also stresses on the need to use an SPI (solder paste inspection) machine. "I teach lots of printing classes. I always stress SPI. I tell people if there is only one automated inspection machine they can add to their line this year, it should be an SPI machine. These things not only pay for themselves very quickly, they are a great analytical tool to help engineers test and tune print processes," Shea says.

Overall, Shea is a huge proponent of process control throughout the entire factory.

"I was lucky enough to work for a brilliant statistician early in my career, and I quickly became a believer," she concludes. **SMT007**



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Electronic Industry News and Market Highlights

IoT Data Traffic Per Node: The New Critical Metric for IoT System Designers ▶

The best IoT message bandwidth planning may not survive the first contact with real-world data as IoT system integrators (SIs) and network planners face the challenge of developing a project concept while at the same time anticipating the data traffic use case requirements.

Global Smartphone Production Growth Will Drop to Only 5% in 2018 ▶

According to the latest research by TrendForce, Chinese smartphone brands have continued the prior year's strong growth momentum in 2017, bringing the global smartphone production to 1.46 billion units, an increase of 6.5% compared with 2016.

Global Defense Spending Forecast to Reach \$1.7T in 2018 ▶

Global defense expenditure is set to increase again in 2018 to reach its highest level since the end of the Cold War, according to the annual

Jane's Defense Budgets Report released today by IHS Markit.

Intervention in the Memory Market by China's NDRC May Affect Prices of Mobile DRAM ▶

On 22 December 2017, China's National Development and Reform Commission (NDRC) held a meeting with representatives from Samsung to express concerns about Samsung's role in the continuing price increase for memory products.

IHS Markit Identifies the Top 8 Technology Trends for 2018 ▶

From the Internet of Things (IoT) to the cloud to artificial intelligence, industries are seeing a new wave of technologies that have the potential to transform and significantly impact the world around us.

Shipments of Cellular M2M Terminals to Reach 13.7 Million by 2022 ▶

Berg Insight released new findings about the market for cellular M2M terminals. About 4.9 million cellular M2M terminals were shipped globally during 2016, up by 28% from the previous year.

Worldwide Spending on 3D Printing to be Nearly \$12B in 2018 ▶

Global spending on 3D printing (including hardware, materials, software, and services) will be nearly \$12 billion in 2018, an increase of 19.9% over 2017. By 2021, IDC expects worldwide spending to be nearly \$20 billion with a five-year compound annual growth rate (CAGR) of 20.5%.





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Feature Interview by Stephen Las Marias I-CONNECT007

Aculon Inc. commercializes unique surface coatings leveraging nanotechnology and other surface modification techniques. The company's original focus was the optical industry, developing treatments of prescription eyewear, sunglasses and other optics. In 2010, the company launched its electronics business, and since then has been one of the leading providers of nanocoating for stencils. Since 2012, Aculon has been a supplier of nanocoating to protect printed circuits from waterproofing. In 2015, the company launched its own series of Aculon branded products called NanoProof.

In an interview with *SMT007 Magazine*, Aculon Chairman and CEO Edward Hughes speaks about addressing their customers' challenges and ensuring customer satisfaction.

Stephen Las Marias: What challenges are your customers facing?

Edward Hughes: In electronics, we have two core products—NanoClear for stencils and NanoProof for PCB waterproofing. The challenges for stencil producers are both cost and complexity. There is tremendous cost pressure to reduce stencil costs at the same time as complexity increases as apertures become smaller due to miniaturization. For PCBs, waterproofing is a huge issue not just for mobile phones but also other premium electronics. NanoProof allows customers to waterproof their device in a cost effective, easy to apply manner without costly vacuum equipment.

For NanoClear, we added repellency functionality to stencils that paybacks in hard savings in generally less than 200 prints. As a result, our customers enjoy dramatic improvements in first pass yield and lower consumables costs for an investment of less than \$50 per stencil. For NanoProof, we are providing a more effective waterproofing solution up to and including IPX-7 that is both cost effective and easier to apply than alternative conformal coatings or vacuum deposition processes.

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Las Marias: What are the major drivers for growth for your company?

Hughes: We have terrific penetration of the stencil market with our NanoClear products in the United States.



Edward Hughes, Aculon

For NanoClear, most of the growth is coming from Europe and Asia. For NanoProof, the growth is all coming from OEMs wanting to waterproof their devices. 2018 is going to be the year when most premium electronics offer some form of waterproofing and

traditional solutions such as conformal coatings do not cut it.

Las Marias: What trends do you see as you look out at the electronics manufacturing industry?

Hughes: Increased complexity and functionality of PCB design. Both trends mean that the use of nanocoating with stencils or PCBs is going to be more prevalent.

Las Marias: What percentage of your customers do you work closely with from design to assembly?

Hughes: Very few. Most customers come to us as either the stencil does not print well and they need a nanocoating, or the marketing team has decided they need waterproofing for the device and the engineering team has been tasked with making something work without changing the design.

Las Marias: What is your customer satisfaction goal?

Hughes: Very high. Once we get spec'd into a product, we stay with the product for years.

Las Marias: What is the most important attribute for customer service?

Hughes: Speed. We need to get back to our customers quickly.

Las Marias: What is the cost of not meeting customers' needs?

Hughes: You do not spec'd into a program and lose the business opportunity.

Las Marias: What is your biggest unfulfilled need from your supply base?

Hughes: Inventory. Some of our raw materials are either custom or in high demand. As our business grows, we are placing more demands on our suppliers and some are struggling to keep up.

Las Marias: How important is the technical expertise of the customer service staff?

Hughes: Very. While our customers don't necessarily understand all the details of our chemistry solutions, being able to understand their needs is critical to not only establishing credibility early on but also allowing us to offer a solution that works.

Las Marias: What is the most important feedback/metrics you want from your customers?

Hughes: Repeat orders. If they like it, they continue to buy.

Las Marias: How would you rate your responsiveness to all customer requests?

Hughes: Excellent. As a smaller company, we are very nimble and so can customize development quickly to meet customer needs.

Las Marias: What is a recent example of how you exceeded customer expectations?

Hughes: Much of our work is covered by confidentiality agreements but an excellent publicized example is a Rauland Borg case study using NanoClear. Within a six-month time frame, Rauland Borg applied NanoClear on all



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their stencils and were able to reduce defects by 52%, increase SMT throughput by over 30%, and save over \$1 million per year. Their total investment was less than \$5,000 in NanoClear products.

Las Marias: Highlight some best practices to improve the electronics assembly process.

Hughes: We are a big believer in Chrys Shea's research in the SMT industry for improving print processes. Her best practice recommendation for improving the SMT print process is something she calls "the trifecta". She recommends a combination of: (1) using softer wipe paper; (2) using engineered solvents; and (3) using NanoClear nanocoating on all your stencil. She has developed tons of data that shows

it saves money, improves print quality, and is easy to do.

Las Marias: Is there anything else you'd like to add?

Hughes: 2018 is going to be another great year for Aculon. The market is moving towards needing more nanocoatings whether it is for better stencil printing or for waterproofing. We have industry leading products in both categories and are well positioned for continued growth.

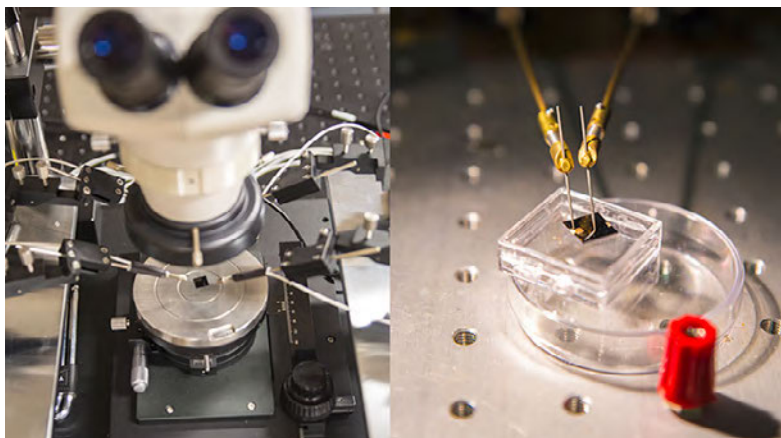
Las Marias: Thank you very much, Edward.

Hughes: Thank you. SMT007

Making IoT Possible with a New Breed of Memristors

The Internet of Things (IoT) is coming, that much we know. But still it won't, not until we have components and chips that can handle the explosion of data that comes with IoT. Two hurdles need to be overcome. First, current transistors in computer chips must be miniaturized to the size of only few nanometers. Second, analyzing and storing unprecedented amounts of data will require equally huge amounts of energy.

Sayani Majumdar, Academy Fellow at Aalto University, along with her colleagues, is designing technology to tackle both issues. They have designed and fabricated the basic building blocks of future components in what are called "neuromorphic" computers inspired by the human brain.



In their recent article in *Advanced Functional Materials*, Majumdar and her team show how they have fabricated a new breed of "ferroelectric tunnel junctions", that is, few-nanometer-thick ferroelectric thin films sandwiched between two electrodes. They have abilities beyond existing technologies and bode well for energy-efficient and stable neuromorphic computing.

The junctions work in low voltages of less than 5 V and with a variety of electrode materials—including silicon used in chips in most of our electronics. They also can retain data for more than 10 years without power and be manufactured in normal conditions. We are no longer talking of transistors, but 'memristors'.

"What we are striving for now, is to integrate millions of our tunnel junction memristors into a network on a one square centimeter area. We can expect to pack so many in such a small space because we have now achieved a record-high difference in the current between on and off-states in the junctions and that provides functional stability. The memristors could then perform complex tasks like image and pattern recognition and make decisions autonomously," says Majumdar.



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June 5-7, 2018
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Symposium on Counterfeit
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June 26-28, 2018
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by Ken Horky

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Assist time is the human intervention required to keep a machine producing during normal operation. It does not include errors, maintenance, setup, and prototyping.

Improving machine process throughput requires more or faster machines. Lost time on a machine can't be recovered without adding more time. Consider a SMT printed circuit board assembly (PCBA) with 500 component placements:

- If a line is stopped for one minute, for any reason, and its capacity is 5,000 components per hour (cph)
- 83 placements are lost or four PCAs per 24 hours will not get shipped to the customer, likewise
- 40,000 cph = 667 placements lost or 32 PCAs per day
- 100,000 cph = 1667 placements lost or 80 PCAs per day

There are many reasons for a machine to require assistance. PCB loading, stencil wiping, paste addition, feeder replenishment, and PCBA unloading—some require labor, some can be automated, but all will require some amount of time to complete.

The pick-and-place (PnP) machine is usually the bottleneck. Let's simplify and only look at three assist operations required of every PnP machine (see Table 1).

Line A may be low volume; Line B, medium volume; and Line C, high volume. The maximum achievable throughput would require instantaneous board transfer, registration and feeders of unlimited supply.

Considering the PCBA above with 500 placements, assuming all the parts are supplied on tape and reel with an average reel size of 3,500 parts/reel, the resulting throughput based on Table 1 assist times can be seen in Table 2.

For comparison, the maximum achievable throughput can be seen in Table 3.

As line throughput increases, assist time has greater impact and can justify increasing automation.



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The acquisition of Cartel brings APCT much needed capacity and regional support, while the acquisition of Cirtech brings APCT Flex & Rigid Flex capabilities and the corresponding certifications of the Defense & Aerospace industries.

According to APCT President / CEO Steve Robinson, "As APCT continues to grow, we will not only share our expertise with those new to us; but will continue to nurture the culture of Passion, Commitment & Trust that has become the very fabric of our existence."

APCT Continues Its Mission Statement of:

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|-------------------|---|
| Passion | <i>To Provide Ultimate Customer Satisfaction</i> |
| Commitment | <i>To Service and Execute with High Reliability</i> |
| Trust | <i>To Be Earned By Our Actions</i> |

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Table 1.	Line A	Line B	Line C
cph/Place Cycle Time Seconds	5,000 /0.7	40,000 /0.09	100,000 /0.036
1) PCB Load & Register	20	5	2
2) PCBA Unload	10	2	1
3) Feeder Replenish	60	40	20

Table 2.	Line	cph	Place Cycle Time Seconds	PCAs Built per Hour	DeRating
PCB Load & Register	Line A	4,737	0.76	9.5	5%
	Line B	36,000	0.10	72	10%
	Line C	90,000	0.040	180	10%
PCBA Unload	Line A	4,865	0.74	9.7	3%
	Line B	38,298	0.09	77	4%
	Line C	94,737	0.038	189	5%
Feeder Replenish	Line A	4,884	0.74	9.8	2%
	Line B	35,493	0.10	71	11%
	Line C	86,301	0.042	173	14%
TOTAL	Line A	4,516	0.80	9.0	10%
	Line B	31,188	0.12	62	22%
	Line C	75,449	0.048	151	25%

Table 3.	Line	cph	Place Cycle Time Seconds	PCAs Built per Hour
TOTAL	Line A	5,000	0.72	10
	Line B	40,000	0.09	80
	Line C	100,000	0.036	200

How to Reduce Assist Time

Print

- Use manual dispense guns with paste supplied in cartridges rather than scooping from jars

- Automate under stencil wipe and paste deposition
- Reduce stencil fiducial verification when possible
- Reduce auto post print inspection points when possible. Programming a single

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scan across the length of a board may suffice

Place

- Improve operator's response time to a machine request for assistance
- Purchase larger reel sizes, splice small reels into larger reels, multiply feeders' positions
- Segregate panels with X-outs so you only search for bad marks when necessary
- Have extra feeders loaded and ready, so that many systems continuously report which feeder will run out next

Reflow

- Automate handling, loading, and unloading.

In General

- Reducing operator assist time up and downline of placement will allow faster response to feeder replenishment
- Prioritize operator response for the bottle neck in your line
- Locate machines to reduce operator travel distance
- Increase conveyor speeds

The numbers and calculations used here are greatly simplified. You can always create a simple spreadsheet with the assist variables you identify in your process for a better understanding of the impact on your throughput. **SMT007**



Ken Horky is a process engineer at Peterson Manufacturing.

Cicor's Approach to Miniaturization: Cost of Function, and More

Cicor is a Swiss PCB manufacturer and an electronics manufacturing services (EMS) provider, offering turn-key solutions and HDI work to their customer base, which currently includes four of the five biggest hearing aid manufacturers in the world.

Karl Heinz-Fritz is the company's VP of technology, wherein he is responsible for technology development,

dealing with all of his company's product groups. Given his background in electronics, particularly in substrate manufacturing, PCBs, thin film circuits, thick film circuits, as well as the micro-assembly of these boards, a big part of his job is to elaborate solutions together with customers.

"And that is what I like the most about this job: making contact with customers, trying to find solutions, and trying to offer alternatives if something is not possible or feasible. I don't like to say, 'No, that's not possible.' This is also what I'm encouraging my people to do, to try to offer options to help our customers to make products more stable, more reliable. Design for manufacturability is a big part of our business," says Heinz-Fritz.

To read more about I-Connect007's Barry Matties' interview with Heinz-Fritz, including their newest product line, which can shrink the size of a circuit by up to 40%, and the importance of measuring the cost of functionality, [click here](#).





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Feature Interview by Stephen Las Marias I-CONNECT007

Vexos Inc. is a full service, high-mix, low- to mid-volume electronics manufacturing service (EMS) provider with a proven track record of supplying state-of-the-art engineered product solutions to a diverse group of OEMs and other product-based companies. The company prides itself in offering its customers local service, with a global footprint to accommodate any of their product/assembly needs—from PCBs and custom electro-mechanical components to EMS.

In an interview with *SMT007 Magazine*, Greg Hebson, global director for strategic accounts at Vexos, speaks about working closely and growing with customers, as well as ensuring total customer satisfaction.

Stephen Las Marias: Greg, what challenges are your customers facing?

Greg Hebson: One of our ongoing concerns based on the market is extended lead times for electronic components and best managing

material availability as required for both our sustaining products as well as new program introductions. The more visibility that our customers can provide, all the better. Having a rolling forecast that is updated on a frequent basis provides significant value in managing the material pipeline as necessary to support the product build schedules as needed. Many of our customers currently offer this type of forecast planning horizon, which provides significant benefits for all involved.

Significant focus is being provided to support our ongoing customer demand needs. We strongly encourage our customers to provide a rolling demand plan with a planning horizon of six to 12 months for our ongoing material planning. Ongoing communications is critically important to ensure that actions are being taken to support our customers production needs

Las Marias: What are the major drivers for growth for your company?

Hebson: We look to continued growth by supporting our current customers and meet-

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ing their EMS manufacturing needs with both existing programs as well as new product initiatives. Equally important is engaging with new customers on a regular basis. Our seasoned sales team understands that the life blood of any organization is based on new program launches. We focus a significant amount of time in working with new program initiatives within the engineering groups to provide additional support and value as and when the program is being developed.



Greg Hebson, Vexos

Las Marias: What trends do you see as you look out at the electronics manufacturing industry?

Hebson: Customer requirement for new product launch support and speed to market continue to dominate our discussions. This, coupled with a somewhat uncertain end-market demand, drives the need for high levels of procurement and manufacturing flexibility. Although these business pressures are not new, they continue to grow in importance as we provide service to new and existing customers. Environmental compliance and the selection of component materials, which comply with environmental requirements, are growing as a focus area as we work with OEM customers.

We continue to invest in training for our staff in these areas to remain current with environmental directives. Also, as more OEMs shift their focus from factory exit costs to total cost of ownership, we see growing opportunity to demonstrate the benefits of a global sourcing and manufacturing model. I see this as a very positive trend.

Las Marias: What percentage of your customers do you work closely with from design to assembly?

Hebson: Mostly, our model aligns well with our customer's needs during the early design

stages. Be it working on new electro-mechanical products and/or the EMS assembly requirements allows us to become involved very early in the process. We focus a considerable amount of time in designing out costs, with an eye towards design for manufacturability (DFM). During our involvement in design reviews, we'll focus on key areas throughout the cycle and provide critical feedback to address potential issues and ensure a successful new product introduction. Design

reviews can also be categorized into material (design for supply chain), test (design for testability), fabrication (design for fabrication) and assembly (design for manufacturability).

Key areas of DFM include:

- Develop, support and release product level process flow, control plans, FMEA, Master Validation Plan and IQ/OQ/PQ in conjunction with your engineering. Design FMEA and critical part inputs drive risk assessment and development strategy.
- Develop process and test traceability to support your reporting requirements.
- Utilize our copy exact processes and procedures to facilitate multiple site transfer and validation as production ramp.
- To support the product development, automatic optical inspection (AOI), 5DX, flying probe, in-circuit test (ICT), and functional system integration and test capabilities will be quoted and provided to support the product development.
- Process engineering in conjunction with your requirements will design any necessary custom packaging and perform required testing as per ISTA requirements.

Working closely with our customers on early involvement in the design cycle can provide a product that is more cost effective, has increased



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Figure 1: Vexos has the size and capabilities of a larger Tier 2 EMS provider while maintaining the flexibility and advantages of a Tier 3 manufacturer in this space.

manufacturability and quality, and has higher reliability and a longer overall lifecycle.

Las Marias: What is your customer satisfaction goal?

Hebson: On-time delivery at the lowest total cost of ownership. Vexos is dedicated to developing robust, integrated solutions that excel in creating customer value and satisfaction. We develop, maintain, and continually improve effective and efficient processes to ensure excellence in on-time delivery and the quality of our products and services.

Las Marias: What do you think is the most important attribute for customer service?

Hebson: Without question, trust, is the number one attribute. Our customers need to be confident that we are looking out for their better interest, all the time. We are an extension of their production organization, and they need to be 100% confident that we will do as necessary to support their needs.

Las Marias: What is the cost of not meeting your customers' needs?

Hebson: The short answer, is you lose revenues for both your customer as well as your company, which is never a good thing for all involved. Open, honest and continued communication is key to keeping all well informed. Our company prides itself in meeting customer expectations, certainly this assumes that the customer's expectations are realistic and achievable.

Las Marias: What is your biggest unfulfilled need from your supply base?

Hebson: In determining which suppliers are awarded business, we factor in value-added and supply chain services that distributors offer. Such services can reduce cost of ownership, improve delivery and reduce supply chain risk. Having the right number of capable distributors can help EMS providers avoid shortages, reduce cost and manage supply chain risk.

Las Marias: What is the most important feedback/metrics you want from your customers?

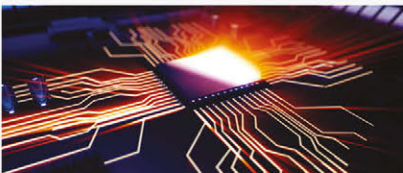
Hebson: Growing sales revenues. If we are growing with a customer, one can assume

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that we are adding value and providing our customers with a sustainable strategic advantage. Our ultimate goal is to grow with our customer, providing a win-win relationship for our collective organizations.

Las Marias: Please highlight some best practices to improve the electronics assembly process.

Hebson: We are diligent about maintaining flexible and responsive production time to meet our customers' needs. From new product introduction (NPI) to an entire program lifecycle, Vexos' unique and innovative hybrid manufacturing solutions create options best suited to our customers' products' markets and maturity level by utilizing the geographic strengths of each of our global locations to effectively support their products through their entire lifecycle.

Las Marias: How important is the technical expertise of the customer service staff?

Hebson: Having a dedicated, technical team that understands our manufacturing process is critically important. All our customers are assigned a specific Program Manager to manage the commercial and operational aspects of our business relationship. Each Program Manager resides at the manufacturing facility and over-

sees the entire relationship from NCI, NPI to full production. Having one point of contact is extremely important, we want to be certain that our customers has a "go to" contact for ease of communications.

Las Marias: Is there anything else you'd like to add?

Hebson: One of our primary strengths is that we have the size and capabilities of a larger Tier 2 EMS provider while maintaining the flexibility and advantages of a Tier 3 manufacturer in this space. It can offer customers higher quality of services—at a comparable price point—that they would get from a large Tier 2 firm, but with the ability to support new product introductions more quickly and provide expert support with a deeper understanding of the customers' business mindset.

What makes us different in the Tier 3 space is a strong focus on engineering expertise and supply chain, as well as a global footprint to support strategic supply chain migration of our customers as they ramp up their own production. The culmination of those three things makes us very attractive.

Las Marias: All right, thank you Greg!

Hebson: Thank you. SMT007

Indium's Karthik Vijay Talks Engineering for Automotive Applications

Karthik Vijay is the head of Indium Corporation's application support team in Europe. In his role, he is at the center of the complex material challenges faced by the world's biggest automotive manufacturers in their creation of PCBs and power modules. I-Connect007's Barry Matties interviewed Karthik at last year's productronica about his responsibilities, industry challenges, trends and opportunities, and standards creation in autonomous vehicles. Everything from stencils and laser cutting to flux technology and jetting were also discussed.

If you want to know about where material technology currently stands in the automotive landscape, read the [full interview here](#).





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April 11

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IPC Europe Technical Education
in English
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April 18–19

Workshop

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in German
Ingolstadt, Germany

April 24

Workshop

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Free World
San Jose, CA, USA

April 24

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Complimentary event, network and learn more about IPC
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April 25

Webinar

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April 25

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Workshop

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May 9

Webinar

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May 15–17

Conference

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May 21–23

Meeting

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May 23

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Meetings

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Improving SMT Yield and Reducing Defects: A Rauland Case Study

Article by Edward Hughes
ACULON

Ever-increasing demand for more complex boards that have higher densities of components means more challenges for SMT assembly operations and yields. Smaller component sizes and more densely packed PCBs lead to more powerful designs in much smaller product packages. These advancements have spurred a new set of challenges in building smaller and more complex assemblies.

Even though SMT products have been manufactured in high volume for decades, SMT line issues continue to be prevalent and new demands continue to pose new challenges. While the SMT print process is not complicated, controlling the outcome is complex. Having an underperforming SMT process results in lots of rework, lower throughput and added product costs as well as product reliability issues.

Rauland, a division of AMETEK Inc., is an 80-year integrated communications technol-

ogy company that builds nurses call stations and school bell systems. The company responds to market needs globally with two distinct communication system product lines: Responder, designed for the healthcare industry; and Telecenter systems, which serve the educational market.

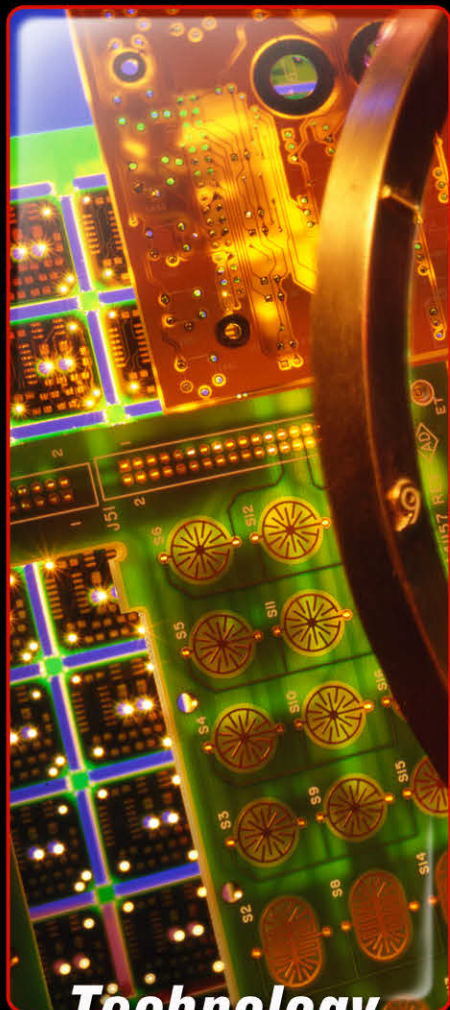
SMTA-certified Process Engineer Jimmy Crow works at Rauland's highly sophisticated, FDA-compliant manufacturing facility that has state-of-the-art SMT equipment. At Rauland they build four- to eight-layer PCBs, place BGA, PCBGA, QFNs, typical double-sided boards, with its smallest part to date an 042 Aperio.

Disciplined and quality conscious, Crow was not happy with the performance of his SMT line. There were too many defect and too much line downtime. Rework levels were also too high. His goal was to reduce SMT related defects and increase throughput while maintaining quality.

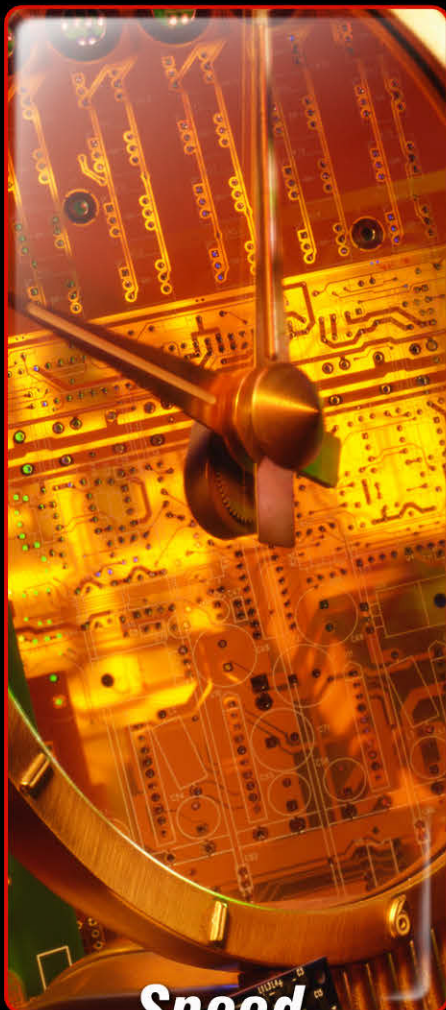
Studies have shown that 65% of defects from SMT lines comes from the screen-print-

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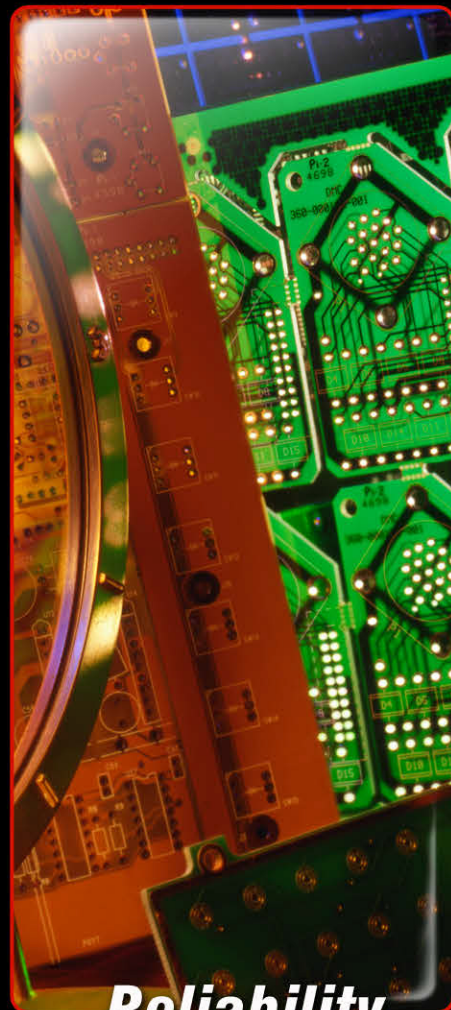
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Business Case: Actual Quality Improvement

Between May 2016 and August 2016

SMT defects **down 52%**

• Per Koh Young Zenith AOI

ATE defects **down 42%**

• Expensive to repair & retest

	Defects in SMT (OQR Report)				Defects in ATE (OQR Report)			
	Defects	# Boards	Defects/Board		Defects	# Boards	Defects/Board	
May	804	90,000	0.89%		1503	49,842	3.0%	
Aug	763	179,772	0.42%		1753	100,866	1.7%	
Reduction in SMT Defects			52.49%	Reduction in ATE Defects			42.4%	

Figure 1: Jimmy Crow delivered terrific results for Rauland: SMT-related defects were reduced by over 50%; throughput was increased by over 20%, and the company saved \$1 million per year for three SMT lines.

ing process, and Crow felt this was certainly the case in his factory. With a 22-second mean cycle time, the stencil printer was the gating process on the assembly line because it was stopped every two and a half minutes for cleaning. As a result, the SMT line would be empty of boards. The line badly needed balancing as no one wants the stencil printer to be the slowest item on assembly line.

To achieve this, Crow started by concentrating on the screen printing process, which has the largest impact over yield, throughput, quality, and downtime costs. He concentrated primarily on process improvements. Crow began a systematic root cause analysis of the defects.

1. Under Screen Cleaning

Crow's initial focus was on the substances that clean the screen mechanically—the “paper” and the under-screen solvents used. After investigating different types of paper, Crow found there were better options out there than the current product. He selected a more porous wipe material that he thought would allow for better wiping. The Micro-Care Stencil easily handled the sharp edges on the SMT stencil, which often shredded old-style stencil

wipes, causing defects and rework. The structure of the open paper also captures solder balls better than some of the closed structure fill papers.

2. Solvents

Crow then turned his attention to under-screen solvents. IPA (isopropyl alcohol) was problematic because newer solder pastes are comprised of synthetic resins, and the alcohol made the solder viscosity and machinery difficult to maintain. The cleaning properties were not good enough with

IPA, as it did not clean and caused some paste bricks to cling to the aperture walls. He even turned off the IPA and sprayed nothing, and experienced the same results. So, he knew he needed to find a better solvent.

For the solvent, he wanted something that was efficient without being harmful to the screen printer. He ultimately chose Zestron Vigon UC160, an aqueous-based cleaning medium specifically designed for SMT stencil. The water based formulation evaporates more slowly than IPA, but could clean with less wipes.

3. Nanocoating

In taking a systemic view of his SMT line issue, Crow had found a better paper and a better solvent, but he was still experiencing defects and downtime. They were still wiping every four to five boards based on the complexity of the stencil. Something was missing to make the process improvement complete.

That was when Crow met an SMT manufacturing expert, Chrys Shea, at an industry conference and found she had been conducting the same SMT line improvement programs and had delivered remarkable results. Her scientific approach to solving the SMT line

issues mirrored Crow's, but she had already found the missing ingredient that he was looking for, a nanocoating. Shea's research had led her to advocate Aculon's NanoClear, a stencil treatment technology, for several years as she had been able to demonstrate significant improvements in performance across many SMT lines.

When Crow added NanoClear to his SMT process, he followed Shea's advice and expected to double under-stencil wipe cleaning every fourth or fifth board to every eighth or ninth or tenth board. With Aculon's NanoClear, Crow's throughput was increased by a third and the factory's defect as tracked by Koh Young Zenith and AOI dropped by 52%. All his projections were blown away. Crow's line could now run 24 print cycles before cleaning. Their AOI and ATE tests saw no reduction in quality. With a faster screen printer, a faster SMT line and a cleaner process, Crow maintained improved quality while running faster.

The Numbers

Crow thought he had found the trifecta—softer wiper paper, engineered solvents and a nanocoating. As a result, Crow delivered terrific results for Rauland: SMT-related defects were reduced by over 50%;

Rauland-Borg Cost Savings Calculator (available at www.Aculon.com/NanoClear-Stencil-Wipes)	
Quality	
Current First Pass Yield, %	80
Projected First Pass Yield, %	99
% Improvement	19%
% of defects requiring simple rework	90
% of defects requiring complex rework	10
Savings in Yield Improvement, per print	\$1.05
Productivity	
Current Wipe Frequency	5
Projected Wipe Frequency	24
% Reduction	79%
Per print savings, under wipe consumables	\$0.007
Cost Reduction	
Cost of simple rework	\$2.30
Cost of complex rework	\$34.50
Cost of wiper paper, per wipe cycle	\$0.03
Cost of solvent, per wipe cycle	\$0.02
Modify cost information on the "Resources" tab	
Payback Period	
Savings per print	\$1.06
Cost of NanoClear	\$25.00
Cost of Application	\$20.00
Payback - # of Prints	43
Annual Savings per SMT Line	
# of prints per hour	90
# of production hours per week	80
# of paper roll changes per week	12
Time to change wiper roll, minutes	5
Annual Cost Reduction	\$395,338
>>> PLUS <<<	
Additional Production Uptime, hours per year	52
Additional PCBs assembled per year	4680

Figure 2: With the cost calculator, management could easily see the result of the process improvement program.

Operating Cost Savings Estimated	
Cost of Simple Rework	
Time Required (min)	4
Labor rate, per hour	23
Benefit rate (%)	25
Overhead rate (%)	25
Cost of Simple Rework	\$ 2.30
Cost of Complex Rework	
Time Required (min)	60
Labor rate, per hour	23
Benefit rate (%)	25
Overhead rate (%)	25
Cost of Complex Rework	\$ 34.50
Cost of Wiper Paper	
Cost per roll	20
Length of roll (m)	10
Advance per wiper pass (mm)	5
# of wiper passes in cycle	3
Cost of Paper per Wipe Cycle	\$ 0.03
Cost of Wiper Solvent	
Cost of solvent container	30
Capacity of solvent container (L)	4
Volume of solvent used on each wipe (ml)	2
# of solvent passes in wipe cycle	1
Cost of Solvent per Wipe Cycle	\$ 0.02

Figure 3: The cost calculator considers the costs of rework, both simple and complex, the cost of wiper paper, and the cost of the solvent.

throughput was increased by over 20%, and the company saved \$1 million per year for three SMT lines. First pass yield went from 80% to 99%. The line had a 79% reduction in under-stencil wiping as the interval went from five prints per wipe to 24 prints per wipe.

Using the downloadable cost of ownership calculator Shea created for Aculon, Crow could

demonstrate to management the result of his process improvement program. In calculating savings, the cost calculator considers the costs of rework, both simple and complex, the cost of wiper paper, and the cost of the solvent. Using the calculator, Crow could determine that the cost per board for simple rework was \$2.30 per board compared with \$34.50 per board for the cost of complex rework. In addition, the cost of paper was just \$0.03 per board and the cost of solvent was \$0.02 per board.

By combining the rework savings along with the reduction in paper and solvent used due to less under-stencil wiping, the annual savings demonstrated from using the calculator were considerable. In addition, as Crow's team was not changing wiper rolls as often,

he was getting an extra 52 hours—over a full shift week—of additional production a year. For his investment, Crow produced an additional 5,000 boards a year. With approximately 200 stencils at a cost of \$25 an application, a total investment across all stencils is about \$5,000—to save \$395,000.

Crow's management recognized the magnificent work by giving him a bonus and promotion. So, what can we say, but, 'Well done Jimmy!' Here's to a job well done. **SMT007**



Edward Hughes is the chairman and CEO Aculon.

Rewritable Wires Could Mean No More Obsolete Circuitry

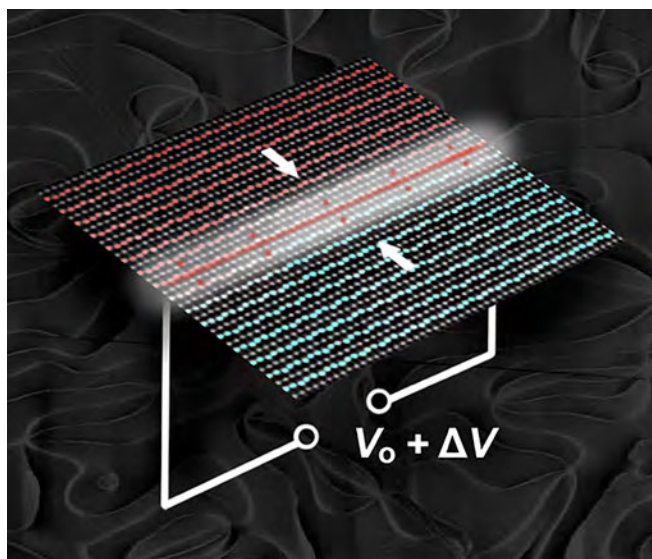
Ferroelectric materials have spontaneous electrical ordering that can be changed by applying an electric field. Where two domains of different polarizations meet, it is called a ferroelectric domain wall. These domain walls are promising for next-generation circuit elements due to their unusual electronic properties and because they can be formed, moved, and erased on demand.

Scientists envision a transistor where the gate is a domain wall itself—and whether you can pass current

through the domain wall is controlled by the charges in the domain wall. Now, scientists have found that they can reversibly switch domain walls between being resistive or conductive depending on the electric field they apply.

Using atomic-resolution electron microscopy and spectroscopy, they found that the electrons that move to the wall were confined to just one to two repeating crystalline unit cells in erbium manganite (ErMnO_3). When the polarizations of the two ferroelectric domains point at each other (head-to-head), there is nominally a buildup of positive charge at the domain wall. This positive charge was compensated by extra electrons that accumulated on the atoms within the domain wall. These electrons were stuck, shielding the local charges, and did not conduct.

By applying an electric field, extra electrons flowed into the channel at the domain wall. When all the local charges were sufficiently shielded, the electrons in the channel were free to move within the domain wall, forming a 2-D conductive sheet. This conductive sheet could be used as a switch or transistor. The switch is "off" when current does not flow. Applying an electric field allows current to pass, turning the switch "on." This paves the way towards developing all-domain-wall electrical devices.



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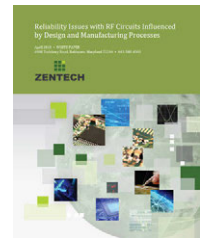
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RF Reliability Influenced by Design and Manufacturing

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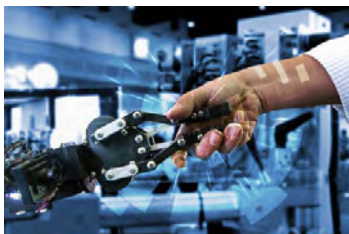
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TOP 10

Recent Highlights from SMT007.com

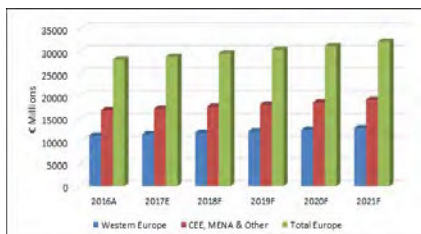
1 Is UK Manufacturing Ready for the Fourth Industrial Revolution? ▶

The new fourth Industrial Revolution (4IR) is driving the transformation of manufacturing across the world, encompassing breakthroughs in artificial intelligence, big data, the Internet of Things and 3D printing.



2 Positive Outlook for European EMS Industry ▶

After a few years of very slow growth, the mood in the European EMS industry is more buoyant in 2017 and the prospects for further growth are good.



3 Customers Drive Investment Decisions ▶

In our recent survey on investing in new equipment, one question we asked is what or who influences the research into new equipment to buy for their factories. A majority, 77% of respondents, say that addressing customers' needs is the primary influence in their research for new equipment, followed by market conditions or trends.

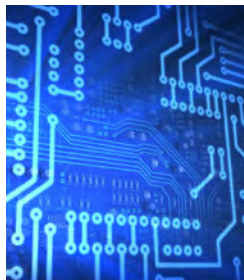


4 Top Reasons for Investing in New Equipment ▶

In our recent survey, a majority of respondents said they consider increasing capacity and improving their existing manufacturing capability as top reasons for investing in new equipment for their production lines.

5 IPC North American EMS and PCB Statistical Programs Open ►

IPC's statistical programs for the rigid printed circuit board, flexible circuit and contract electronics manufacturing industries in North America are now open to new participants for 2018.



6 Incap Group Appoints Tero Lehtonen as CFO ►

Tero Lehtonen has been appointed as chief financial officer and a member of management team of Incap Group effective January 2, 2018.



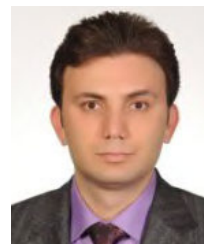
7 IPC Releases Through-Hole Component Prep & Hand Soldering Training Video ►

Many through-hole components are manually inserted, and hand soldered into SMT assemblies. This media training program will teach your operators and technicians best industry practices to make sure the job is performed properly and efficiently.



8 SMTA Invites Industry to Show Support for Students in Electronics ►

Many people would agree that the students of today will be the engineers of tomorrow, and the Surface Mount Technology Association (SMTA) is committed to nurturing that connection between academia and industry.



9 Syrma Technology Unveils Eco-Friendly A/C Inverter Controller Boards ►

Syrma Technology has launched a line of easily customizable air conditioner inverter controller boards, designed to coincide with increased global demand for green HVAC systems.



10 New Training Videos Available on IPC EDGE ►

IPC has announced new training videos available on IPC EDGE, its online training platform designed to deliver the education needed to acquire and develop the competitive skills necessary to excel in the electronics industry.



SMT007.com has the latest news and information. Subscribe to our SMT Week newsletter when you register at: my I-Connect007.

Career Opportunities

Pssst!
Are You Looking
for Someone?



Place your notice in our Help Wanted section.

For just \$500, your 200 word, full-column—or, for \$250, your 100 word, half-column—ad will appear in the Help Wanted section of all three of our monthly magazines, reaching circuit board designers, fabricators, assemblers, OEMs and suppliers.

Potential candidates can click on your ad and submit a résumé directly to the email address you've provided. If you wish to continue beyond the first month, the price is the same per month. No contract required. We even include your logo in the ad, which is great branding!

To get your ad into the next issue, contact:

Barb Hockaday at barb@iconnect007.com or +1.916.608.0660 (-7 GMT)

I-Connect007
GOOD FOR THE INDUSTRY





Work where you live!

The I-Connect007 China team is seeking an experienced salesperson to generate and manage a revenue stream for our Chinese publications.

Key Responsibilities include:

- Sell advertising contracts for monthly magazine
- Develop and cultivate new business
- Keep timely and accurate records
- Generate and follow up on all leads
- Manage contract renewals
- Account management: work with local and international team to provide customer support
- Phone and email communications with prospects
- Occasional travel

Qualifications

Successful candidates should possess a university degree or equivalent, experience with managing and cultivating leads, projecting, tracking and reporting revenue. We are looking for positive, high-energy candidates who work well in a self-managed, team-based, virtual environment.

Compensation

This is a base salary-plus-commission position. Compensation commensurate with experience.

Requirements

- Must be located in China Mainland, South China area preferred
- Good command of Chinese language, proficient with English speaking and writing
- Able to follow established systems and learn quickly
- Able to maintain professional external and internal relationships reflecting the company's core values
- 2-5 years' sales experience
- Experience with Microsoft Office products
- Must be highly motivated and target-driven with a proven track record for meeting quotas
- Good prioritizing, time management and organizational skills
- Create and deliver proposals tailored to each prospect's needs
- Experience in the electronics industry desirable

[QUALIFIED CANDIDATES: CLICK HERE TO APPLY](#)

Career Opportunities



Position: Field Application Engineer

Saki America Inc., headquartered in Fremont, CA, a leader in automated inspection equipment, seeks two full-time Field Application Engineers (FAE), one in the Fremont headquarters and the other for the Eastern and Southern United States.

The FAE will support the VP of Sales and Service for North America in equipment installation, training, maintenance, and other services at field locations. The FAE will provide technical/customer support and maintain positive relationships with existing and future customers.

Strong analytic abilities and problem-solving skills are a must in order to understand customer applications and troubleshoot issues. The FAE will perform demos and presentations for customers and agents as well as assisting in trade show activities. Candidate must have a minimum of a two-year technical degree, experience in AOI, SPI, and X-ray inspection, and strong verbal and written communication skills. The position requires the ability to travel about three weeks per month. Must be a US citizen and be able to lift up to 40 lbs.

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Become a Certified IPC Master Instructor at EPTAC

Job Summary:

We are growing! EPTAC, a leading provider in the electronics training industry is looking for some great people to join our team. If you love teaching people, choosing the classes and times you want to work, and basically being your own boss, this may be the career for you. We are looking for instructors that have a passion for working with people to develop their skills and knowledge. If you have a background in electronics manufacturing and an enthusiasm for education, drop us a line or send us your resume. We would love to chat with you. Opportunities available across U.S. and Canada, especially in our growing markets of California, Chicago, Minnesota and New England. Some travel involved. IPC-7711/7721 or IPC-A-620 CIT certification a big plus.

Qualifications and Skills:

- A love of teaching and an enthusiasm to help others learn new concepts and skills
- Background in electronics manufacturing
- Previous soldering and/or electronics/cable assembly experience
- Previous IPC Certification a plus, but will certify the right candidate

Benefits:

- Ability to operate from home: no required in-office schedule
- Flexible schedule: control your own time, work as often as you like
- IRA retirement matching contributions after one year of service
- Training and certifications provided and maintained by EPTAC

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Career Opportunities



PCB Assembly Supervisor— full time Accurate Circuit Engineering— Santa Ana, CA

Position Summary: Responsible for all assembly processes to ensure continued growth as directed by management.

Essential Job Functions:

- Create, implement, and supervise in-house manufacturing facility
- Recruit, hire, train, and supervise assembly floor personnel
- Extensive hands on experience with all aspects of PCB assembly
- Understanding of IPC-A-610 standards
- Research and acquire additional assembly resources
- Gather data on product shortages, lead times, price changes, etc.
- Coordinate the assembly activities with sales to ensure 100% on-time delivery
- Create, implement, and supervise daily quality processes to ensure 100% accuracy
- Document, monitor and review progress of the business unit
- Respond to internal and external customers in a timely manner
- Coordinate walk-through, site audits, etc.

Qualifications:

- Minimum 3 years as operations supervisor of electronics assembly house
- 5+ years' experience in the electronics industry
- Previous experience as a quality or operations supervisor preferred
- Ability to solve practical problems using pre-established guidelines
- Strong facility in Microsoft Office applications
- Excellent verbal and written communication skills
- Ability to work with people of diverse backgrounds
- Highly organized/excellent time management skills
- Ability to perform at the highest level in a fast-paced environment
- Valid California driver's license.

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PCB Process Planner

Accurate Circuit Engineering (ACE) is an ISO 9001:2000 certified manufacturer of high-quality PCB prototypes and low-volume production for companies who demand the highest quality in the shortest time possible. ACE is seeking a skilled individual to join our team as a PCB process planner.

Responsibilities will include:

- Planning job travelers based on job release, customer purchasing order, drawings and data files and file upon completion
- Contacting customer for any discrepancies found in data during planning and CAM stage
- Consulting with director of engineering regarding technical difficulties raised by particular jobs
- Informing production manager of special material requirements and quick-turn scheduling
- Generating job material requirement slip and verify with shear clerk materials availability
- Maintaining and updating customer revisions of specifications, drawings, etc.
- Acting as point of contact for customer technical inquiries

Candidate should have knowledge of PCB specifications and fabrication techniques. They should also possess good communication and interpersonal skills for interfacing with customers. Math and technical skills are a must as well as the ability to use office equipment including computers, printers, scanners, etc.

This position requires 3 years of experience in PCB planning and a high school level or higher education.

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Career Opportunities



Chemical Process Engineer

Chemcut, a leading manufacturer of wet-processing equipment for the manufacture of printed circuit boards for more than 60 years, is seeking a Chemical Process Engineer. This position is located at Chemcut's main facility in State College, Pennsylvania. Applicants should have an associate degree or trade school degree, or 4 years equivalent in chemical process engineering.

Job Responsibilities Include:

- Developing new industrial processes
- Providing process criteria for both new equipment and modifying existing equipment
- Testing new processes and equipment
- Collecting data required to make improvements and modifications
- Assisting in investigating and troubleshooting customer process problems
- Ensuring that equipment works to its specification and to appropriate capacities
- Assessing safety and environmental issues
- Coordinating with installation/project engineers
- Ensuring safe working conditions and compliance with health and safety legislation

Key Skills:

- Aptitude for, and interest in chemistry, IT and numeracy
- Analytical thinking
- Commercial awareness
- Ability to perform under pressure
- Communication and teamwork
- Problem-solving

Experience with circuit board processes is a plus.

Contact Arlene at 814-272-2800 or by clicking below.

[apply now](#)



Field Service Technician

Chemcut, a leading manufacturer of wet-processing equipment for the manufacture of printed circuit boards for more than 60 years, is seeking a high-quality field service technician. This position will require extensive travel, including overseas.

Job responsibilities include:

- Installing and testing Chemcut equipment at the customer's location
- Training customers for proper operation and maintenance
- Providing technical support for problems by diagnosing and repairing mechanical and electrical malfunctions
- Filling out and submitting service call paperwork completely, accurately and in a timely fashion
- Preparing quotes to modify, rebuild, and/or repair Chemcut equipment

Requirements:

- Associates degree or trade school degree, or four years equivalent HVAC/industrial equipment technical experience
- Strong mechanical aptitude and electrical knowledge, along with the ability to troubleshoot PLC control
- Experience with single and three-phase power, low-voltage control circuits and knowledge of AC and DC drives are desirable extra skills

To apply for this position, please apply to Mike Burke, or call 814-272-2800.

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Career Opportunities



Electronics Expert Engineer

Orbotech is looking for an Electronics Expert Engineer to handle various hardware activities, including communication, data path processing, device interfaces and motion, as well as system supporting functions in a multi-disciplinary environment.

What Will Your Job Look Like?

- Providing cutting edge hardware solutions for challenging product line needs
- Developing board design and Logic in VHDL
- Defining and managing interfaces (software, algorithm, mechanics and electricity)
- Successfully integrating hardware with other product disciplines
- Supporting the product needs during and following release

What Do You Need to Succeed?

- BSc in electronics engineering
- At least 5 years of R&D experience in complex board design, mainly FPGA (communication interfaces, DDR controller, algorithm implementation)
- Experience in an Altera/Xilinx development environment
- Experience in ECAD design tools (DxDsigner, ModelSim) is an advantage
- Knowledge in laser interfaces, RF and analog is an advantage

Who We Are

Virtually every electronic device in the world is produced using Orbotech systems. For over 30 years, Orbotech has been a market leader in developing cutting edge inspection, test, repair, and production solutions for the manufacture of the world's most sophisticated consumer and industrial electronics.

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Electronics Team Leader

Orbotech is seeking an Electronics Team Leader to join our electronics team, which develops multi-disciplinary systems, including vision/laser, image processing, and control and automation missions.

What Will Your Job Look Like?

- Lead a team of electronics engineers in a multi-disciplinary environment
- Lead electronic activities from requirement phase to development, integration and transfer, to production
- Be the focal point for other disciplines and projects managers
- Maintain and improve existing electronics platforms

What Do You Need to Succeed?

- BSc/MSc in electronic engineering/ computer science from a well-recognized university
- 5+ years' experience in digital board design, high-speed links, computing embedded systems, and HW/SW integration
- 2-3 years' experience in leading a team of engineers
- Solid skills in complex FPGA design with multi-modules
- Solid skills in high-speed board design, DDR3/4, PCIE, USB, IO, and optic links
- Ability to design and execute end-to-end solutions

Who We Are

Virtually every electronic device in the world is produced using Orbotech systems. For over 30 years, Orbotech has been a market leader in developing cutting-edge inspection, test, repair, and production solutions for the manufacture of the world's most sophisticated consumer and industrial electronics.

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Career Opportunities



ventec
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Technical Sales Engineer **Positions available in the** **Chicago area and California**

Do you want to advance your career by joining a globally successful and growing world class CCL manufacturer and help drive that success? As a California-based member of the technical sales team, your focus will be on Ventec's core market segments: mil/aero, automotive and medical, offering a full range of high-reliability materials including polyimide, IMS and thermal management products.

Skills and abilities required:

- Drive & Tenacity!
- 7 to 10 years of experience in the PCB industry in engineering and/or manufacturing
- Detail-oriented approach to tasks
- Ability to manage tasks and set goals independently and as part of a team
- Knowledge of MS office products

Full product training will be provided. This is a fantastic opportunity to become part of a successful brand and a leading team with excellent benefits.

Please forward your resume to:

jpattie@ventec-usa.com and mention
"Technical Sales Engineer - California Based
or Chicago area" in the subject line.

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INTERNATIONAL GROUP
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Ventec Seeking U.S. Product **Manager for tec-speed**

Want to work for a globally successful and growing company and help drive that success? As a U.S.-based member of the product and sales team, your focus will be on Ventec's signal integrity materials, tec-speed, one of the most comprehensive range of products in high-speed/low-loss PCB material technology for high reliability and high-speed computing and storage applications. Combining your strong technical PCB manufacturing and design knowledge with commercial acumen, you will offer North American customers (OEMs, buyers, designers, reliability engineers and the people that liaise directly with the PCB manufacturers) advice and solutions for optimum performance, quality and cost.

Skills and abilities required:

- Technical background in PCB manufacturing/design
- Solid understanding of signal integrity solutions
- Direct sales knowledge and skills
- Excellent oral and written communication skills in English
- Experience in making compelling presentations to small and large audiences
- Proven relationship building skills with partners and virtual teams

This is a fantastic opportunity to become part of a leading brand and team, with excellent benefits.

Please forward your resume to
jpattie@ventec-usa.com and mention
"U.S. Sales Manager—tec-speed"
in the subject line.

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Career Opportunities



IPC Master Instructor

This position is responsible for IPC and skill-based instruction and certification at the training center as well as training events as assigned by company's sales/operations VP. This position may be part-time, full-time, and/or an independent contractor, depending upon the demand and the individual's situation. Must have the ability to work with little or no supervision and make appropriate and professional decisions. Candidate must have the ability to collaborate with the client managers to continually enhance the training program. Position is responsible for validating the program value and its overall success. Candidate will be trained/certified and recognized by IPC as a Master Instructor. Position requires the input and management of the training records. Will require some travel to client's facilities and other training centers.

For more information, click below.

[apply now](#)



PCB Equipment Sales

World-class manufacturer of wet process equipment for the PCB and plating industries, Integrated Process Systems Inc. (IPS) is seeking qualified candidates to fill a position in equipment sales. Potential candidates should have:

- Process engineering knowledge in PCB manufacturing
- Outside sales background
- Residency on the West Coast to manage West Coast sales
- Knowledge of wet process equipment
- Sales experience with capital equipment (preferred)

Compensation will include a base salary plus commission, dependent upon experience.

[more details](#)

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For information, please contact:
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GOOD FOR THE INDUSTRY

Career Opportunities

Altium®

Business Development Representative at Altium

New Logo Business Development representatives are highly motivated and hardworking with an upbeat can-do attitude. They work with our New Logo Sales Team to displace our competition in accounts by offering Altium's unified PCB development tools within a defined region.

The New Logo Developer's (NLD) main responsibilities will be qualifying leads and prospecting into competitive lists, searching the web, and utilizing internal sales tools (Inside View, LinkedIn, Marketo, Salesforce) to uncover and work with opportunities for the New Logo Closer to close. They are expected to meet or exceed monthly, quarterly & annual quota.

Responsibilities:

- Develop lead opportunities by collecting information that includes business pains/needs, timelines, authority and project teams, budget, competitive information, etc.
- Aggressively drive daily prospecting calls to build pipeline of prospective clients and occasionally closing smaller deals
- Develop relationships with key partners in their territory to identify new business opportunities
- Plan and prioritize personal sales activities in conjunction with the New Logo Closer, with the goal of achieving sales targets
- Work alongside inside sales teams on specialized projects such as call-out campaigns, promo drives and webinar fulfillment
- Once trained, maintain an in-depth knowledge of Altium products and technologies, competitive products, and industry trends.

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Altium®

Application Engineer

The application engineer is the first contact for our customers who have technical questions or issues with our product. We value our customers and wish to provide them with highest quality of technical support.

Key Responsibilities:

- Support customer base through a variety of mediums
- Log, troubleshoot, and provide overall escalation management and technical solutions
- Create various types of topic based content, such as online help, online user guides, video tutorials, knowledge base articles, quick start guides and more
- Distill complex technical information into actionable knowledge that users can understand and apply
- Continually develop and maintain product knowledge

Requirements:

- Understanding of EDA electronic design software, schematic capture and PCB layout software
- Bachelor's degree in electronics engineering or equivalent experience
- Sales engineering and/or support engineering experience
- Circuit simulation and/or signal integrity experience
- Understanding of ECAD/ MCAD market segments
- Understanding of micro controllers, SoC architecture and embedded systems market
- Database experience preferred (i.e., MySQL, PostgreSQL, Microsoft Access, SQL Server, FileMaker, Oracle, Sybase, dBASE, Clipper, FoxPro) etc.
- Experience with PLM/PDM/MRP/ERP software (Program Lifecycle Management) preferred
- Salesforce experience a plus

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FPGA Design Expert

Orbotech is seeking a FPGA Design Expert to join our electronics team, which develops multi-disciplinary systems including vision/laser, image processing and electro-optics.

What Will Your Job Look Like?

- Lead image acquisition and processing activities in the team
- Engage in all aspects of FPGA design activity: requirement phase, coding, synthesizing, verification support and LAB bring up
- Participate in system definitions for current and next generation products
- Collaborate with other teams: SW, algorithm and QA

What Do You Need to Succeed?

- BSc/MSc in Electrical Engineering from a well-recognized university
- Extensive knowledge of VHDL
- 5+ years of FPGA development experience (requirement, architecture, RTL coding, simulation, synthesis, timing analysis, P&R, board level integration and verification)
- Experience in designing and implementing low-latency, high-throughput FPGA designs utilizing PCIe Gen2/3, Gigabit Ethernet, SERDES, DDR3/4
- Experience in complex FPGA such as Altera Stratix-II and Arria 5&10 devices
- Authoring documentation experience such as FPGA specifications and FPGA verification plans

Who We Are

Virtually every electronic device in the world is produced using Orbotech systems. For over 30 years, Orbotech has been a market leader in developing cutting-edge inspection, test, repair, and production solutions for the manufacture of the world's most sophisticated consumer and industrial electronics.

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Arlon EMD, located in Rancho Cucamonga, California is currently interviewing candidates for **manufacturing and management positions**. All interested candidates should contact Arlon's HR department at 909-987-9533 or fax resumes to 866-812-5847.

Arlon is a major manufacturer of specialty high performance laminate and prepreg materials for use in a wide variety of PCB (printed circuit board) applications. Arlon specializes in thermoset resin technology including polyimide, high Tg multi-functional epoxy, and low loss thermoset laminate and prepreg systems. These resin systems are available on a variety of substrates, including woven glass and non-woven aramid. Typical applications for these materials include advanced commercial and military electronics such as avionics, semiconductor testing, heat sink bonding, high density interconnect (HDI) and microvia PCBs (i.e., in mobile communication products).

Our facility employs state of the art production equipment engineered to provide cost-effective and flexible manufacturing capacity allowing us to respond quickly to customer requirements while meeting the most stringent quality and tolerance demands. Our manufacturing site is ISO 9001: 2008 registered, and through rigorous quality control practices and commitment to continual improvement, we are dedicated to meeting and exceeding our customer's requirements.

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February 1–2, 2018
Lyon, France

SMTA Pan Pacific Microelectronics Symposium ▶

February 5–8, 2018
Big Island, Hawaii, USA

IPC APEX EXPO 2018 Conference and Exhibition ▶

February 27–March 1, 2018
San Diego, California, USA

productronica China 2018 ▶

March 14–16, 2018
Shanghai, China

China International PCB & Assembly Show (CPCA Show 2018) ▶

March 20–22, 2018
Shanghai, China

SMTA West Penn Expo & Tech Forum ▶

March 28, 2018
Monroeville, Pennsylvania, USA

MicroTech 2018 ▶

April 9–10, 2018
Egham, UK

2018 SE Asia Technical Conference on Electronics Assembly ▶

May 8–10, 2018
Kuala Lumpur, Malaysia

PCB EXPO Thailand ▶

May 10–12, 2018
Bangkok, Thailand

Medical Electronics Symposium 2018 ▶

May 16–18, 2018
Dallas, Texas, USA

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