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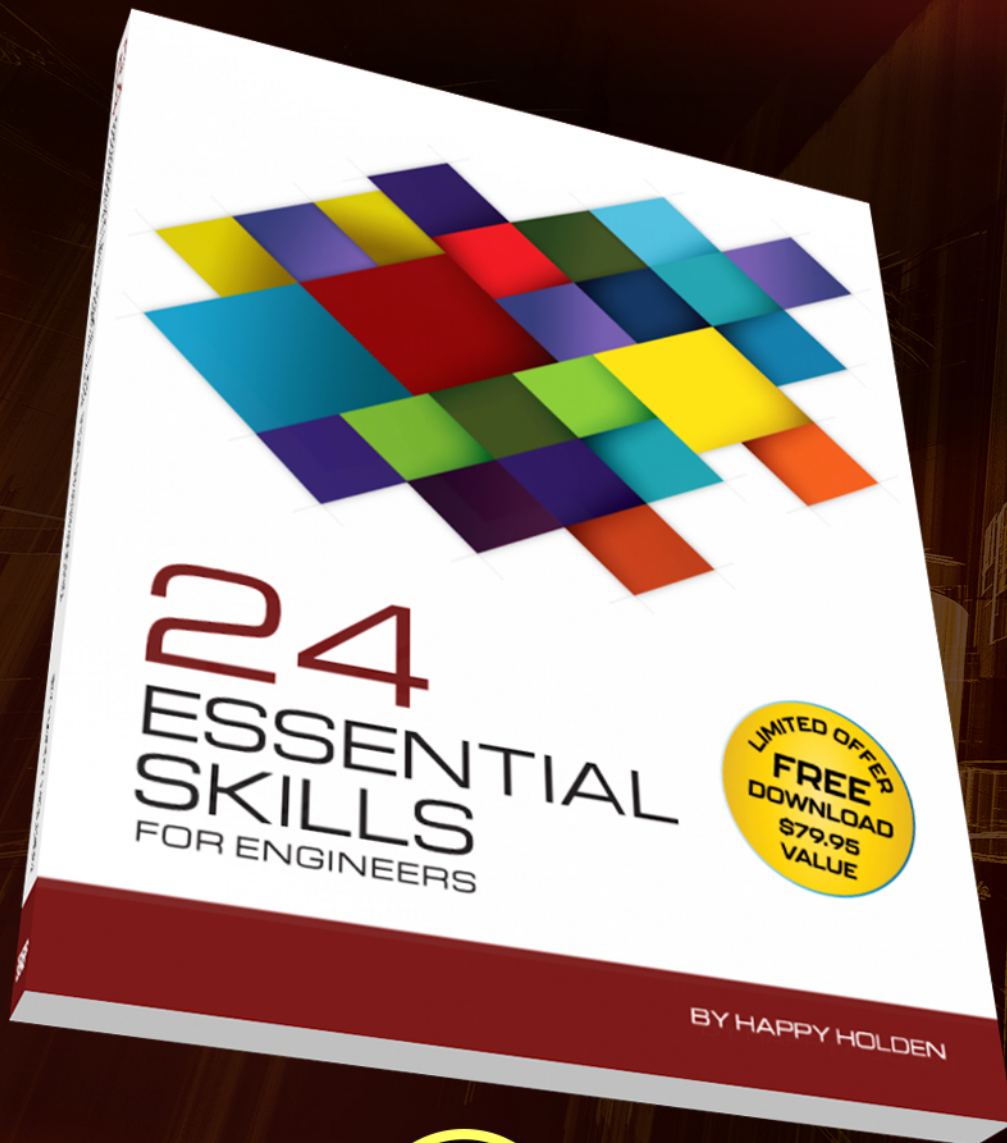
M A G A Z I N E





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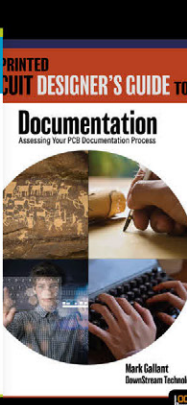
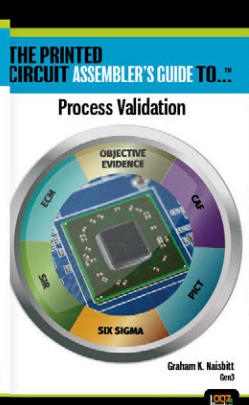
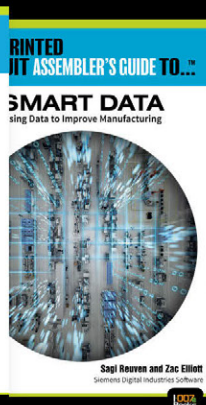
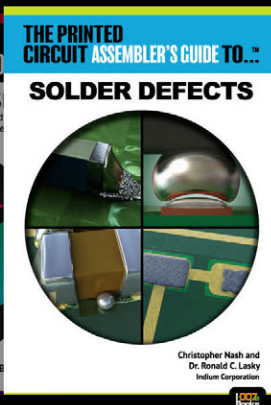
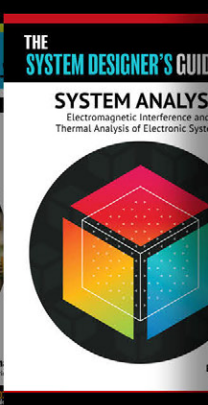
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# PCB007

## M A G A Z I N E

# IPC APEX EXPO Preview Issue

In this issue we provide you with a preview of what you can expect in San Diego. We have interviews with fabricators and suppliers who are exhibiting and presenting classes at IPC APEX EXPO. IPC show managers discuss the events planned for this year's show, and we share a variety of conversations with those involved in IPC's STEM program.

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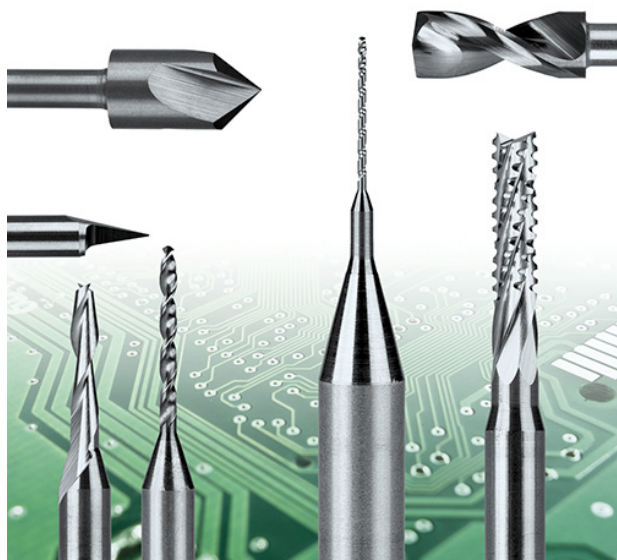




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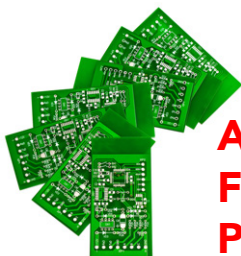
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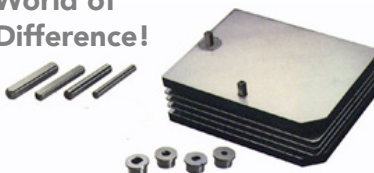
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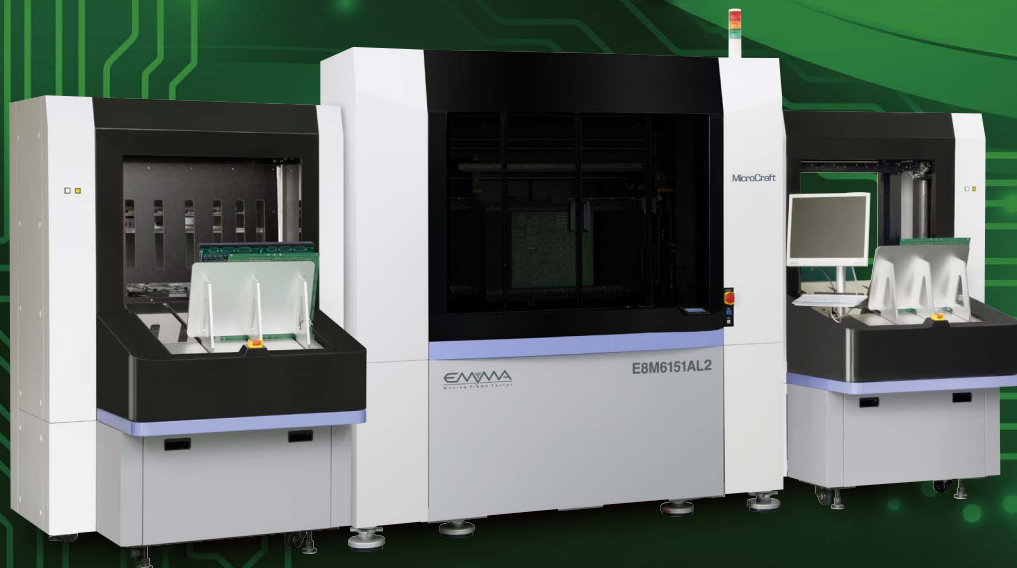
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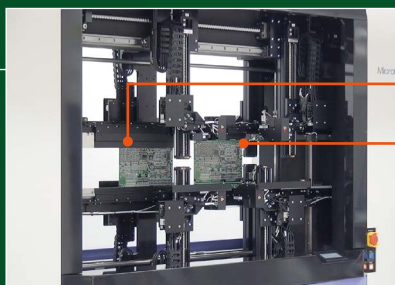
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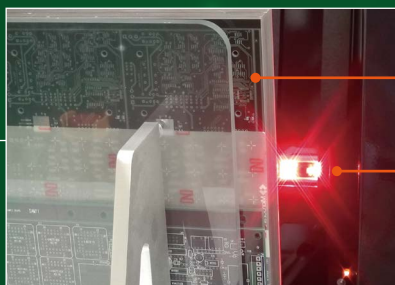


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# Time For a Stroll

## The Shaughnessy Report

by Andy Shaughnessy, I-CONNECT007

Robert Plant could have been talking about trade shows when he sang, “It’s been a long time since I did the stroll.”

When was the last time you did the stroll down the aisles of a trade show? IPC APEX EXPO 2020 was probably your last trade show.

So, we’re all excited about the upcoming IPC APEX EXPO 2022 in San Diego. The show is less than six weeks away, and I’m looking forward to joining you in celebrating the return of trade shows to our industry.

It feels like the last IPC APEX EXPO was 10 years ago, not two. That was a solid show. I

went sailing around the bay with editors Kelly Dack and Pete Starkey, and those were good times.

Then all hell broke loose in the form of COVID-19. This was unlike anything the industry had ever experienced. Even in the days after 9/11, there was a feeling of unity and rebuilding, and we knew that the worst was over. But with COVID, there was no end in sight—there still isn’t, really.

Over the past few years, some of us contracted COVID. Pete Starkey and I both had COVID, but we came out of it no worse for the

wear. I’ve spoken with some of you who had mild cases and lost a few days of work, while others were in and out of the hospital for months. A few of my friends and relatives caught COVID and almost overnight they were gone.

COVID is so random and chaotic—it’s a tornado that destroys every third house in the subdivision, leaving survivors to wonder why they were spared.

But even in the face of a global shutdown that killed of thousands of businesses, our industry did what had to be done. Fabricators re-routed their shop floors so that employees wouldn’t have to work so close together, and they spent untold amounts of time and resources sanitizing workstations. Many fabricators in the





medical, defense, and aerospace sectors were dubbed “essential businesses” and never shut their doors.

The PCB industry survived and thrived. We saw a lot of silver linings to this dark cloud. Last year, some company owners would tell me, in a conspiratorial whisper, “We’re actually having a great year. Mum’s the word.” We all learned to adapt, and we made our companies better and stronger. Tens of thousands of people found out that they could work from home. Try getting your people back into the office now that they’ve experienced the 15-foot commute. If they’re not required to be on the shop floor, you probably have not seen them in person lately.

We then saw the advent of the “Zoom employee,” and eventually, the virtual trade show. I’m sure you attended at least one virtual trade show or conference. We covered all of them in these pages, and I enjoyed watching expert panels and sessions while wearing pajamas. (Speaking of silver linings, how much did your company save on air travel and hotel rooms last year? Six figures?)

But we quickly discovered that, while a Zoom show is better than no show at all, it’s not the same as rubbing elbows with your colleagues and customers. For many of us, trade shows and conferences are the pay-off, the best part of the job. We are social creatures, and trade shows give us the chance to reconnect with old friends and make new

ones. We crave person-to-person interactions, and virtual trade shows simply can’t provide that.

Even more, a live event is a great way for a journalist to take the pulse of an industry. What’s the buzz on the show floor? What new technology is everyone talking about? What challenges are bedeviling your engineers?

We’ll find out next month. But in the meantime, jump into this issue, where we provide you with a preview of what you can expect in San Diego. We have interviews with fabricators and suppliers who are exhibiting and presenting classes at IPC APEX EXPO. IPC show managers discuss the events planned for this year’s event, and we share a variety of conversations with those involved in IPC’s STEM program, including a local high school teacher whose students are now planning engineering careers after being inspired by last year’s STEM event.

IPC APEX EXPO often feels like a reunion, but I believe this year’s show will have an air of celebration. And after the last two years, I think we deserve to celebrate. I hope to see you all there, doing the stroll on the show floor. **PCB007**



**Andy Shaughnessy** is managing editor of *Design007 Magazine* and co-managing editor for *PCB007 Magazine*. He has been covering PCB design for 20 years. He can be reached by [clicking here](#).

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# Industry Market Drivers, Inflation, and the Supply Chain



Shawn DuBravac

**Feature Interview by Barry Matties**  
I-CONNECT007

In this wide-ranging interview, Shawn DuBravac, chief economist for IPC, discusses a variety of market drivers and pressures that are affecting PCB manufacturing and assembly. He also shares his thoughts on the relationship between inflation, wages, and the current supply chain challenges—and what all this may mean to your bottom line in 2022.

**Barry Matties:** Shawn, as we look at the pressures the industry faces today—supply chain, inflation, labor and so on—how should our industry be viewing or reacting to these pressures?

**Shawn DuBravac:** These are forces that are impacting not just companies in the electronics manufacturing industry but also everyone who is upstream and downstream of them. These forces, for the most part, aren't likely to abate soon, and will likely stay with us well into 2022. These forces are causing companies

to really rethink the type of relationships they have with their supply chain. It's causing them to rethink pricing, their suppliers and supply chains, and what those relationships look like.

**Matties:** Looking at our end-markets, what do you see? I'm thinking of automotive, military, medical, and so on.

**DuBravac:** Speaking broadly, we definitely see pressure on the auto industry. We've obviously seen a significant extension of lead times. Many of those shortages are playing out in other industries.

When demand picks up and lead times lengthen, it causes an acceleration of orders because people say, "I wasn't going to place that order for three weeks when it was a three-week lead time, but now that it's an eight-week lead time, I need to place that order today." Ultimately, lengthening lead times pulls orders forward and exacerbates the problem.

The supply chain is working to address the rapid rise in demand that we've seen over the last year. We're not seeing lead times extend



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significantly, but they remain very high. We've also seen a slowdown in demand which will help drive us to a more sustainable equilibrium. We saw, in the U.S. in particular, things slow in the third quarter. At the same time, inventory levels are low across the board. The backlog of orders continues to grow. It will take some time to work through all these dislocations and many of these pressures will be in place well into 2022.

**Matties:** Do you anticipate any surplus of inventory in 2022 which might result in a dip in our industry? Is there going to be a dip generally because of the slowdown?

**DuBravac:** Right now, we have the opposite dynamic. We've seen somewhat of a dip in certain industries because of the inability to get parts. We see a slowdown because of supply chain dislocations. For example, Apple said recently that the supply chain constraints cost them about \$6 billion in their fiscal Q4. They anticipate more than \$6 billion in lost sales because of the constraints in their fiscal Q1, which includes the holiday quarter and bleeds into the new year.

Some of the dip in the calendar Q3 in the U.S. was because of a rapid slowdown in consumer spending, which was still growing but at a much lower rate. I think some of the cutback in spending was a result of product availability. Recent research from Kelly Blue Book suggested new car buyers were holding off or exiting the car buying market because of lack of inventory and lack of product availability, coupled with stiffness of price.

Now to your question: Do we see a big overhang of inventory forming in 2022? I don't see that for several reasons. Have there been excess orders? Is there double booking? Possibly. But I'm seeing a lot of companies doing things to protect against that.

Distributors aren't taking on new customers in some instances as they're protecting their existing customers. I've heard of distribu-

tors who are allowing companies to only order some multiples of what they had ordered in the past. Maybe it's 10% or 20% more, not allowing them to try to double their orders over what they did in the past. Contract terms have stiffened somewhat, so the ability to cancel orders is not as relaxed as it might normally be or certainly has been in the past. They've done that as a mechanism to firm the orders.

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**I've heard of distributors who are allowing companies to only order some multiples of what they had ordered in the past.**

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When you look at semiconductors, you see a lot of companies using proprietary designs. Using Apple as another example, if Apple ends up with a bunch of extra M1 chips, that inventory is not going to go anywhere else. It will just sit with Apple and their supplier. In the past, you might have a glut of supply that materialized because you had extra orders across the board, which then gets dumped in the market at a lower price. That won't happen with proprietary chips and parts.

There are two other factors that are likely to protect against a large inventory overhang in 2022. One is that lead times are long, so that gives companies a relatively long time to adjust. If you're looking at a six- or 10-month lead time for some things, and suddenly we start to get supply of that, then people have a window in which to adjust. The other factor is that inventory levels are quite low so there will be residual demand to refill those orders to build the inventory back up.

Take the automotive sector, for an example. Typically, we have about two and a half



months of inventory relative to sales. In the current environment, we have a couple weeks of inventory relative to sales. You can have a little bit of an overhang to restock those inventory levels and get them back to more normal, arguably healthy, levels.

**Matties:** So, listening to everything you just said, you seem optimistic that 2022 will be a positive year for our industry.

**DuBravac:** I'm cautiously optimistic, but I think there are tailwinds. If you look at durable goods, which is where our industry fits, that's up from pre-pandemic levels by nearly 20% today. Spending on services hasn't really recovered to pre-pandemic levels yet. Some of that will presumably settle out in 2022. We will see a pickup in spending on services. We see some headwinds against spending on durable goods as a result.

Growth rates will be slower for the economy in 2022. We'll have presumably less stimulus than we have had since Spring 2020. Even considering the potential for the infrastructure bill, you're going to have less stimulus to drive spending. We'll be more reliant on wage increases and business investment to drive growth. Businesses are showing a bit of uncertainty, and consumers are showing less confidence than they were pre-Delta variant.

Here's an anecdotal example from a friend. His phone was dying, so he went to the carrier store to get a new one, but they weren't in stock. He got the battery replaced instead, and now the phone is charging fine, so he isn't going to upgrade. He said, "Well, now it's charging fine, so I'll just use this phone a little longer."

That happens in a lot of categories where we extend the durability of the product. You see it in cars, especially, where there is a high degree of durability, and the life cycle can be long.

Going back to my example with Apple, by their estimate they've lost over \$12 billion in sales over the past six months. Some of that will materialize later in 2022. Maybe some of it is a missed opportunity, but some of it will re-materialize. As I said, there are some headwinds and tailwinds, but the overall environment looks pretty good.

**Matties:** The other impact, of course, is labor. Right now, there's obviously a shortage of labor. When you're looking at the market reports, how do you factor the labor into your thinking?

**DuBravac:** If you look at IPC's newly released indices, the ability to hire skilled labor remains a major constraint and companies—at least over the next six months—so I don't anticipate that to improve. In fact, most firms say that will deteriorate over the next six months. My rough estimate is that we have nearly 120,000 open jobs in our industry in the U.S.

Prices will go up for labor because they're going up in other places for labor. Manufacturers are competing against Amazon, Walmart, Starbucks, and everyone up the value chain, depending upon what type of job you're recruiting for.

**Matties:** Many of those major companies are offering hiring bonuses and other incentives.

**DuBravac:** Exactly. Both Amazon and Walmart this year offered to pay higher education costs for some of their employees. Walmart announced a couple months ago they were going to give half of their associates, about 750,000 people, a smartphone to use while they're in the store but then also to use for their own personal use outside of the store. So, there are these fringe benefits together with real tangible benefits.



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**Matties:** What advice do you give our industry about labor?

**DuBravac:** It's clearly a very competitive market. It will be very competitive in 2022. Prices will be going up and, as an economist, it looks to me like the reserve wage has gone up. We've never come anywhere close to having this many open jobs in the economy—as of the last count, almost 10 and a half million open jobs. We've never seen levels like this before. At the same time, we still have a fair amount of unemployment. Why haven't some of these individuals who are unemployed taken these jobs that are open?

Some of it looks like the reserve wage has gone up. They're not willing to work in certain jobs unless the total compensation package is improved. But beyond that, workers are also looking for a more holistic view of their work environment. For younger generations, like Gen Z, some want to be associated with a good cause. They want to believe in the mission of the organization.

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**For younger generations, like Gen Z, some want to be associated with a good cause. They want to believe in the mission of the organization.**

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For others, it's training opportunities. By my estimate, probably about a third of those who are unemployed are not getting a job because there's a skill mismatch—the skills gap. Sometimes it's the employer who thinks they're not qualified. Sometimes it's the worker who is maybe not applying to certain jobs because they feel they're not qualified. It goes both directions. Some companies are taking an

interesting innovative approach, what they call “returnships” as opposed to an internship, which might be targeting a young, first-time employee. Instead, returnships can offer training opportunities to those people who have been out of the workforce for some time.

Speaking of benefits that might be attractive, help with childcare is something that employees are struggling with. They can't go back to work because they don't have childcare. I think we've lost roughly 100,000 workers in childcare services from pre-pandemic levels. This is about 10% of the number of workers who had been employed in this sector. This has a ripple effect. Childcare providers have fewer employees so they're not able to accommodate as many children. And then suddenly that childcare center is booked up. As a result, parents can't find childcare so they can't go back to work.

Maybe some of these employers offer in-house childcare, childcare credit, or something else to help facilitate that. There are some real tactical options that can help employees overcome some of these obstacles, and some of them will cost money. Companies will need to take that into account as well.

**Matties:** With this labor gap, it shifts the calculus for business owners regarding automation.

**DuBravac:** Right, a higher cost of labor changes the labor-capital equation. You have seen automation show up in lots of interesting places. There's been some automation in the Italian wine industry because they can't find labor to pick grapes and do other manual tasks. White Castle is using a robot called Flippy to cook french fries because they're struggling to find workers.

White Castle recently announced that they cold-called, sent emails, made phone calls, and sent texts to 550,000 individuals who had applied to work at the restaurant in the last four years. I think they had about 30,000 who showed interest. So, you've got this company



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trying to find workers and then using technology—automation—to offset the difference.

It's one of the great conundrums when it comes to jobs: When you look at Capitol Hill it's usually the Democrats who want to raise the minimum wage and raise wages overall. At the same time, the offsetting feature of that is that it could drive automation and lead to fewer workers in some settings. So, you must find the right balance. In many instances, what I would call a starting wage has already risen above any minimum wage requirement.

**Matties:** Right. It's all related because as wages go up, so do the retail prices. It's a sliding scale. It might be a feel-good moment that the costs are passed on.

**DuBravac:** I think we're in that transition period right now. If you look at the research that IPC is publishing every month, companies report that orders are up, but at the same time costs are up and profit margins are down. So, they probably haven't raised prices as much as they should to offset higher costs.

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**In 2021, on average,  
about two thirds of our  
manufacturing companies  
said they had raised prices  
or were planning to raise  
prices and they were up  
about 14.5% on average.**

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In 2021, we saw a lot of triage in every industry. The manufacturers I've talked to across the board were saying, "Our costs have gone up, but we didn't raise our prices for any number of reasons. Short term, we're taking the hit in margin compression but longer term, we'll have to adjust prices."

In 2021, on average, about two thirds of our manufacturing companies said they had raised prices or were planning to raise prices and they were up about 14.5% on average. We also asked them what they anticipated raising prices in the first half and the second half of next year. On average, it was 7-8% increases.

**Matties:** On top of that?

**DuBravac:** Yes, on top of that. I don't think we've seen the end of price increases. Contracts needed to be rewritten. And companies needed to see if the cost increases they were facing were temporary or more permanent. Prices are up and companies will need to pass those forward. But I do think the rate of increase will slow. For example, energy prices and commodity prices, generally, are all up significantly. It's unlikely that they will double again on top of already high prices. Oil is hovering at \$80 a barrel, give or take. I don't anticipate seeing that going to \$160 a barrel, for example.

**Matties:** I think the rate of increase is slowing.

**DuBravac:** Yes, and that's ultimately what inflation is: a rate of increase. At the same time, in the consumer market, we had two compounding effects in 2020 and 2021. One was consumers stopped buying things, so savings naturally grew. Two, they had a tremendous influx of stimulus which drove up income in terms of checks from the government and any number of other mechanisms that were used to supplement unemployment benefits and spur spending. We saw household savings increase significantly—multitrillion dollars in increases. That cushions the consumer just a little bit in 2021 and in 2022 toward the higher prices.

**Matties:** But that buffer will run out.

**DuBravac:** And when it runs out, I think order growth will naturally slow. So, using the auto industry as a simple example, people are will-





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ing to pay manufacturer's suggested retail price (MSRP) on a car right now because inventories are tight, and they've got the ability. In some cases, they're getting attractive financing options. Some are even paying over MSRP. But that is not a typical situation for the auto industry. Typically, buyers pay about 85% of the sticker price in a normal year. It's a great time to be an auto dealer, but that's not going to last; as inventories rise, it will be much harder to sell vehicles at the sticker price.

**Matties:** The same could be said for the real estate industry as well. It's a great time to be a realtor. We're starting to see price decreases in the real estate market.

**DuBravac:** Right. If you look at real estate, you're going to see some pressure on pricing. Some of what has happened is people rethinking the quality of life they want—where they want to live, needing a different-sized space, wanting to be in or out of the city. When that settles

out, we get a new equilibrium. What makes it different than, say, 2009 is that we don't have a lot of excess and predatory lending.

So that piece of the dynamic has changed. I point this out just to say that we're not going to go into an environment where you see a free fall of housing prices. We are under inventory in housing because the last 10 years we've underbuilt housing. So, part of the reason prices have gone up is because there's a dearth of available homes for people. There are pressures that will keep prices from deteriorating significantly.

**Matties:** Sure. What emerging markets do you think the industries should be preparing for?

**DuBravac:** Just in the last two weeks, we've had major announcements around virtual digital environments. Facebook obviously renamed their whole umbrella company to Meta. Microsoft announced at Microsoft Ignite that they were bringing Mesh to Microsoft Teams which

will bring the mixed-reality capabilities to Teams. They talked a lot about the metaverse.

Whether we call it XR or the metaverse, I think there's a tremendous opportunity there. Had we been further along in that roadmap, I think that you would have seen a large uptake and an acceleration for mixed reality as we went into the COVID shutdown, but we just didn't have the hardware or the service infrastructure in place. The metaverse is definitely an emerging market to watch.

Another area to watch is the transition from digitization to datafication. Part of this transition involves bringing greater computation power to areas that only recently were digi-

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**In the U.S., as we work to catch up with Europe and other regions that have been more progressive, we'll be seeing a lot of companies report more precise measures of their ESG impact.**

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tized. One of the great examples of this datafication is the MBUX Hyperscreen curved display that Mercedes introduced earlier this year. It extends pillar-to-pillar across the dashboard of the car, with a multicore central processing unit (CPU). This screen uses artificial intelligence and has what is called a "Zero Layer" interface which uses voice and touch. So, now we're seeing the computerization of that dashboard. Google has announced some major initiatives to change the dashboard as well. This is just one example of what is happening in every industry.

The broad electrification of vehicles is another big trend and we have just barely seen the cusp

of that. But all the auto manufacturers are pushing in that direction and inevitably that will come. This ties into a much broader narrative related to the environmental, social, and corporate governance (ESG) movement that's happening globally among corporations. In the U.S., as we work to catch up with Europe and other regions that have been more progressive, we'll be seeing a lot of companies report more precise measures of their ESG impact. You've seen the Securities and Exchange Commission (SEC) come out and say, "A lot of companies are talking about ESG. We think that there needs to be some standardization in how this information is communicated." In SEC Chair Gary Gensler's speech a few months ago<sup>1</sup>, he laid out what he saw as his outline for ESG disclosure, and he suggested it should be mandatory instead of voluntary.

If the SEC has mandatory ESG disclosure requirements, how does that all factor back to us? Well, a piece of that is not only your own carbon footprint, but it's your supply chain and measuring your whole supply chain. Electronics manufacturers may not be as far down this path as others are who tend to be more consumer-facing, but they're going to have to be there because their buyers are going to require it.

Over the next decade, I think ESG will have a major impact on the industry. If a major OEM is required by the SEC to disclose certain things and to measure things in certain ways, then so will their supply chain. I think you'll see other requirements on the social and government piece for public companies, but the environmental piece is something that feeds into the supply chain.

**Matties:** Is there supply chain reshoring? How dramatic is it? Is it something we need to be aware of? And if so, what's the long-term effect?

**DuBravac:** Yes, my sense is that it's happening to some extent on the margin. There were already forces at work pre-pandemic, tariffs and other



things which were causing companies to re-examine their supply chains. We had lengthened supply chains over numerous years, primarily to reduce cost within those supply chains and to avoid tariffs. The tariffs that were put in place under President Trump change those equations. Companies were thinking about it already, but the tariffs caused them to start looking at alternatives.

Initially they looked throughout Asia. We started to see Vietnam, Cambodia, Malaysia, Indonesia, and other places all become areas of exploration. The pandemic hit and that caused a lot of companies to look closer to home, in Mexico, and other places like that. It's happening on the margin. But this is a slow process. You build a factory, and it has multiple decades of usability. It takes some time for a major transition to take place.

**Matties:** Do you think the inflation is slowing the reshoring drive?

**DuBravac:** When companies are looking at reshoring decisions, I don't know that they're necessarily looking at it as, "Should we reshore or not?" I think they're looking at it in a holistic sense, asking, "Where should we manufacture?" They're looking much longer than near term inflation pressures; the next three, five or 10 years.

I think the jury is still out whether inflation pressures could be as severe in three years, five years. There's an argument that they won't even be this severe in a year. There are some arguments against that as well. But I think that in much longer time horizons they don't consider some of those near-term pressures. The flip side is that, if you're looking at a capital deployment and factories of the future, arguably the cost is going to be comparable wherever you are in the world outside of some labor component tied to deploying that capital.

So, if I'm buying equipment, it will have a general global price and I'm going to pay the

same wherever I buy it. Now, I'm going to have some other costs based on local implementation or regulation. Let's say Apple suddenly and unilaterally said, "We're going to produce 50% of what we sell in every market inside of that market." It's not a reshoring decision by itself but that they want to service the markets with production inside of those markets. Then you would see a big swing back because there is so much consumption in the U.S.

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**I think the jury is still out whether inflation pressures could be as severe in three years, five years. There's an argument that they won't even be this severe in a year.**

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You've had a lot of companies say, "There's a lot of ambiguity happening right now in China, and we don't want to be in this market." At the same time, you have a lot of the Chinese companies which have lost a lot of value in the last year as there seems to be a tightening of the regime's direction. I think the tariffs in place are a factor, but there are a lot of forces that have diminished the view of China.

**Matties:** Shawn, you have given us a lot to consider today. Thank you and we look forward to seeing you at IPC APEX EXPO.

**DuBravac:** Thank you, Barry. PCB007

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# Direct Imaging: Stitching Together Key Markets with Altix

Interview by Nolan Johnson  
I-CONNECT007

Nolan Johnson meets with Damien Boureau and Alexandre Camus of Altix to discuss direct imaging, what's currently happening in that marketplace, and how the solution and demand for characteristics vary by region.

**Nolan Johnson:** Let's start with a quick thumbnail on your background and your role at Altix.

**Damien Boureau:** I'm R&D director, heading all the R&D projects for the company. In my team, we work together with different experts in micromechanics in optics, software, electronics, optoelectronics, and so on. I have a master's degree in optics and lasers, and have been working in the PCB industry, especially in machine manufacturing, since 1998.

**Alexandre Camus:** I take care of the marketing. I'm still rather new in the company. I used to be in China in the food import/export industry, and before that I was in the fitness industry.

**Johnson:** Thanks. Let's discuss what's currently happening in the marketplace with respect to direct imaging. From your perspective, what's happening in the market?

**Boureau:** Yes, that's a large subject. The direct imaging market now is really mature. I say that because I've seen the stats of direct imaging in the 1990s, and in the '90s it was quite difficult to have an application in PCB shops with direct imaging. Now, the market is mature; you can say that roughly 60% of the customers in Europe and in the U.S. who are equipped with direct imaging equipment are working with direct imaging equipment not only for outer layer applications, but also for inner layers. They may be working with dry resist or with ink, but more and more, they are including solder mask applications.

The market is growing in these kinds of applications. The new equipment is bringing more power, thanks to high-power additives. We can also multiply the number of DMDs (digital micromirror device) inside the equipment, which makes the product more produc-



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tive. That's why solder masks can also be produced through direct imaging equipment.

If we start from the beginning, direct imaging was lasers plus high-speed rotating mirrors, but the technology has changed a lot over the years. Now we can have various pieces of equipment from the market: DMDs, LEDs, etc. These LEDs and DMDs bring a more efficient and more versatile way to make images through direct imaging.

That's another reason why the market share is growing in all the PCB processes. For example, the equipment now uses LEDs. We can multiply the number of DMDs inside the machine, depending on what the customer intends to do in terms of productivity. Thus, we can incorporate in one equipment, in one factory, all three processes. This is really a plus regarding direct imaging in the market.

**Johnson:** What are the customer pain points when they're talking about new equipment and what they're looking to add to their manufacturing floor?

**Boureau:** When focusing on European and U.S. markets, which are quite similar, (and excluding China or Asia, in general) in terms of small-to medium-size companies, they are looking at equipment that is as versatile as possible. They are trying to have it all in one if they can. If they can have direct imaging equipment, for example, and are able to replace their innerlayer, outerlayer, and solder mask imaging equipment, all their systems, they will focus on that.

Customers will still have different equipment because you cannot image innerlayers and solder mask panels at the same time on just one machine. They want versatility in their equipment because it secures the process. If you have



Damien Boureau

one machine out of order, you can even produce on the same equipment and share the process on the same equipment. I hope I'm making that clear.

**Camus:** It reduces the downtime. If a machine is not working, you can still manage, thanks to the versatility of your equipment.

**Johnson:** Right. For example, you have two machines, and because they're versatile and

can do all the work, you can have one down for maintenance and still have manufacturing throughput.

**Boureau:** That's correct. In real time, in real life, during the day you will dedicate one piece of equipment for innerlayers and the other one for outerlayers, for example, but by doing that, you can change all the layers on the first machine if the outerlayer machine is down, for example.

**Camus:** It's a good backup plan; kind of an insurance policy.

**Johnson:** If you're targeting primarily Europe and the U.S., then a higher mix, lower volume, more technical product tends to be the norm. That sort of flexibility in your equipment becomes more important to the customer.

**Boureau:** That's why I excluded China at the beginning, because most factories in Asia are completely different compared to what we see in Europe and the U.S. The Asian companies are looking for completely different performance characteristics from the equipment. They're looking more for reliability or productivity. That's why we have added an ADIX reel-to-reel machine in our catalog, to produce FPC boards, which are done a lot in Asia and

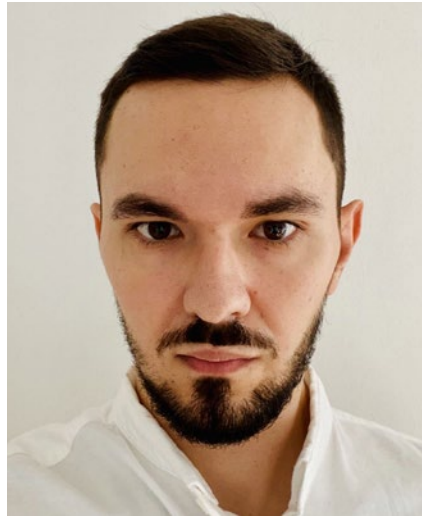


which is a fully automatic system bringing a high productivity rate.

**Johnson:** Right. It's interesting that you use the words productivity and reliability. I would think that while the U.S. and European markets are looking for the same things, the criteria for productivity and reliability in Asia, at volume, is different than the criteria for productivity and reliability in the U.S. and Europe, where you have a higher mix. In a more high-mix manufacturing environment, setup becomes a larger part of the task; there are slightly different constraints to being productive and reliable. How is Altix managing those constraints for the U.S./North American market?

**Boureau:** You're right that productivity and reliability are two different terms, considering either Asia's or the European point of view. Looking at direct imaging, or even for those units in Asia, the production batches are very large, and they will change a few during the day or the night shifts in the factory. Compared to what we see in the U.S. or Europe, they will have very small batches, as you say, a few panels that they will change often during the day, and they must be able to set up the machines quickly. So, what we have developed and what we want to develop in the future are different kinds of software tools that help the customer set the machine as quickly as possible.

The first tool we set is called ADIX Tools and is used widely in our European and U.S. customers' factories. This software allows the customer to prepare all the batches offline, out of the machine, to set all the parameters through configuration files, and to send these files to the machine so that the operator in front of the machine only needs to call the batch at the end. With just one click, the machine will



Alexandre Camus

be ready in a few seconds to produce the following batch with everything relayed in the offices, in the CAM station, or wherever; it depends on the customer organization's software parameter files. This is very useful for our customer who often changes the batch, especially inside the machine.

**Johnson:** It would seem like there would be a lot of R&D effort to enable quick changeovers. How have the inter-machine communication protocols, such as HERMES and CFX, enabled solutions for your software?

**Boureau:** It is very challenging on the manufacturing floor with our customers and their markets because, you may or may not know, we are not only addressing the PCB industry, but also the PCM (photochemical machining) industry. First, considering the two markets, the questions are not the same, and it's not the same considering the geographic area. In smaller U.S. or European factories, you have fewer people ready to prepare dedicated software or dedicated communication between the CAM station, between the equipment, and so on, so we have to bring the expertise to help them, and to connect the equipment with all the systems.

China, for example, will put more focus on standard protocols like those we can have in the microprocessing industry called SECS/GEM. In this case, we would have to develop protocols dedicated to their factory and to the world factory. We will add a big project, in which IT will be involved with all the other equipment manufacturing. The considerations are completely different regarding the two types of customers.

The main protocol is a TCP/IP protocol, which is a more reliable way to exchange



The Altix Acura Premium series is fully automatic and capable of medium- and high-volume production.

parameter files and data. But as our equipment is waiting for specialist data, we defined an easy way to have this connection for the smaller factories. It's easier for them to configure through an XML file, which is a really simple and reliable solution in which all the parameters will be set through panels and will be sent to the machine.

**Johnson:** When working with direct imaging, the software controls how you manage and then apply that image onto the material. Those data prep functions are not that different from printing on paper, or other driving displays. I'm thinking about functionality such as clipping, rasterization, scaling, and transformation, etc. What sort of R&D is underway at Altix for image management?

**Boureau:** A lot. If we look at what we are doing right now in R&D around direct imaging, there are two main subjects. The first one is productivity. Even if our equipment today can meet all the productivity needs of most of our custom-

ers, we still work on it because it's the thing regarding direct imaging when compared to photo exposure units.

We are working on what we can find around the image, the file, and the data rasterization in direct imaging; this is also the main aspect we are working on with direct imaging. There are many things to work with regarding the files and the image processing in direct imaging. In 2018, for example, we started adding a clipping function into our reel-to-reel equipment which is a way to bring very long images into a machine which is otherwise not able to print such long images.

For example, our reel-to-reel ADIX unit can print up to 685-millimeter image lengths. But in some of the PCB applications that we have now, such as for 5G or for automotive battery interconnection, and so on, we have more requests asking for 10 meters, 100 meters, and even longer. With the clipping function we can take this quite long Gerber, 10 meters, for example, and to clip it in several small images, print each image through the right imaging



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machine and then, during the printing and the processing, stitch them again. At the end, you have your whole PCB. This is done for FPC industries, and for ADIX reel-to-reel equipment, but this is just one of the R&D projects regarding image and image processing in direct imaging.

A second process that we have worked on is almost the same, but we call it stitching. In this case, the customer is looking for a way to have a single PCB image repeated several times on the web, but with a very constant step. So, we put in the first image and then we are able to put in the second image with the perfect stitching in between the first and the second one, and then again for the third and the other ones. In early 2015, we started this stitching function for conventional exposure for web application, but we duplicated it into direct imaging recently. So, these two functions that we brought into our equipment quite recently (two or three years ago) are dedicated for the applications I previously mentioned—5G and mass PCB production.

**Johnson:** Is there anything just over the horizon that customers should be watching for?

**Camus:** We unveiled our new machine, the Adix SA duo, at productronica. In short, it is the association of a new innovative light source and a dual table system. Of course, the plan is to start the communication before, during, and after the event. For IPC, we will be attending IPC APEX EXPO through our U.S. company.

**Johnson:** Altix also has PCM solutions. Tell me what's happening in that space.

**Boureau:** Yes, this is very important for us. The PCM and PCB industry needs are close to each other and we're always looking to develop new products for both markets. We keep in mind the constraints and needs of the two markets when developing new equipment for photo exposure, conventional exposure units, or for direct imaging. It's very important for us, that's why I just want to mention that again.



Altix offers roll-to-roll direct imaging for fine-line resolution.



The Altix Adix PT/F is designed for high-mix, low- and medium-volume production.

**Johnson:** Can we talk more about automation?

**Boureau:** Today, the main direct-imaging manufacturers, are proposing equipment with automation, trying to meet the questions about productivity and reliability, as we do have two types of automation for the semi-automatic machine, which is made for boards. We have a very compact automatic system that is dedicated to small factories, for example, to be able to have night shifts fully automatized with this system, when they have only a few workers in the factory.

But, for larger companies, we also have developed a full inline automation system around our equipment. This automated equipment is allowing us to load and unload the panels on from the machine, flip them, so that we can do side A and side B. Panels are coming from lamination to the chemical process through our direct imaging machine.

**Camus:** I would also like to mention that some of our clients and prospects are concerned

about the rising costs of the workforce in some countries, which is why they tend to be interested in more automated solutions—to balance out these costs. It's an economic question.

**Johnson:** That's a common theme throughout the industry. There's the kind of development work that you are doing—especially for Europe and North America—and the availability of data. Now we're able to implement feedback and feed-forward loops on the manufacturing floor. With that, now you start to include solutions to alleviate the operator staffing shortages everyone is facing. And that pushes you toward automation as well, creating this very automated, robotic, but reconfigurable, manufacturing environment. Looks like Altix is right in the middle of all of that.

Well, with that gentleman, thank you for your time, this has been quite insightful.

**Boureau:** You're welcome, thank you.

**Camus:** Thank you. PCB007



# Photonic Soldering

## Happy's Tech Talk

by Happy Holden, I-CONNECT007

Printed electronics (PE) continues to be a growing technology. But one of its advantages, as well as a drawback, is that low-cost substrates, like paper, cannot take the temperature of solder paste reflow. Also, the inks need to be cured. One current way to cure the printed inks is with ultraviolet radiation curing, such as that used with solder mask or legend inks.

One innovation is the curing or annealing of printed inks with flash tubes, which produce a high-intensity, broad-spectrum white light as seen in Figure 1.<sup>1</sup> You might be famil-

iar with the technology from photography, as electronic flash or strobes. But these, on the other hand, are much larger and much higher in power. You have probably noticed from photography that these electronic flashes produce heat. But this heat is limited to the surface only, so that the inks can be cured or annealed but the substrate remains cool.

Inks cured to the temperature at which they become conductive using IR ovens requires substrates that can withstand these temperatures, like polyimides, ceramics, and epoxy

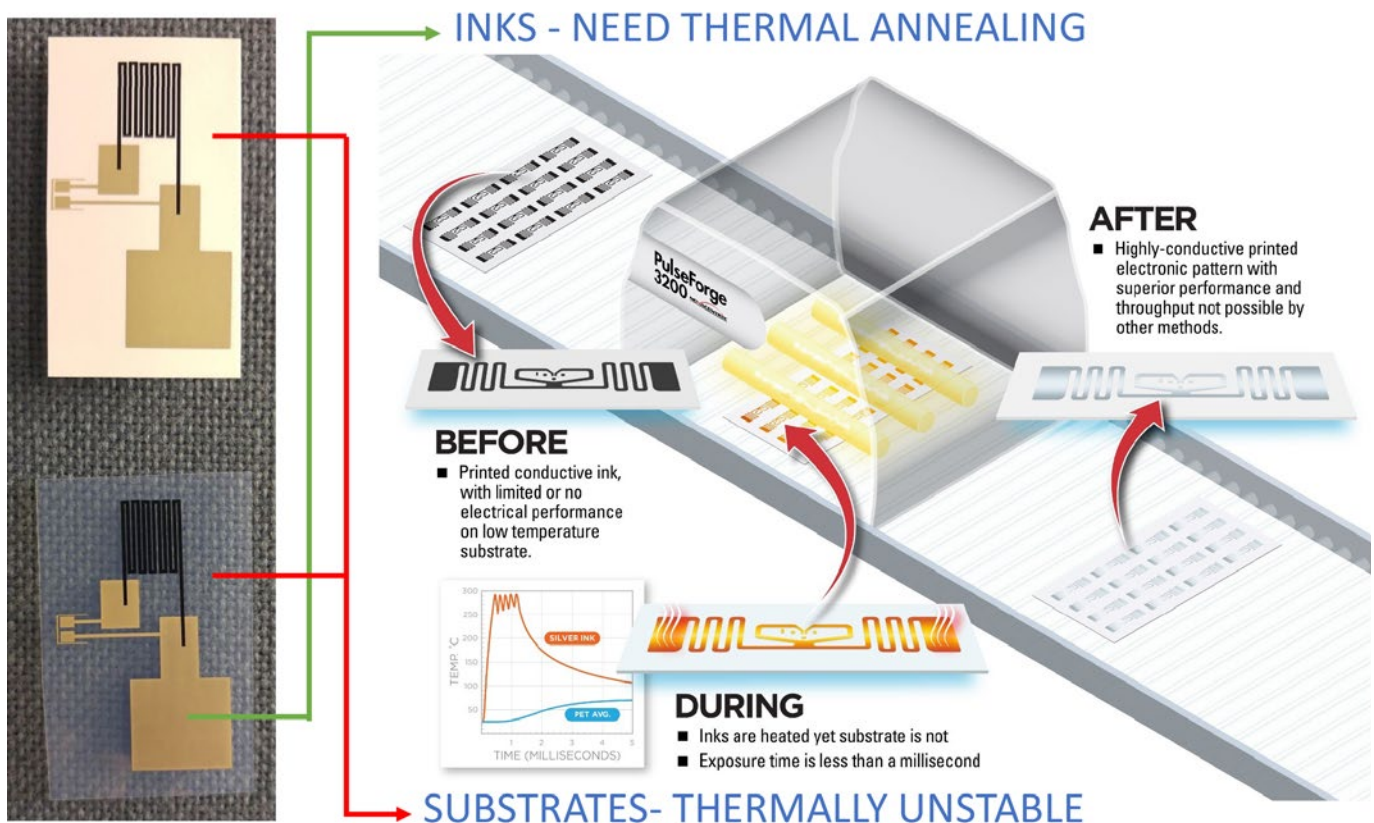


Figure 1: From photonic curing and annealing to photonic soldering/sintering, the flash tube can transfer a significant amount of energy quickly. (Source: NovaCentrix)



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## **PANEL SIZE 21x24**

UV Dose as recommended	Tact time/side	Panels/minute	Panels/hour	22 hrs/day
100mj/cm2 Solder Mask	21.10	1.35	83	1825
150mj/cm2 Electra EMP110-DI	36.50	0.80	48	1056
250mj/cm2-Taiyo PSR 4000 BN DI	43.00	0.70	42	924
700mj/cm2 (White LED SM)	52.70	0.56	34	748

fiberglass. The flash tube’s white light is not drying with temperature; it is drying with the high energy density of electromagnetic radiation (ER). The ER rays penetrate deep into the layer to be dried and excite the molecules there.

The absorption of the energy happens in a few tenths of a second. The molecular activation vaporizes the solvent or water. Because the radiation energy penetrates deep into the layer, it couples to the pigments and dries them from the inside out, and the undesirable effects on the surface such as bubble formation or blistering do not occur. In addition, ER light can be dosed and applied in a very targeted manner, right to the point.

With this innovative technology, highly conductive patterns, components (resistors/capacitors) and insulators can be cured on substrates like papers, fabrics, or plastics, all in less than a few hundred milliseconds.<sup>2</sup> Printing technologies as well as ink types are detailed in Chapter 11 of *Flexible Circuit Technology*, 4<sup>th</sup> Edition.<sup>3</sup>

Photonic Soldering and Sintering

Table 1 provides an outline of different selective soldering techniques organized by how the thermal load is delivered. In these conventional cases, the exposure is confined to the heating area to ensure lower thermal load on the temperature-sensitive parts of the device. Since the heating medium is confined and will need to be moved from one area to another, the speed of processing with these techniques is typically slow.

Light-generated (ER) heating, as in laser soldering, can also be performed by flash tubes, but with the advantage of soldering components not in the line-of-sight. The first of these new

Source of Heat	Example of Selective Soldering Techniques		
Conduction	Soldering irons	Hot bar or ribbon	
Convection	Hot gas	Micro flame	
Melted solder	Selective dripping	Solder wave	Solder jet
Radiation	Focused light beam	IR light	Laser beam
Electric current	Induction	Resistance	

Table 1: An outline of different selective soldering techniques arranged by thermal heating source thermal profile. (Source: NovaCentrix<sup>4</sup>)

soldering systems is PulseForge, developed by NovaCentrix.

With the use of 500-volt power supplies of 30 to 40 KW capability attached to banks of high-voltage storage capacitors and controlled by high-voltage circuits, specially designed flash tubes can now perform the standard lead-free reflow in just seconds and with power usage just 10% of standard reflow ovens.

Figure 2 shows that light-absorbing materials will heat during the light pulse, and cool immediately when the light is removed. Although this is possible to solder with just one pulse, the superior process is to use a pulse-train of pulses (with differing pulse duration and power) so as not to overheat the substrate.

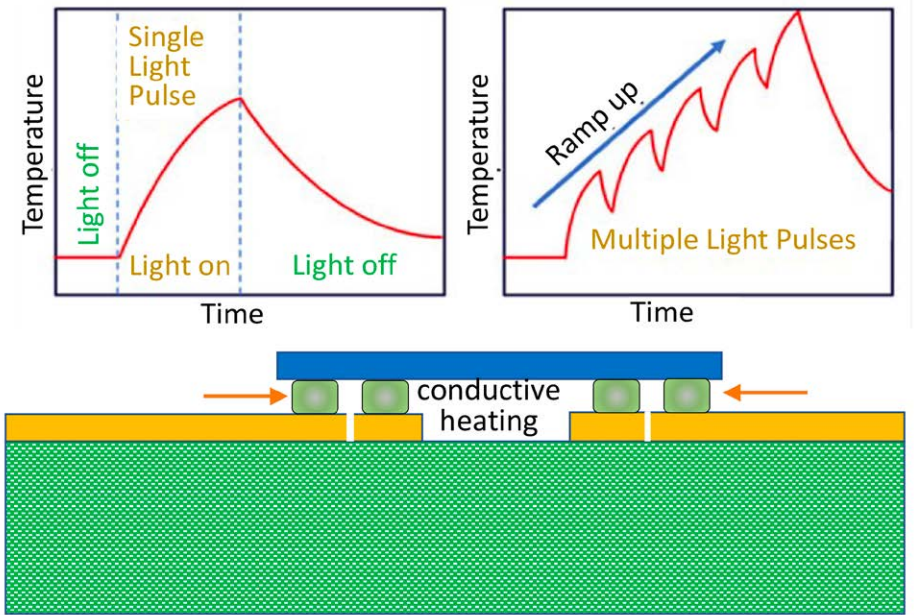


Figure 2: PulseForge soldering, differentiating from normal reflow with broad-spectrum white light. (Source: NovaCentrix)



Thermal Profile

The photonic soldering process builds on the process of using high-intensity flashes of broad-spectrum light to heat up a multi-layered stack in a non-equilibrium process. This process was developed as part of enhancing the manufacturability of flexible hybrid electronics (FHE) by sintering metal particle-based inks into conductive traces.

The photonic soldering tools rely on extremely high average power delivery for a xenon gas-filled flash lamp. As such, flash lamps must be water-cooled to prevent run-away heating and detrimental damage to the system under high-duty use. Additionally, the flash lamp system needs to have digital controls to adjust for soldering of different-sized components under various thermal conditions.

SAC-305 (Indium 8.9HF, type 4) solder paste was manually stencil-printed on the copper contact pads. Wet thickness of the applied solder paste was roughly 75 μm. Sulfur-tolerant chip resistors in 0603 packages from Rohm Semiconductors (part number SFR03) were used as the main component (Figure 3).

Areas which absorb parts of the spectrum more efficiently convert the light energy to

thermal energy more effectively than other areas and result in a localized temperature increase. The temperature profile of the material being processed can be controlled by varying the timing of the pulses (pulse length and delay between subsequent pulses). The temperature reached can be above the rated temperature of constituent parts of the device stack without damaging them, in part because the heating is noticeably short, and the device stack will revert to ambient conditions soon after the light illumination has stopped.

The soldering process (Figure 3) shows the ideal trade-off between light power density and flash durations. The soldering is accomplished from one to four seconds depending on power density. Power settings from P1 to P9 will induce reflow from 4.5 to 8 seconds, with the shortest at P9 of 0.5 seconds.

Spatial Selectivity

The photonic soldering process is unique and provides a soldering process for a given material system (substrate, conducting track, solder, and component) that cannot be duplicated in a normal reflow oven. The average power is a function of the energy of a single light pulse

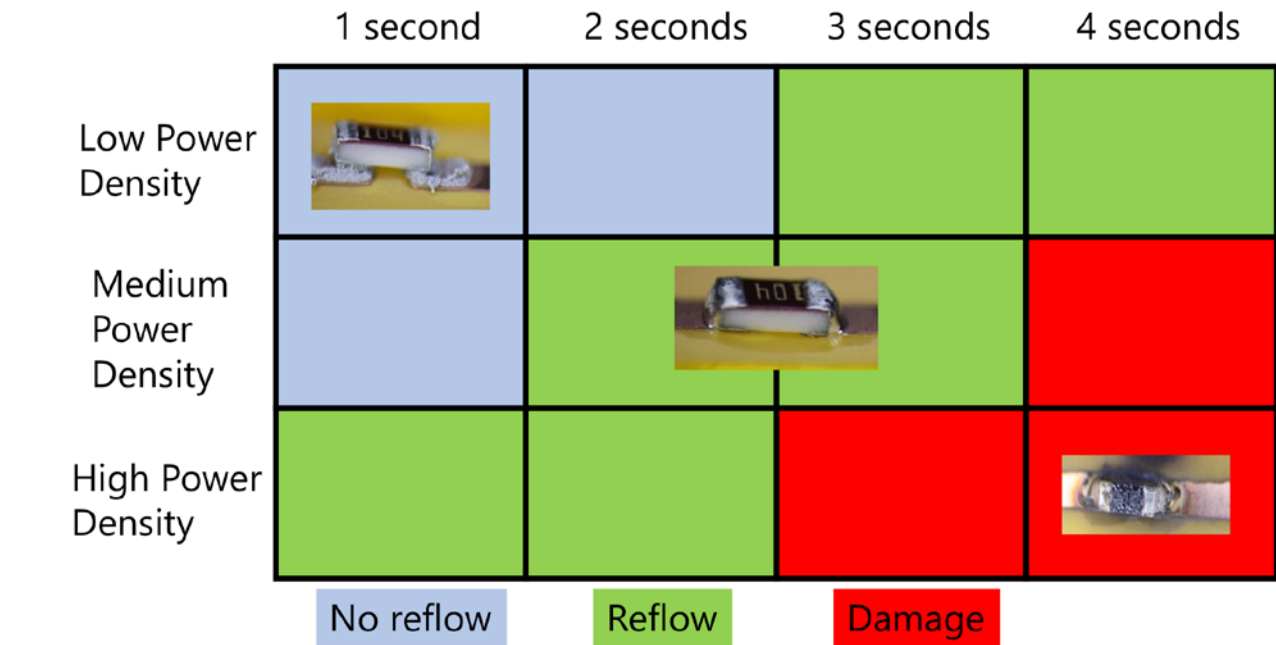


Figure 3: Process development: Power density vs. time. (Source: NovaCentrix)

(depends on the voltage to which capacitor banks are charged and the length of time for which they are discharged) and the frequency at which light pulses are incident on the material system. Average power is the critical control over the temperature ramp rate achievable for the device stack. While certain device structures can be soldered with extremely high ramp rate, others require a slower ramp rate to preserve device structure and prevent uncontrollable outgassing. The temperature range can be controlled by spatial selectivity for:

- Thermally-sensitive substrates like LED arrays on PET
- Thermally-sensitive components like batteries or displays using an aluminum mask with laser-cut openings
- Thermally-sensitive regions like the reflow under a BGA with conductive heating
- Thermally-sensitive solder joints like SAC305 reflow in 0.375 seconds
- Reliability-sensitive lead-free solder joints where the short heating time minimizes intermetallics
- When low voids are required, <3% voids are achievable

For the same structure, the peak temperatures can be manipulated either by increasing the ramp rate, exposure time, or a combination of both (Figure 4). Like standard reflow mechanism, each change provides a different opportunity in optimizing the solder joint quality. For the explored device structure, at an average incident power density of 16 W/cm<sup>2</sup>, reflow of the solder can be observed starting at 1.5 seconds but will improve the joint quality up to three seconds as reflected through improved fillet shape and intermetallic formation. At five seconds of exposure, we start to observe mechanical failure and buckling of the flex circuit. Figure 5 shows an interior of the photonic soldering equipment. This equipment (Figure 6) comes in a batch and conveyORIZED unit. A complete automated assembly

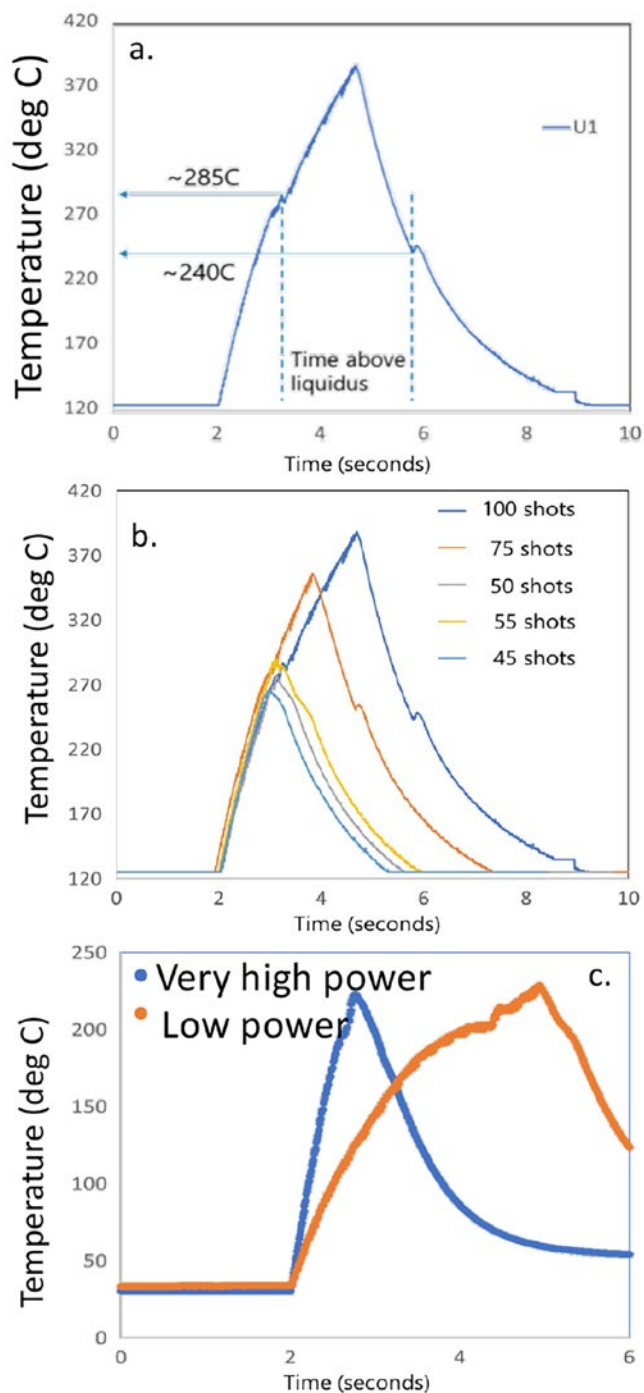


Figure 4: a) Temperature profile of SAC305 solder joint on a 0603 resistor with medium power for three seconds; b) Temperature profile of the solder joint with different pulse trains at high power; c) Temperature profile of a solder joint with different power settings. (Source: NovaCentrix)

line of paste-inspection-placement-soldering would be only 21 feet long and have a processing time of only three to four minutes.



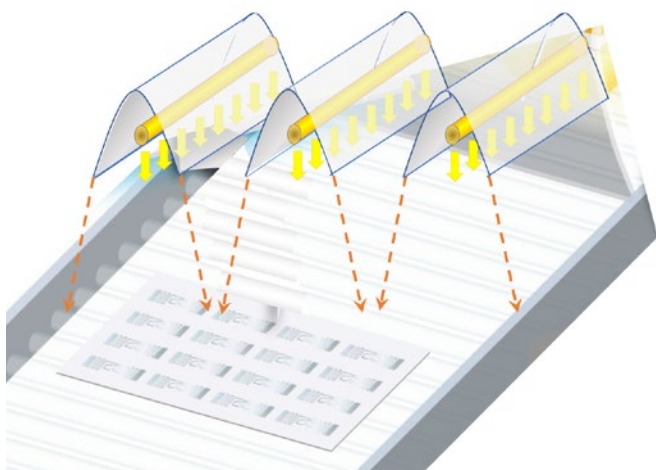


Figure 5: Custom flash tubes, reflectors, power supplies, cooling, and exposure control ensure soldering without heating the underlying substrate. (Source: NovaCentrix)

## Summary

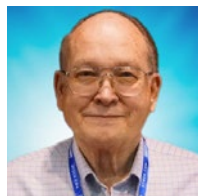
This new soldering process can accommodate a substrate up to 300 x 400 mm with R2R possible. The new opportunities now possible are:

- Use high-temperature solders for comparable quality
  - SAC-305, SnSb, etc.
- Use of temperature-sensitive substrates for lower costs
  - PET, TPU, PVC, PPE, PEI, PVF, PEN, etc.
- Solder multiple sized components at once
- Potential for R2R handling
- Achieve comparable results to reflow ovens but much faster

- Works equally as well with FR-4 and other traditional boards but with a smaller footprint
- Allows soldering on aluminum
- Will work with no direct line-of-sight
- Provides soldering on curved surfaces
- Provides flexible/alternative product design options
- No thermal stress on stacked microvias
- Lower energy requirements
- Selective control of soldering parameters
- Optional N<sub>2</sub> processing area **PCB007**

## References

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**Happy Holden** has worked in printed circuit technology since 1970 with Hewlett-Packard, NanYa Westwood, Merix, Foxconn, and Gentex. He is currently a contributing technical editor with I-Connect007, and the author of *Automation and Advanced Procedures in PCB Fabrication*, and *24 Essential Skills for Engineers*. To contact Holden or read past columns, [click here](#).



Figure 6: Equipment from batch scale to conveyorized production scale. (Source: NovaCentrix)

# Why, Why, Why: Never Stop Questioning

## Testing Todd

by Todd Kolmodin, GARDIEN SERVICES USA

If you have been around young children, I'm sure you have fallen into the "Why" game or "Why" loop with the young'un. I'm now a grandfather and the game started again a long time ago. "Grampa? Why is that man limping?" "Well, he has a cast on his foot." "Why, Grampa?" "Well, it looks like he was injured." "Why?" And so it goes. These brilliant young children have mastered root cause analysis and they don't even know it.

Unfortunately, as we grow older, we tend to accept certain things at face value based on experience. The man is limping because he has a cast due to injury and we leave it at that.

Sometime later we see the same man, now with a cast on his arm. Again, the grandson starts with the whys. "It looks like he now injured his arm as well," and I'm thinking, "This dude is clumsy or has had some very bad luck." Overcome by curiosity, we approach the man and inquire about his injuries since we have seen him twice.

"Nice of you to ask," he says. "You see, I fell down the steps on my porch twice because of the rotted boards. I was meaning to repair them but I'm a little low on cash. I lost my job due to COVID-19."

Ah, now we have solved the puzzle. The limping is

due to a cast from an injury, but the injury is due to a fall, based on rotted boards on a porch the man could not fix. Welcome to the Five Whys.

Grandson: "Why is the man limping?"

- Why 1: He has a cast
- Why 2: He fell off his porch
- Why 3: Rotted boards
- Why 4: Neglected maintenance
- Why 5: No money due to layoff

We have learned much about the man's ill fortune. If we had just left our query at the 10,000-foot level, we would have just accepted that the man had a cast because of an injury. Why the man fell the second time may require a checkup from the neck up with his physician, but that is another story. Because we asked, we discovered why the man fell into his predicament. From this, we can formulate some meaningful corrective action. Since the man does not have money to fix the porch, we can help by closing off the porch, preventing access and further injury. This is a short-term corrective action. The problem is not solved, but a recurrence of the possible injury has been prevented. This can also be the containment phase of the solution.



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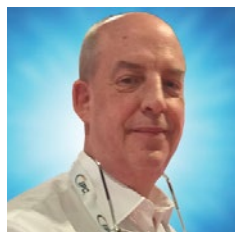


We know that if you walk on the porch, you can get injured, so we prevented access. The full corrective action would be for the man to heal, get a job and repair the porch. Once complete, the restrictions to the porch can be removed and life will continue as normal. Right? Wrong. We are forgetting something—preventive maintenance. We need to add a step, so the man inspects the porch on a routine basis to identify any problems in an early stage to prevent recurrence of the initial problem. Now we have officially closed the loop.

You see, we tend to accept things prematurely as we get older. We make assumptions based on life experiences. This can be problematic in process development and maintenance. We need to question more when necessary. Any nonconformance, whether it be on the manufacturing floor, electrical test, or in our daily routines can utilize the Five Whys discipline.

Most, if not all nonconformance issues, can be rooted down five levels at least. Don't give up too early. To find true root causes, it takes some critical thinking. Just because a brainiac created the process or activity doesn't mean they cannot be wrong. Even the smartest of minds are wrong some of the time. We all are. Ask questions.

Happy holidays to all my readers. It is with your support that I keep writing. My best to all of you and your families wherever you may be. **PCB007**



**Todd Kolmodin** is VP of quality for Gardien Services USA and an expert in electrical test and reliability issues. To read past columns or contact Kolmodin, [click here](#).

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## Ultra-pure Semiconductor Opens New Frontier in Study of Electrons

Princeton researchers have created the world's purest sample of gallium arsenide, a semiconductor used in devices that power such technologies as cell phones and satellites.

The team baked their material down to one impurity for every 10 billion atoms, reaching a level of quality that outstrips even the world's purest silicon sample used in verifying the one-kilogram standard. The finished gallium arsenide chip, a square about the width of a pencil eraser, allowed the team to probe deep into the very nature of electrons.

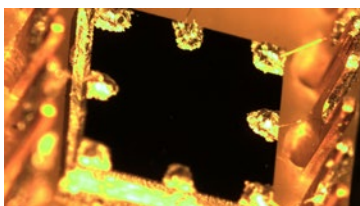
Rather than sending this chip to space, the researchers took their ultra-pure sample to the basement of Princeton's engineering quadrangle where they wired it up, froze it to colder-than-space temperatures, enveloped it in a powerful magnetic field and applied a voltage, sending electrons through the two-dimensional plane sandwiched between the material's crystalline layers. As they lowered the magnetic field, they found a surprising series of effects.

The results showed that many

of the phenomena driving today's most advanced physics can be observed under far weaker magnetic fields than previously thought. Lower magnetic fields could empower more labs to study the mysterious physics problems buried within such two-dimensional systems. More exciting, according to the researchers: These less severe conditions present physics that have no established theoretical framework, paving the way for further exploration of quantum phenomena.

One surprise came when the electrons aligned into a lattice structure known as a Wigner crystal. Scientists previously thought Wigner crystals required extremely intense magnetic fields, around 14 Tesla. "Strong enough to levitate a frog," said Kevin Villegas Rosales, one of the study's two first authors, who recently completed his Ph.D. in electrical and computer engineering. But this study showed that electrons can crystallize at less than one Tesla. "We just needed the ultra-high quality to see them," he said.

(Source: Princeton University)



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# Supplier Highlights



## Atotech Reports Q3 2021 Results, Narrows 2021 Full-Year Guidance Range ►

Atotech, a leading specialty chemicals technology company and a market leader in advanced electroplating solutions, reported financial results for the third quarter of 2021. The company maintained its revenue guidance and narrowed the Adjusted EBITDA guidance range for the full year 2021.

## DuPont Announces Acquisition of Rogers Corporation ►

Rogers Corporation announced that it has entered into a definitive merger agreement to be acquired by DuPont in an all-cash transaction that values Rogers at approximately \$5.2 billion.

## The Big Picture: Cybersecurity and Hardware Security ►

Wherever I go, I am pleasantly reminded of the role our industry plays in everyday lives. From the sight of people texting and calling loved ones on their phones, to children laughing and playing with their high-tech toys, to doctors and nurses using advanced med tech to keep someone alive. These moments remind me of how important the safety and security of our work is.

## Unimicron Holds Sustainability Co-Prosperity Award ►

Unimicron implements sustainable supply chain management regularly holds annual supplier meetings and commends excellent suppliers there. Since the COVID-19 epidemic broke out globally in 2020, and with the efforts of all citizens, the domestic epidemic is still under control, but in the face of the epidemic, we must still be cautious.

## KLA Opens AI-Advanced Computing Lab at Indian Institute of Technology ►

KLA Corporation announced the opening of two important facilities in Chennai, India, supporting the company's investment in innovative research and talent development.

## Nano Dimension's Revenue Increased by 107% in 9 Months, 206% in 3 Months ended September 2021 ►

Nano Dimension Ltd., an industry leader in Additively Manufactured Electronics (AME), Printed Electronics (PE), and Micro Additive Manufacturing (Micro-AM), announced financial results for the third quarter ended September 30, 2021.

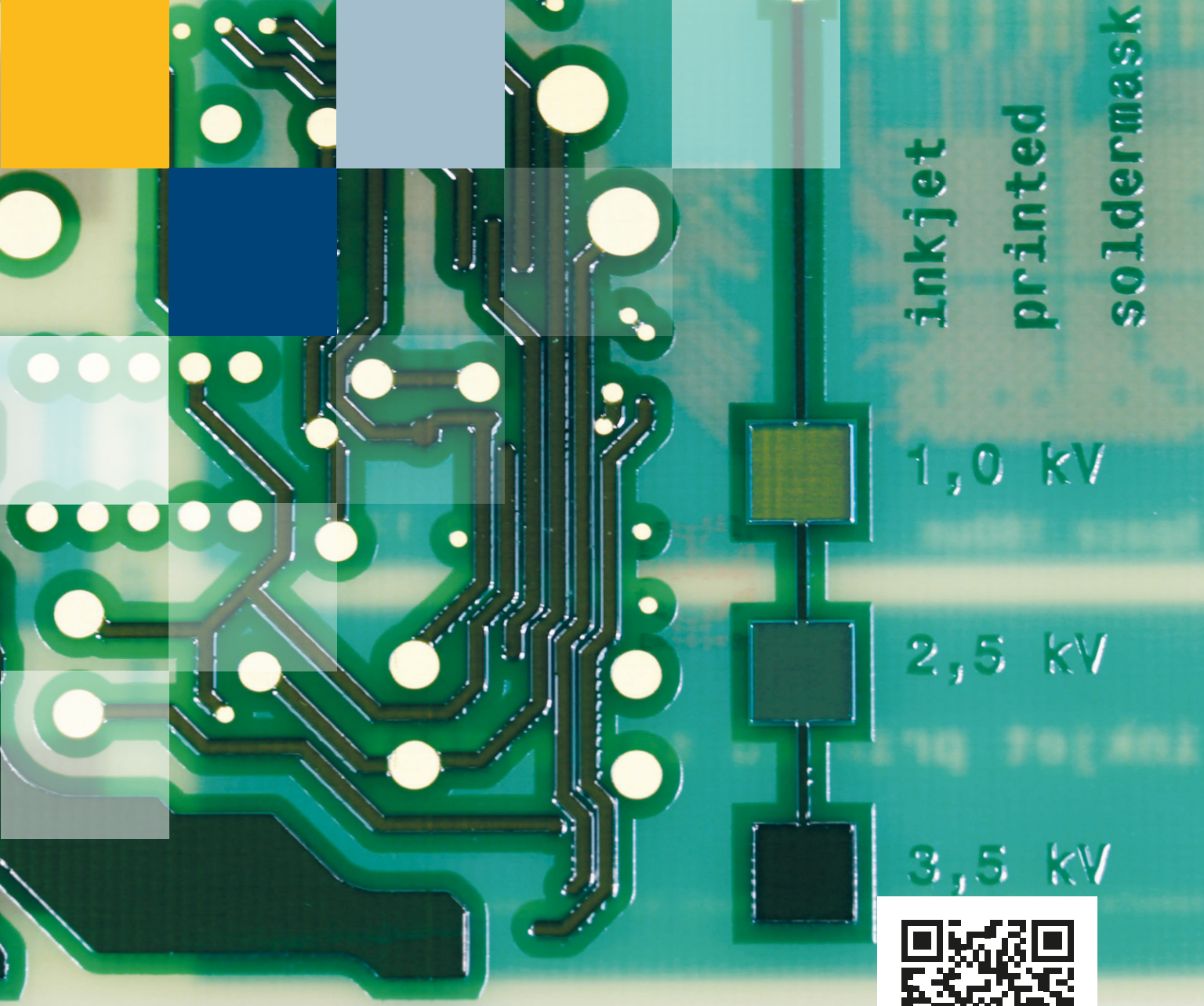
## Additive Reality: You've Opened Up the Inkjet Printer Box, Now What? ►

The moment will come when some of you readers will advance from interest to complete involvement with the technology. This will be a fun ride as you will experience first-hand the concepts seen so far in this column. However, we all know that any reliable technology relies on one healthy, not so exciting, good habit: preventive maintenance.

## Weyls Named Vice President, Circuitry Solutions for MacDermid Alpha ►

MacDermid Alpha Electronics Solutions, a global supplier of integrated solutions from our Circuitry, Assembly and Semiconductor division that provides unmatched capabilities in electronics design and manufacturing, announces the appointment of Erik Weyls as vice president of its Circuitry Solutions division.





## INKJET DEPOSITION OF SOLDER MASK RESISTS FOR PCB PRODUCTION

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# A Tour of the New **Isola** Factory: **Investing** in North America

Interview by Barry Matties

I-CONNECT007

I recently toured Isola's new 118,000-square-foot low-volume, high-mix manufacturing facility in Chandler, Arizona. The facility's construction began in 2020 and, like many building projects, was delayed because of the COVID-19 pandemic. Building a new factory during the pandemic was certainly a challenge but the team persevered and the new greenfield facility is now operating to meet the needs of the North American market.

During the tour, I met with Travis Kelly, Ed Kelley, Sean Mirshafiei, Jenny Inocencio, and

Walt Niziolek. We covered a range of topics, including lab operations, hiring, the supply chain, R&D, and the concept of the new facility. The factory was designed to extensively utilize automation to improve efficiencies and, as Travis Kelly stated, "to de-risk the labor shortage issue." As we walked through the facility, it was clear that automation efficiencies were in action as material moved from one process to the next with well-orchestrated choreography.

However, automation does not handle every step in the process. There is a vibrant workforce, and their contributions are highly valued. The following are excerpts from this wide-ranging, daylong tour.



Travis Kelly



Ed Kelley



Sean Mirshafiei



Jenny Inocencio



Walt Niziolek





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**Barry Matties:** Travis, in our past interviews we talked a lot about your commitment to a strong culture. This new facility is a positive reflection of that, for sure.

**Travis Kelly:** Yes. We spend a lot of time showing our employees that we care because obviously they are the most valuable resource at Isola. We want to provide a nice environment. We're always doing new things that reinforce to our employees that they are appreciated. The employees really like it and understand that we care about them.

*In the new facility, Isola invested in an expanded state-of-the-art laboratory to support quality and R&D. The lab includes a variety of testing equipment, from Fourier transform infrared spectroscopy (FTIR) and scanning electron microscopy (SEM) analysis for identification of contaminants, to micro-section equipment used for evaluation of printed circuit board integrity after thermal excursions. Ed Kelley and Jenny Inocencio kicked off the tour in the new laboratory.*

**Matties:** How does this new lab compare to your previous facility?

**Ed Kelley:** In our previous building, it was mostly a manufacturing area, so we had to squeeze the R&D labs into that building. This new building was designed to specifically allocate space for R&D purposes.



Ed Kelley in the R&D and analytical lab.

**Matties:** What is the R&D team focused on now?

**E. Kelley:** Historically, a lot of laminate suppliers relied on outside suppliers of resins; we continue to do so, but we're also looking at tailoring certain polymers for our own purposes. Many of the resins we buy can be used in all sorts of applications. We might want to take some of these commercially available resins and formulate them with something that we've



The Johann Schumacher Laboratory is named for an Isola technical fellow and engineer who has developed numerous innovations throughout his 35 years with Isola.

developed to give us some unique properties specific to our applications. So, we are doing some of our own polymer synthesis work which is supported by equipment such as our nuclear magnetic resonance (NMR) unit.

Much of our product development work today is focused around 5G and automotive market needs, where electrical, thermal, and CAF resistance properties are critical. With 5G, of course, every component of the product is critical—the resin system, the glass cloth that's reinforcing it, as well as copper foils. We are very focused on combining these raw materials in ways that meet the OEMs' requirements while also providing a product that is as easy to use as possible for our PCB manufacturing customers.

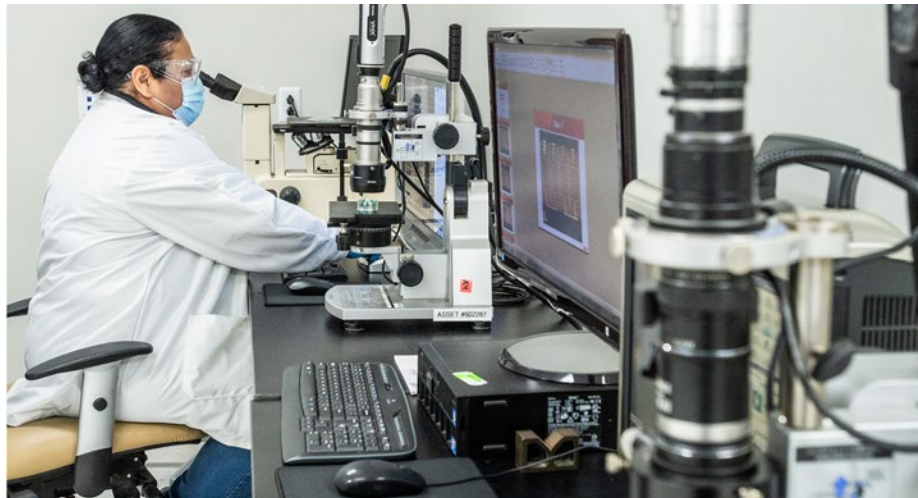
**Matties:** What about halogen-free products?

**E. Kelley:** Historically, Isola hasn't had many halogen-free products; that's been a more recent focus. If you look at the wired telecom space, for example, there are needs in different loss segments, and therefore different levels of electrical performance for our products. We have a complete portfolio of the non-halogen-free materials, and now we're looking at filling in the halogen-free offering. Very soon we will be introducing an extremely low loss product called TerraGreen 400G, which is also halogen-free.

As these extremely low-loss materials are more costly, we are seeing an increase in hybrid PCB stackups where PCB designers use the extremely low loss materials in critical layers and use less expensive materials in other layers. Since we want to keep the whole stackup halogen-free, we need to have halogen-free products that have different loss characteristics. Much of our recent work has been on filling in those halogen-free segments.

**Matties:** What customer interactions do you have here with the lab? Are they coming in, and what are their needs?

**E. Kelley:** There were a lot more coming in prior to COVID, but we still do a lot of testing. For example, we have a Technical Program Management (TPM) group. Some of our applications engineering support people who are customer-facing will help, not just with evaluations of our materials, but also in looking at PCB designs and recommending stackups and process parameters. We take a very holistic view. It's easy to get focused on just getting



Expert evaluating a PCB design.

the best electrical performance, for example, and lose sight of the other requirements of our product—thermal reliability, CAF resistance, etc. At each stage of our development process, we make sure we're checking all the boxes of requirements, not just, say, electrical performance.

**Matties:** One of those areas tends to be more important to the industry at any given time, I would think.

**E. Kelley:** Yes. 5G, for example, is all about low loss. Everybody wants the best possible electrical performance, which has driven the use of very smooth copper foils that have quickly changed customer specifications on



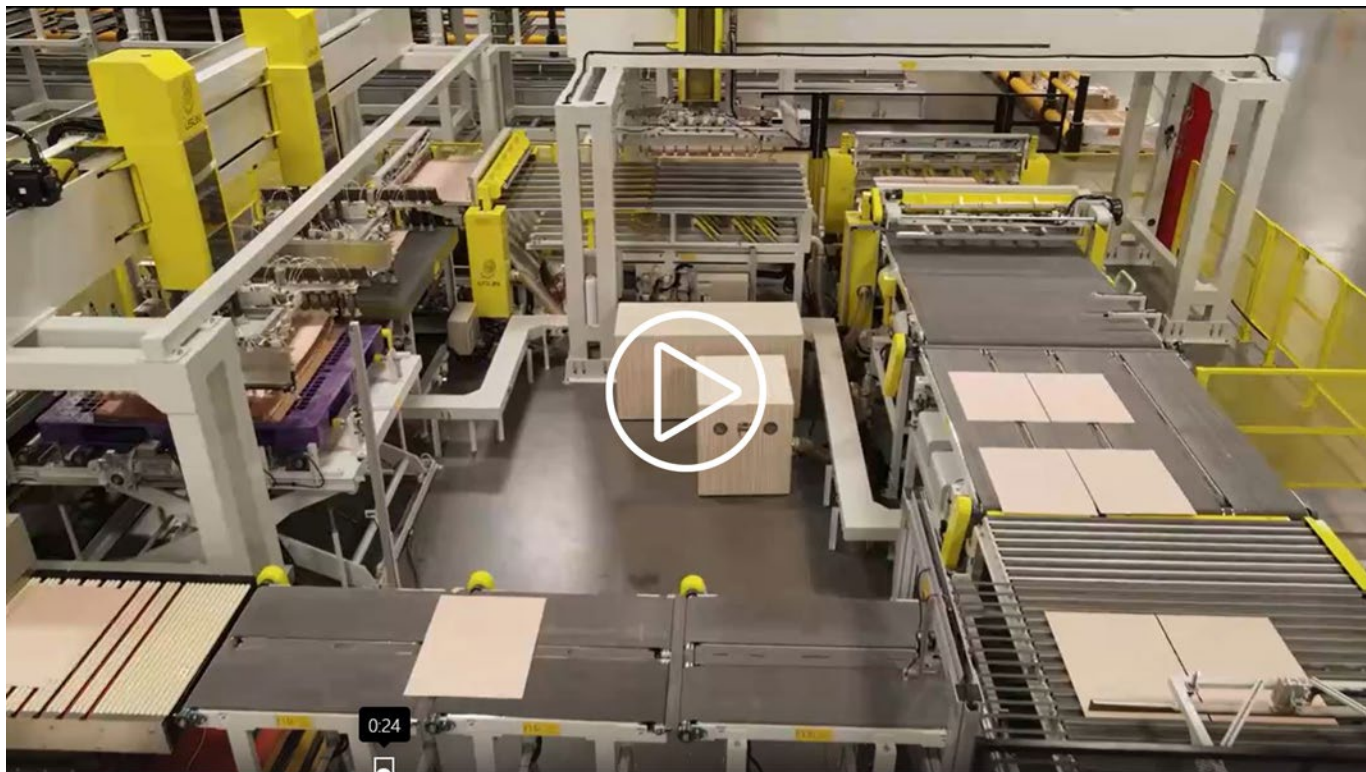
peel strength. The question becomes, if the right measure is not peel strength, how do you assess the reliability? While the focus is certainly on the electrical performance, it creates other concerns. With these very smooth copper foils, the risk of delamination in assembly thermal cycles can increase, and we have also seen cases where CAF growth occurs at the bond line between etched laminate surface and the prepreg bonded to it. So, we work very closely with our suppliers to make sure that the copper profiles and treatments match well with our dielectric material, and we follow a strict test protocol to make sure we are getting reliable adhesion and excellent CAF resistance even though it is the electrical performance that is driving the industry requirement.

**Matties:** And for the automotive market?

**E. Kelley:** As far as product development, we are very focused on higher performance materi-

als for electric and hybrid electric vehicles with high-power, high-voltage, and harsh thermal environments. A few years ago, we went from testing CAF at 100 to 350 to 500 V. Now we're testing at 1,000 and 1,500 V; if you think about it, we understand why people are trying to do this. If you want to charge your electric vehicle, you don't want it to take any longer than filling up a gas-powered car. Certainly, we've learned some things about CAF resistance at those higher voltages, and there are some key differences at those high voltages compared to the lower.

High voltages also generate a lot of heat. The automotive classifications for thermal cycling reliability are going up dramatically, too. There's a bit of a dynamic with the OEMs trying to figure out what materials are available and how to design a PCB to have a reliable product. In turn, we are working to develop more reliable products to offer greater design flexibility. There is a lot of testing going on right now. We are also working on products for



Automation efficiencies in action as materials move from one process to the next in well-orchestrated choreography, as shown in this short video.

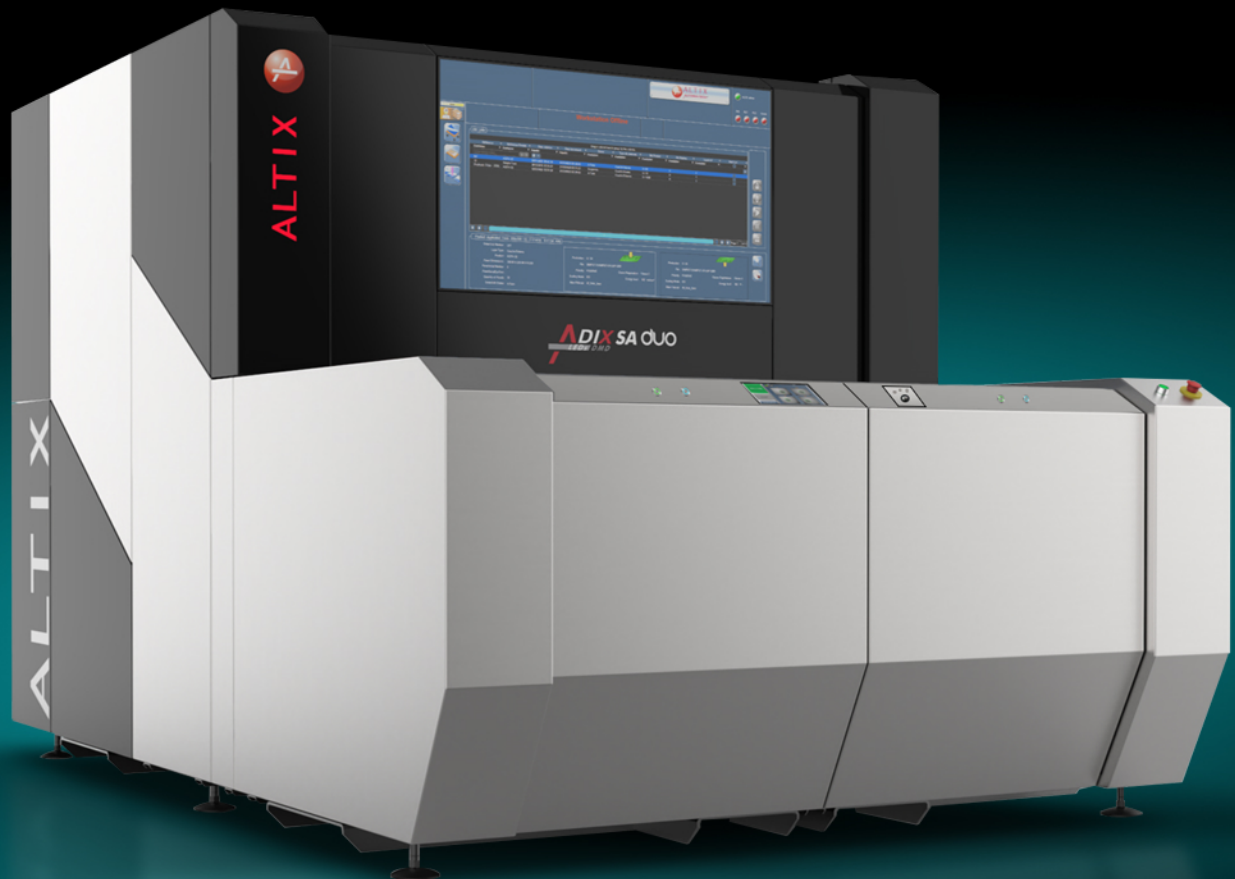




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**Matties:** Ed, do you see increased collaboration, in terms of material selection, between the OEM and the fabricator?

**E. Kelley:** Yes. Using the example of 5G again, we are the experts on what our materials can do in terms of electrical and other performance requirements that are important to the OEM, but if our material is very difficult to use in the PCB manufacturing process or in specific designs, then we all still have a big problem. One specific example: Every few weeks we have a call with a large telecom OEM and one of their PCB fabricators that does a lot of material evaluations and qualifications. They always ask about the status of our testing. What are the issues that we're trying to overcome? This regular collaboration ensures that we are performing testing relevant to both the OEM's and fabricator's needs and that we are working toward meeting their schedules.

**Matties:** How important is the circuit designer in this process?

**E. Kelley:** On that particular call, one of the designers participates, which is really good for us and the fabricator so that we understand the design challenges we need to address in order to be successful; even the way the copper pattern is laid out and how thick it is can create problems.

We have a lot of folks here, including myself, who have prior PCB manufacturing and engineering experience. As we develop products, we're always trying to figure out: If we were going to use this product to build complex PCB designs, what would we need so it's compatible across those different applications that designers come up with? That might be something like wanting to know if the resin flow will be enough to fill complex innerlayer circuit patterns. Or how easy it is to drill, desmear, and plate copper in the holes.



*Jenny Inocencio was instrumental in setting up the new lab. She manages Isola's global laboratory services groups, which include Singapore and a smaller team in Germany. As she explained the capabilities of the new lab, I was impressed with her passion for and knowledge of each piece of equipment.*

**Matties:** Jenny, you had an opportunity to help design the lab from the ground up. That must have been a lot of fun.

**Jenny Inocencio:** It was. It was a lot of work, but it was wonderful because I was able to take several ideas from our previous location and build a better footprint where we could strategically place equipment. We wanted to become more effective and more efficient by having a better layout all the way around.

**Matties:** How much customer input did you have while you were putting this lab together?

**Inocencio:** There was a great deal of customer input because our number one focus is being able to turn work orders very quickly to serve our customers. It's at the forefront of everything we do. With that in mind, we want to build around the concept of servicing our customers faster and more efficiently. How can



I build a lab that will provide better service more quickly?

**Matties:** What would trigger a customer to request something, a service from you?

**Inocencio:** It could be routine testing, or they may have an issue where they rely on us to help them solve that issue. With our new products, we're working with customers to get their process set up to produce successfully with our material; a lot of times we will do the testing here to validate that their process parameters are yielding good results.

**Matties:** Do customers know you offer these lab services?

**Inocencio:** Yes, most know. We try to be as helpful as possible. Also, our tech service managers will frequently bring me into customer calls so we can try to understand the best path forward and how I can help them.

**Matties:** You have a lot of testing capabilities here that are nuanced, and customers might not be aware that you can do certain tests.



Isola analytical services workstation.

**E. Kelley:** That's a really important point because we view ourselves not just as the supplier of the base material, but we want to be involved in helping our customers solve their problems. So, to the extent we can help them be successful, we all win.

**Matties:** This is definitely an impressive lab. What would you do differently now that this is all set up?

**Inocencio:** I would have celebrated harder.

**E. Kelley:** It's not too late (laughs).

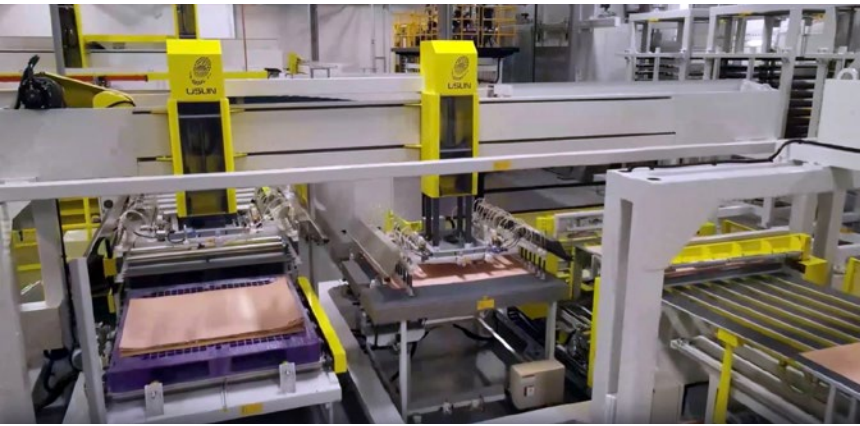
*As my tour continued, Walt Niziolek and his team guided me through the new production area with about 80,000 square feet dedicated to manufacturing. Walt joined Isola as the COO in early 2021, and shared that on his first day he faced a major supply chain challenge—a ship was blocking the Suez Canal.*

**Matties:** Walt, what's your background?

**Walt Niziolek:** I was a soldier for quite a few years. I used to jump out of airplanes for a living. Now I'm an engineer who has run operations in several industries, including automotive.



Lab testing equipment.



Automated material hoists.

**Matties:** So, you understand process and work ethic.

**Niziolek:** Yes, sir. We have a very vibrant, clean, effective environment. As we continue to ramp up, it has a lot of promise. I'm excited about this facility and the team in it. We have dedicated employees who come in every day to succeed. Through the pandemic, we have learned that when you are struggling to hire people to fill positions, or you have turnover in those positions, it exposes processes.

As operators, we focused a lot on base processes such as packaging and labeling. When you consider how fundamental those really are,

they're rife to be vulnerable because you count on employee experience vs. robust process.

It forces you to build the process elements and the supporting process to enhance or reduce your vulnerability in your process. We've spent a lot of time across Isola, and in this facility particularly, revisiting those processes.

**Matties:** That make sense. Sean, this factory is a different concept from the traditional. You built this to be in tune with your customers' needs.

**Sean Mirshafiei:** Yes. The facility was built to support PCB fabricators with high-mix, low-volume requirements. This facility is not currently focused on treating. Our first step in this market is to make sure we handle a high-mix, low-volume manufacturing process. If you look at what has happened over the last 10 or 20 years, the remaining customer base in the U.S. is, generally speaking, high-mix, low-volume production shops. The value they bring to their customers is technology and speed. Our facility needed to mirror that same approach. That's the intention of this.



Walt Niziolek at the lamination press line.



**Matties:** How many openings did your presses have previously?

**Mirshafiei:** In our old facility, we had 30-opening presses and treaters. Now, we have multiple 10-opening hot presses as well as cold presses to handle the mix.

**Niziolek:** The key here is creating that flexibility and executing on it. It centers on laying up in time and collating that press load where I'm not filling a 30-board press, so I'm turning over press loads faster which, by definition, gives me more flexibility. It's pretty exciting.

**Matties:** As we all know, the world is being hit with the ongoing supply chain issues. How are you managing this?

**Niziolek:** Like other companies, we've been frustrated, and we've frustrated some customers. I've never seen anything like it in almost 40 years of doing this. It's just unparalleled. Everywhere you turn, there's a challenge. But our customers have been good, and they have been steady. It's the insightfulness, the thoughtfulness, in how you approach the issue and the flexibility in how you react. We offer a lot of breadth to the customers, and managing that complexity becomes challenging at times, but you need to have contingency sources and plans. It's around that balance and execution against customer expectations. When your offering is performance, there's no substitution.

**T. Kelly:** Force majeure letters have come out from numerous suppliers. It's a challenge every day and everyone is facing it. We read about shipping containers costing \$20,000, or containers on ships that can't get into port. We manage this every day, and there are significant challenges associated with it.

**Matties:** What do you share with your customers these days? They are very concerned about supply chains.

**Mirshafiei:** Yes, they are concerned about risks to the supply chain. They see it not just from us as a material supplier, they see it from all elements of their business. The message that our customers and their customers (the OEMs) were looking for is to finally see an investment in North America to support the industry here. We're not just taking an old model of high volume, low mix, but something that's more tailored to the industry.

That's part of the positive karma that we saw, and that hasn't really abated. What has happened is the pandemic and how this has exposed the dependency of the supply chain.

What they want to see is communication; give them visibility, help them understand what they can plan from a supply standpoint, and keep them up to date. As you heard from Walt, Ed, and Travis, as an industry and as a country, we are all faced with the same challenges.

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**As an industry and as a country, we are all faced with the same challenges.**

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**T. Kelly:** I think the key word is transparency. We've talked about supply chain ad nauseum. That's just not the raw material inputs, it's also shipping constraints, shipping containers, ports being fully congested, and shortages on truck drivers. We can't control that. But we can control transparency. We have hyperinflation, not only on the raw material but, once again, on the shipping cost. So how do we become more transparent with our customers to let them know the challenges we're facing? The force majeure letters from numerous chemical companies; it's all about transparency and over-communicating. This is our focus, and we want to improve. You don't want to be naive and think this is going away soon. There is nothing that we have seen, read, or





Isola's 118,000 sq. ft. manufacturing and R&D Facility is in Glendale, Arizona.

heard about to show this is transitory or short-lived.

**Mirshafiei:** We recognize this is a cyclical business, so you can't take a short-term view of these scenarios. That's why you must be transparent. You must do your best to absorb as much of the cost as you can, which is what we're doing. When it gets to the point that it no longer makes good sense, you must be transparent with your customers about the inflation that you're experiencing. This is a long-term strategy.

**Matties:** You're not unique, though. You're not the only one saying, "We have to raise our prices." We're seeing it at the grocery store, at the gas pumps, in every aspect of life. It's not a shock.

**T. Kelly:** That's right, and it goes to Sean's point. You have to bifurcate the discussion between high demand and inflationary pressures. Eventually there will be an inflection point where inflationary pressures lead to a slowing of demand. As Sean said, everything is cyclical. Ultimately, we will reach the point where we can't pass on that inflation any longer because it will impact demand. That's where you see it, and it's definitely affecting some other sectors because you can't keep up at this pace.

**Mirshafiei:** It seems like the demand will have to soften for the supply chain to recover, to have fewer container ships stuck, or needing to turn around. Frankly, if people don't have the excess disposable income, they won't buy that new game console. They will wait longer to buy the next iPhone, or whatever the case may be. Maybe that's the trigger because it's not like we're suddenly going to have more container ships, a whole bunch more containers, or more available copper. It won't be on the supply side; I think it's going to be on the demand side.

**Matties:** What might be interesting about this cycle, though, is the dip may not be as deep for the U.S. fabricators.

**Mirshafiei:** You're right. We are a pretty broad industry in the U.S., not driven by any one specific segment. Certainly, automotive was extremely strong in Asia. Some aspects of telecom were also extremely strong, which was tied to working from home and so forth. Not being able to have boards built for automotive in Asia pushed it back to Europe. Investments in manufacturing drove industrial growth in Europe.

The U.S. has seen the least swing, the least amount of volatility. You have a very strong base of aero and defense types. You saw the let-off on commercial aerospace, offset by steadiness

in, predominantly, military and defense. And you had the continued investment for NPI work. Probably, the biggest volatility, the biggest headaches, have been the supply disruptions that we're all trying to manage. Imagine if this were the automotive China market. How would the industry react to that kind of an upswing?

**Matties:** Such as when Ford had to shut down the new Bronco production line. That wasn't in their business plan. Do you have any final thoughts that you would like to share with the industry?

**T. Kelly:** I think, ultimately, Isola continues to invest in the business to support its customers. Looking forward, we want to continue to increase that service level, and we can always do a better job. Right now, we must keep a high level of urgency and remain transparent. If we can do that, stay the course and laser-focused on the things we can control, we'll be a good supplier to our customers.

**Mirshafiei:** It's exciting to be part of an organization that has invested quite a bit of money in North America, specifically to adapt to the model that's needed here. That creates value and helps solve problems. Certainly, it's been hard with the supply chain and COVID-related challenges, but that will gradually pass. What remains will be the investment we made to support the resiliency of supply in North America to be able to provide options to our customers that need products quickly and not have to rely on older equipment that wasn't really designed to service this changing market that we're in. That creates value for our customers.

**E. Kelley:** We want to build into our product development so we are not overly reliant on fragile supply chains. But, looking forward, whether it's electric vehicles, 5G, or the real advanced applications yet to come, there are years of technological progress ahead.



Travis Kelly in the new facility.

**Niziolek:** Process reliability is what our customers expect from us. You can't overlook the simple or the obvious. This environment over the last 18 to 24 months has reinforced that for me as an operations professional. It's the fundamentals that truly matter: how well you execute, and how repeatedly you execute against those fundamentals. It ought to be obvious to you when it's happening. But turnover at the fringe has exasperated that, not only for Isola but for virtually everybody, be it the fast-food drive-thru or any of our customers. It's been powerful to me, and I appreciate the industry and my colleagues. I've visited customers. I see the challenges firsthand and I think that, by and large, it has been handled admirably. That doesn't mean we're thrilled, but I'm excited to be part of the team trying to solve these challenges.

**Matties:** Well done! Thank you for opening your doors and inviting me in. This has been really great. To see an investment in North America is wonderful, but to see a smart investment makes it even better. It's wisely done.

**T. Kelly:** Thanks, Barry.

**Mirshafiei:** Thank you. PCB007



# Sarah Czaplewski Discusses the PCB Fab and Materials Track



Feature Interview by the I-Connect007  
Editorial Team

You may remember Sarah Czaplewski, a senior reliability engineer at IBM who co-wrote the Best Technical Paper at the virtual IPC APEX EXPO last year. Sarah was also a member of IPC's Emerging Engineers program.

This year, Sarah is the director of the PCB Fabrication and Materials track at IPC APEX EXPO 2022 in San Diego. We asked Sarah to discuss her role as track director, as well as the classes she's presenting at IPC APEX EXPO and the benefits of attending the conference portion of the show.

**I-Connect007:** Sarah, tell us about yourself and your responsibilities as track director of the Fab and Materials curriculum.

**Sarah Czaplewski:** I am a senior PCB reliability engineer at IBM, and I am serving as the PCB Fabrication and Materials track director for the IPC APEX EXPO 2022 Technical Program Committee. Along with a few others supporting the PCB Fabrication and Materials track, I evaluate submitted abstracts, help organize accepted abstracts into sessions, and review

paper and presentation submissions. As of now, I will be chairing two sessions at the conference: Microvia Design and Test 1, and Surface Finishes and Coatings.

**I-Connect007:** Tell us about your sessions. Why are these topics so important for today's fabricators?

**Czaplewski:** The two technical sessions that I am chairing in the PCB Fabrication and Materials track address topics of interest to PCB manufacturers and OEMs. Let me briefly explain them.

## *Microvia Design and Test*

The densification of electronics has led to widespread use of high-density interconnect (HDI) PCBs with multiple layers of microvias. This increased usage has exposed a critical microvia reliability concern: separation at the plating-to-target-pad interface, causing latent and intermittent opens. Ensuring multiple layers of microvias can withstand thermal and mechanical stresses of assembly and use is of utmost importance.

This year, IPC APEX EXPO 2022 is offering two technical sessions devoted to microvia design and reliability to highlight new findings

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in the industry. The papers in these sessions describe testing to identify design parameters that lead to improved reliability. Fabricators and OEMs in attendance will gain valuable insights about microvia design, test methods, and simulation techniques.

### ***Surface Finishes and Coatings***

This session will focus on new developments in surface finishes with emphasis on meeting next-generation PCB design and performance needs. For example, electroless nickel has provided a reliable barrier layer in ENIG and ENEPIG surface finishes, however, its low conductivity and thickness limits its use in high frequency and high routing density applications. There are two papers addressing alternative surface finishes and their performance and reliability. Another paper will address the use of a thermally conductive polymeric coating on the PCB surface to improve thermal management in applications requiring high processing speeds and increased power requirements. Attendees will gain valuable insights into next-generation surface finish considerations from these papers.

**I-Connect007:** What are some of the key trends and challenges that you see in this segment right now?

**Czaplewski:** The push for higher data rates and increased functionality is driving many trends in PCB materials and fabrication. New extreme-low-loss laminate materials are being developed and incorporated with low Dk glasses and smoother copper foils. New, lower roughening core adhesion promotion chemistries and surface finishes are also being evaluated. In addition, increased global regulations and scrutiny on certain flame retardants is driving more careful monitoring of the compounds used in laminate materials as well as selection and development of new halogen-free materials.

The use of these new materials and processes will require testing to validate reliability, which may reveal challenges in preventing issues such as delamination, among others. Further, fitting more functionality in the same or less space results in smaller conductor spacing and more utilization of multiple layers of microvias. The tighter conductor spacing raises potential challenges in mitigating electrochemical migration and conductive anodic filament growth, and the increased use of microvias (especially stacked microvias), increases the challenge of consistently producing reliable connections. These are just a few of the key trends and challenges in the industry, from my experience.

**I-Connect007:** What are the benefits of attending the Professional Development and Technical Conference at APEX EXPO?

**Czaplewski:** Attendees of the professional development and technical sessions at IPC APEX EXPO will benefit from expanding their technical knowledge and network. The technical sessions will highlight the latest studies in new technologies and materials in the electronics industry. The professional development courses will enable attendees to increase depth of knowledge in a particular area or expand their technical breadth by learning about a new subject. During both technical sessions and professional development courses, attendees will be able to meet and interact with others in the industry. All of this will help further attendees' effectiveness in their current business and future careers.

**I-Connect007:** Thank you, Sarah. We'll see you at the show.

**Czaplewski:** Thank you. **PCB007**



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# Steve Williams

## Explains 'AS9100D: 2016 in Plain English'



Steve Williams

Feature Interview by the I-Connect007  
Editorial Team

Steve Williams, president of The Right Approach Consulting and an I-Connect007 columnist, will be presenting a session in the Professional Development track at IPC APEX EXPO 2022 in San Diego. His session, “Aerospace AS9100D: 2016 in Plain English,” takes place the afternoon of January 23.

We asked Steve to provide some highlights of his class, and to explain why AS9100D is so critical to manufacturers who have customers in the aerospace sector—or wish to enter that lucrative market.

**I-Connect007:** Why is this topic so important for PCB manufacturers in the military and aerospace segments?

**Steve Williams:** The aerospace parts market has a \$900 billion total available market (TAM) and access to this business largely depends on

being AS-certified. From a performance standpoint, implementing AS9100D will result in:

- Better decision-making
- Improved efficiency and customer satisfaction
- Better supplier relationships
- Habitual continual improvement
- Reduction of organizational risks

**I-Connect007:** What are some of the key trends and challenges involved in implementing AS9100?

**Williams:** Upgrading clients’ quality systems to AS9100 is the fastest growing part of my business, which is becoming even more important in today’s business environment. AS includes 100% of ISO 9001 requirements plus over 80 additional ones. AS requires much more discipline than ISO, but the effort required pales in comparison to the organizational performance benefits that can be achieved.

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**I-Connect007:** What are the key takeaways for your class attendees?

**Williams:** They will learn:

- The seven requirements
  - Context of the organization
  - Leadership
  - Planning
  - Support
  - Operation
  - Performance evaluation
  - Improvement
- Nuts and bolts of the major changes
- Organizational context assessment
- Risk-based thinking
- PDCA
- Turtle diagrams: What they are and how to use them
- Process metrics

**I-Connect007:** What are some of the benefits of attending Professional Development classes at IPC APEX EXPO?

**Williams:** One of the greatest aspects of professional development courses at IPC APEX EXPO is the opportunity to learn in a setting that brings together a vast variety of people and companies from around the industry. I have been teaching PD classes for IPC APEX EXPO since 2004. I learn new things from the audience every year, and they learn from each other. The sharing of experiences is one of the great advantages of this venue.

**I-Connect007:** Do you have any final thoughts?

**Williams:** AS9100 can be a game-changer for companies looking to improve organizational performance and provide entry to an incredible revenue stream that would otherwise be inaccessible. If you want to play in the aerospace arena, AS9100 certification is a must. Don't miss this session. **PCB007**

To check out Steve's video message about his IPC APEX EXPO class, [click here](#).

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## Spotlighting a New U.S. Printed Circuit Board Association

Barry Matties recently met with Travis Kelly to discuss the formation of the Printed Circuit Board Association of America (PCBAA), a consortium of U.S.-based companies he chairs to support U.S. domestic production of PCBs. PCBAA was established on three pillars, and Travis explains how they intertwine with each other—and with other similar organizations in the industry.

**Barry Matties:** Travis, we are here to talk about the new association that's forming. Tell me about that.

**Travis Kelly:** I'm excited to discuss the Printed Circuit Board Association of America. It was formed by five prominent companies in the PCB industry that identified a need, not only to educate, but also to advocate for legislation supporting the competitiveness of the domestic PCB industry. The founding members are Calumet, Insulectro, Isola, Summit Interconnect, and TTM. What really sparked the formation of the PCBAA was learning that PCBs are very rarely part of the discussion on the Capitol Hill or in the news as it

relates to microelectronics. There's a lot of discussion around chips and semiconductors. However, chips don't float; they must be embedded onto something. There is a very strong need, but very little awareness around PCBs as it relates to microelectronics, so that's really the catalyst behind forming the organization.

**Matties:** Why do you feel like there was a need to start something separate from the IPC, or will you be collaborating with the IPC?

**Kelly:** IPC, USPAE and PCBAA have complementary missions and serve the microelectronics industry in different ways. For example, advocacy is a common mission with all three organizations taking positions in the policy and legislative arenas. PCBAA was formed to shine a light specifically on PCBs and be the voice of the industry. Once again, PCBs have received very little recognition in a broader conversation around microelectronics, with a few exceptions in Congress.

To read this entire conversation, [click here](#).

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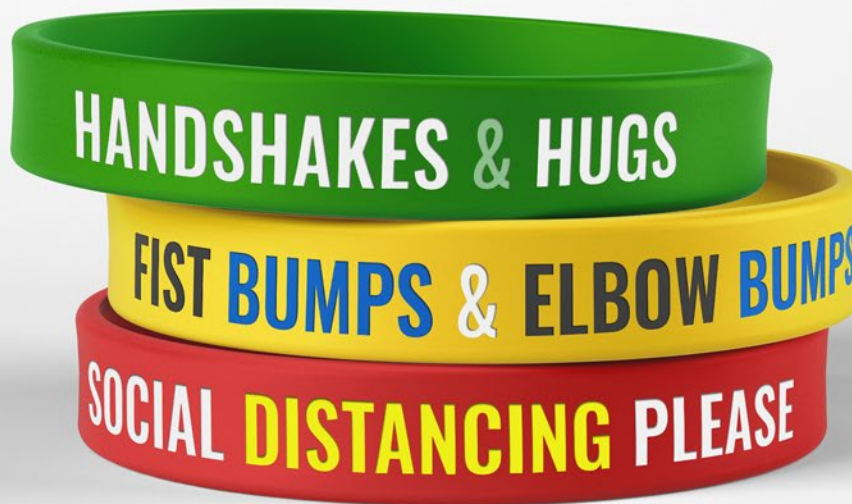
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# What to Expect Regarding **COVID** Restrictions

Feature Article by Alicia Balonek  
IPC

As IPC is adhering to California Department of Public Health Guidelines, proof of COVID vaccination or a negative test will be required to attend IPC APEX EXPO 2022.

IPC has partnered with InHouse Physicians (iHP) for attendees to upload their proof of vaccine or negative COVID test results in advance of arrival at IPC APEX EXPO. Once information is uploaded via the iHP link, a trained medical professional will review the information within 24 hours and provide an email confirmation with a green check mark indicating they've been cleared for entry.

Upon arrival at IPC APEX EXPO, attendees will need to check in at the COVID clearance desk and provide a copy of the COVID clearance confirmation they received from iHP. Once cleared for entry, attendees will receive a plastic wristband and can then proceed to the registration counter to receive their badge. Attendees are asked to wear their COVID

clearance wristband for the duration of their stay at IPC APEX EXPO.

Although there are currently no social distancing requirements in the State of California, colored wristbands will be provided for exhibitors and attendees to indicate their comfort level for interaction while at the event:

- Green: Comfortable with handshakes and hugs
- Yellow: Prefer only fist bumps or elbow bumps
- Red: Interaction with social distancing

IPC will be following the State of California's guidelines; masks will be required for unvaccinated people and masks are recommended for those who have been vaccinated.

Masks, individual hand sanitizers, and hand sanitizer stations will be available for all exhibitors and attendees while at IPC APEX EXPO.

The San Diego Convention Center has enhanced its cleaning, disinfection, and infectious disease prevention protocols. IPC is working closely with the convention center to



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Alicia Balonek

ensure high-touch items are cleaned and sanitized multiple times a day through the duration of IPC APEX EXPO 2022.

Additionally, the San Diego Convention Center became one of the first convention centers in the United States to achieve the prestigious GBAC STAR™ facility accreditation. Under the guidance of the Global Biorisk Advisory Council (GBAC), the convention center is implementing a program of stringent protocols for cleaning, disinfection, and infectious disease prevention.

Centerplate, the food and beverage provider for the San Diego Convention Center, was the first North American venue to achieve the Rise SAFE hygiene verification label for food and beverage services. To earn the label, Centerplate passed a site audit and protocol review covering 36 checkpoints in four core areas: process, people/training, facilities, and hygiene/cleaning. Centerplate demonstrated 100% compliance across all areas.

For the most current information regarding COVID-19 protocols for IPC APEX EXPO, visit [COVID-19 | IPC APEX EXPO 2022](#). **PCB007**

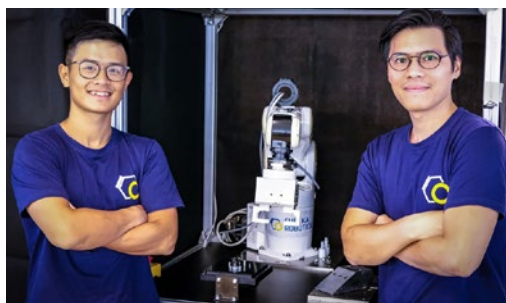
**Alicia Balonek** is the senior director of trade shows and events at IPC.

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## New Software Gives Robots ‘Human Touch’

Eureka Robotics, a tech spin-off from Nanyang Technological University, Singapore (NTU Singapore), has developed a technology, called Dynamis, that makes industrial robots nimbler and almost as sensitive as human hands, able to manipulate tiny glass lenses, electronics components, or engine gears that are just millimetres in size without damaging them.

This proprietary force feedback technology developed by NTU scientists was previously demonstrated by the “Ikea Bot” which assembled an Ikea chair in just 20 minutes. The breakthrough was first published in the top scientific journal *Science* in 2018 and went viral on the internet when it could match the dexterity of human hands in assembling furniture.



NTU Associate Professor Pham Quang Cuong, Co-founder of Eureka Robotics, said they have since upgraded the software technology, which will be made available for a large number of industrial robots worldwide by Denso Wave, a market leader in industrial robots, which is part of the Toyota Group.

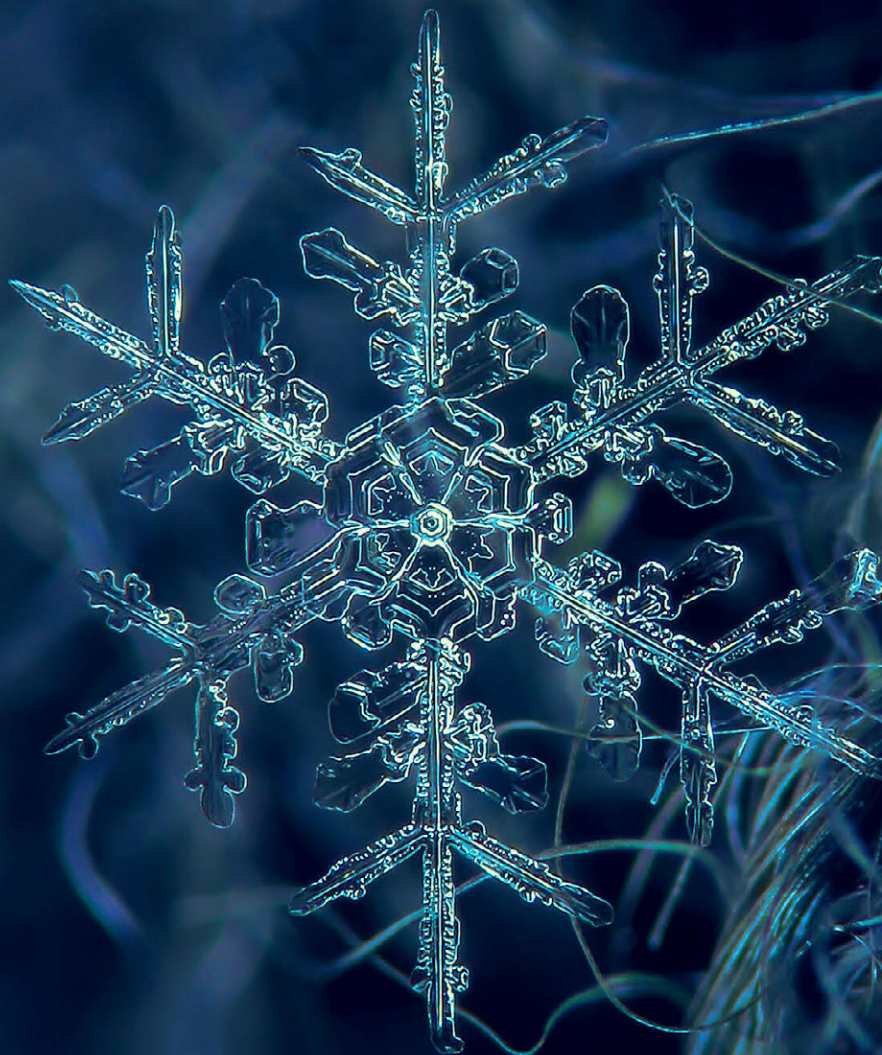
Clients purchasing the latest robots sold by Denso Wave will have an option to include this new technology as part of the force controller, which reads

the force detected by a force sensor on the robot’s wrist and applies force accordingly: apply too little force and the items may not be assembled correctly while applying too much force could damage the items.

(Source: Nanyang Technological University)



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# Jackie Mattox

## Keynotes Women in Electronics Reception

Jackie Mattox, founder, president, and chief executive officer for Women in Electronics, headquartered in Southern California, will keynote the Women in Electronics Reception at IPC APEX EXPO 2022 from 6 to 7:30 p.m. Tuesday, January 25.

Named one of the Top 21 female influencers in 2021, Jackie started her career in the electronics industry during her college years at a small rep firm in Southern California, where she worked her way into the roles of sales and distribution manager and took a passionate interest in strategic key account management. Jackie graduated from California State University-Northridge with a Bachelor of Arts degree in communication/journalism. Jackie has always had a heart for people and especially for women's issues, along with a dedication to personal and professional leadership development. Jackie had a vision for women rising into leadership roles in the electronics industry and



Jackie Mattox

founded Women in Electronics in 2017, which is now a thriving global nonprofit 501(c)3 organization.

Having a very active role in her children's education, she also helped with the start-up of a charter school in Orange County, California. Jackie values time with her children and loved ones, the experience that travel brings, and being home in the city of beautiful Laguna Niguel, California, with her family, life-long friends, and her two dogs, Cocoa and Rubie.

We're looking forward to hearing Jackie's insights on how she's able to manage a family, a business, and a thriving career.

Attendance to the Women in Electronics Reception at IPC APEX EXPO is included in all registration packages, including the exhibit hall only/event essentials package. **PCB007**

Submitted by Alicia Balonek, senior director of trade shows and events.



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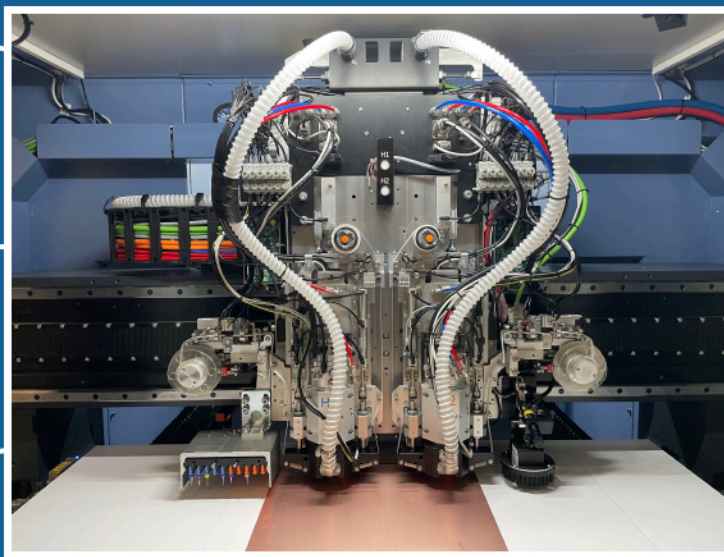
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## Trivia Networking Night

IPC's Trivia Networking event has been reimagined for IPC APEX EXPO 2022 and will feature a special guest, "Hey Mister DJ, Lee Tyson."

DJ Lee's career started 15 years ago in his hometown of Minneapolis, Minnesota. Influenced by the diverse and funky grooves of what later became known as the "Minneapolis Sound," Lee began looking for a way to express his own creativity and passion for music and found his way to a pair of turntables. He is now one of the most sought-after DJs in Los Angeles, Miami, and Las Vegas. Lee also serves as the official DJ for Mercedes-Benz Fashion Week.

Lee's chameleon-like ability, along with his intuitive capabilities to read a room, escalated into expanding spinning records into engaging

crowds through games and trivia. So, if you like Jeopardy, Family Feud or are looking to find usefulness for all your useless knowledge—this is a must attend event.

DJ Lee is the host extraordinaire and in no time, you will be fully engaged and making connections with new people while competing for prizes in this high energy and hilariously entertaining event.

Trivia Networking Night will take place from 6 to 7:30 p.m. Wednesday, January 26. Registration is \$40 which includes a supreme nacho station and two complimentary drink tickets. **PCB007**

Submitted by Alicia Balonek, senior director of trade shows and events at IPC.

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# Technical Track Opportunities

Feature Interview by the I-Connect007  
Editorial Team

Matt Kelly, IPC chief technologist, discusses the growth of the technical conference tracks in this year's IPC APEX EXPO program, as well as market dynamics that are influencing the topics presented at this year's event.

**Nolan Johnson:** Matt, thanks for taking the time to talk with us about what's coming up at IPC APEX EXPO 2022. The theme is the drive for digital transcendence. Can you walk us through your thinking on that theme?

**Matt Kelly:** Sure. When you look at the breadth of the technical topics embedded within Industry 4.0 or Factory of the Future, the number one topic that's long overdue and ready for operational execution is digital transformation. For example, it's amazing how many different processes within a factory are still moni-

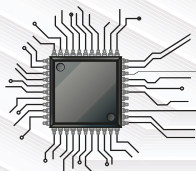
tored and controlled using basic software functionality such as Microsoft Excel.

Let's break it into a couple of different areas. One area is the manufacturing floor where most people think to apply digital transformation. This is where products are built using statistical process control methods. There is tremendous opportunity to improve all process steps and to significantly improve key production metrics including productivity, efficiency, increased yields, reduction of scrap, and, most importantly, highest quality/reliability product assurance.

There's also logistical digitization, things like track and trace, so you can understand where things were built and when, so you can track when things go wrong. On the positive side, people are looking for demand forecasts: "I need to ship X number of pieces by these dates. Where are the parts in my line? How far are we into that job or build?" But on the opposite side, and this happens a lot,

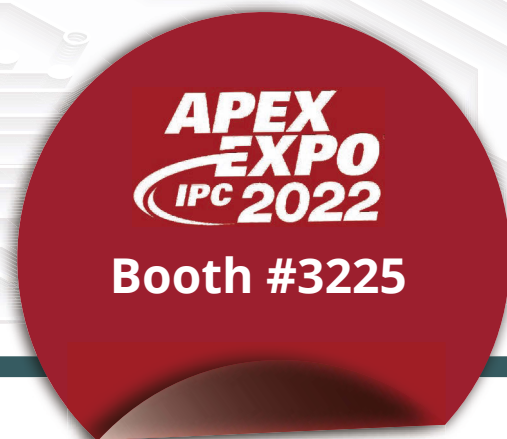
(albeit not widely communicated), these cases are generally quiet, because this is where task forces get initiated. It's problem resolution and containment; an issue will be found, and the line may be stopped. "When was it built? How much of this problem affects what I already have now sitting at the end



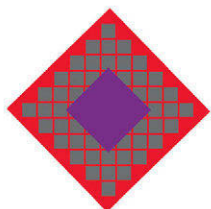


# MivaTek

## Global



# New Technology Release



## NextGen LE

### New Light Engine Technology

Miva Technologies NextGen Light Engine is loaded with new features in support of its technical road-map. The NextGen is now available in all models.

- **Quad-wave Technology:** Images everything - in a single machine.
- **DART™ Compliant:** Scaling and line-width control tools that operate at 10X resolution for the most precise and repeatable total process.
- **New Vision System:** Miva's new vision system sets the stage for its line-width measurement and Gerber driven metrology.
- **Increased camera FOV:** Expanded FOV improves automation operation as well as eases panel alignment.
- **Resolutions:** NextGen 15/30-micron available allows for high speeds and resolutions.

### High Power LED for 2x+ throughput:

Light Engines	1	2	3	4
30Mj Resist	46	83	100	124
50Mj Resist	33	62	75	95
DI SM	25	47	57	73

**\*\*18x24 panels per hour, both sides, 2400DT**



# DART

Digitally Adaptive Rasterization Technology

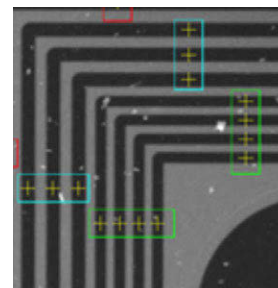
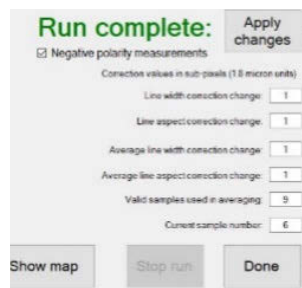
### Digitally Adaptive Rasterization Technology

DART™ changes everything. Rasterization at 10X imaging resolution permits on the fly digital adjustments to line-width and scaling at 10X system resolution for hyper-precise feature/scale control.

- **TRUE Zone:** Pre-rip scaling capabilities allow for true zone scaling in linear or non-linear algorithms at 10X system resolution.
- **Feature Tuning:** Globally adjust feature sizes to include changes in develop or etch conditions in sub-pixel increments.

### DART Optimization Suite

- **FA Tool:** Closed loop digital line-width compensation to include develop and etch process variation for first article or continuous.
- **Process Control Tools:** Topographical mapping of develop and etch process variations for improved process control and AB etch uniformity.
- **Coming Soon:** Integrated AB Registration Confirmation





of line?” There is a lot happening. There is work in progress (WIP), in addition to what has already gone through the line. There’s containment and maverick lot containment. The value of digitization is that collected data can help engineers and operations management understand where things are and quality impacts of what’s happening.

Lastly, the supply chain management portion of this is coming to the forefront because of electronic component and mechanical part shortages. “Where are my components? What are my lead times? Who are my approved vendors? Has there been a natural disaster and I need to engage second source supply? Which suppliers have been qualified? Am I getting hit with tariffs? Should I consider switching to a regional or alternate geography source?”

Believe it or not, digitization at an industry level is still in its infancy. It needs to be utilized and applied in the factory, in the supply chain management, and most importantly, between companies. This is where things really start to gain value.

If you look at topics that encompass Industry 4.0, specifically things like digital twin, AI, and machine learning, they are wonderful enablers that will provide value. But they cannot—and will not—happen if you don’t have a proper data infrastructure. These are prerequisites. Industry 4.0 will take off when we can digitize and have the data collected. Digitization is the number one topic for Industry 4.0.

**Johnson:** Can we expect to see more research papers submitted on Factory of the Future type topics on digital transformation at the APEX EXPO Technical Conference?

**Kelly:** We are thrilled with the number of abstract submissions we have received. As of today, we have over 150 submissions, which may



Matt Kelly

be the highest number we’ve ever received. It shows the appetite and the interest people have to present and share their knowledge.

Last year was our first year for Factory of the Future, and it was offered in a virtual format. This year, we have a full track of 29 papers with contributions from IBM, Omron, MTC, Lockheed Martin, Continental, and ASM to name a few.

**Johnson:** Wow, 29 papers. How do you see these papers and what’s happening on the exhibition floor to tie this all together?

**Kelly:** This year we’re launching the first Factory of the Future Pavilion. We’re bridging the raw technical content in the conference with the companies and the suppliers that are working in this space. The difference is when you’re in a conference, we’re very technically focused. We have commercialization rules, trade names, with limited ability to promote your company. The pavilion is a place on the exhibition show floor where companies can talk tech and promote their commercial product and service offerings. This is the first pavilion that we’re offering and expect that to grow in future years.

**Johnson:** Based on what you’re hearing and what you know about what exhibitors are doing around Factory of the Future, can conference attendees anticipate getting some of that product-specific information on the show floor this year?

**Kelly:** Yes, absolutely. The pavilion is an open space for multiple segments of the industry to come together, such as MES software providers, artificial intelligence, and virtual reality. Also, on the show floor you will see IPC-2591 CFX qualified equipment suppliers of that protocol, and then just an increase in the capabilities of those suppliers.

**Johnson:** Great. I'm going to step back and ask a broader question. How does IPC choose the topics for the technical program?

**Kelly:** We've organized the technical program by nine different categories, spanning 1) Factory of the Future implementation; 2) enabling future technologies; 3) meeting extreme requirements; 4) PCB fabrication and materials; 5) circuit design and component technologies; 6) quality, reliability, test, and inspection; 7) assembly processes; 8) electronics materials; and 9) conscientious engineering. These nine categories are managed by our technical program committee, the TPC. This organization of volunteers are subject matter experts in the industry. We rebuilt the committee this year from the ground up.

**Johnson:** Great. From your perspective, how important is it to have these voices together in one event—suppliers, manufacturers, and OEMs?

**Kelly:** It's key. You need to have that voice from the original equipment manufacturer. They're the ones dreaming up and designing new products with requirements that flow down on how things are built, and the quality and reliability levels needed. On the other side, you have material suppliers, and equipment and tool suppliers. They are continually offering new equipment and capabilities so that these new products can be made.

**Johnson:** Matt, what are your recommendations for getting the most out of the program?

**Kelly:** It's always tricky. Everybody loves the amount of content, and then the feedback is that there's too much content and they can't attend it all. Come prepared and organized with your must-see agenda each day. In fact, we have mobile apps to help you with that. The program will pull you in many directions, so come with a map. For example, there are four

simultaneous tracks with the technical conference alone.

**Johnson:** How does the technical program merge with the professional development courses?

**Kelly:** We have a full slate of professional development (PD) courses. There's something for everyone. We've been careful that the PD course schedules do not overlap with the technical conference. Most PD courses are entry-level and general know-how, but the class can still get very deep into the topic due to the length of the classes. We find that many of the PD attendees are either new to the industry, may have a new job, or have a new assignment, for which they need some new base knowledge.

**Barry Matties:** What has you most excited about the technical program and the professional development program overall?

**Kelly:** In the technical conference, what really jumps out at me is the continued demand for these Factory of the Future topics. I'm excited about all the different topics we'll be bringing; I'll give you some examples. We have "transformational journey" style strategic topics, and then we get into more specifics. We have wonderful sessions on cybersecurity, supply chain, artificial intelligence, and machine learning. We have sessions on Factory of the Future and what that means for quality, and an entire area on flexible hybrid electronics as well.

The conventional technologies are also making significant advancements. I'm referring to our PCB Fab and Materials track. From what I can see, we likely have the strongest PCB fab track there has been.

There are, for example, 29 stellar papers on microvia design, HDI, and semi-additive processes. The semi-additive processes are new buildup technologies delivering much smaller line and spacing capabilities. We have two



different sessions on printed circuit structures and additive manufacturing electronics. I want to stress that these are new ways of producing PCBs. This is not just standard lamination and lithography techniques; these are brand new additive processes, not subtractive, and they are driving the new standards initiatives. We have brand new content coming out of the conferences that then goes straight into the standards committees.

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## We have brand new content coming out of the conferences that then goes straight into the standards committees.

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**Matties:** Are you adding zero waste into your technical programs?

**Kelly:** Yes. If you look carefully at our Factory of the Future mission, it includes sustainable electronics. In the conference, we have a track dedicated to conscientious engineering, led by IPC's Kelly Scanlon.

**Matties:** Obviously, we're seeing an accelerated curve in terms of AI and automation, but what do you see the factory really looking like in five or 10 years?

**Kelly:** In the next five years, I expect a tremendous amount of improvement and focus on PCB fabrication techniques. We're seeing this in advanced packaging for IC substrates currently, as well as second-level board assembly and fabrication. There's a lot of emphasis on how PCBs are made. The driving force for that emphasis is miniaturization, speed, thermal, and multi-function. Partnering with fab technique improvements is the construct of Factory of the Future.

**Matties:** If I'm a board fabricator and I'm looking at a five-year window for my business, what should my plan be focused on?

**Kelly:** New materials, much tighter and tougher design points, plus expanding the technology offering and capability you have. If you're not looking at these new design points—HDI structures, SMT processes, printed circuits, and additive manufacturing—then, unfortunately, you'll be left behind.

**Matties:** I thought we would have seen additive in a stronger format a decade ago, but here we are today, and it seems to be accelerating nicely. Is that surprising to you at all?

**Kelly:** No, it's not surprising. Unfortunately, the printed circuit board fabrication industry, as well as EMS providers, have continued to be commoditized. When something is commoditized, it's deemed easy, as if anybody could do it. Yet we certainly know that's not true with printed circuit boards. I hope IPC can help the industry focus and promote these new technologies, whether that's in board fab, Factory of the Future, or advanced packaging. There is currently significant research and development on materials, processes, and advancements that must be overcome to make this advancement. Shaking off that commodity label is critical.

**Matties:** You mentioned some new standards that will evolve out of the changing landscape; what standards should we be aware of? And if you want to participate, obviously, there's an advantage to being on the early standards at the participation level.

**Kelly:** Yes. You're already seeing our new Factory of the Future digital standards portfolio grow. On the top of that list is the Connected Factory Exchange (CFX, IPC-2591). Then we have cybersecurity, a model-based design standard, and a digital twin standard that's forthcoming. That Factory of the Future portfolio

is growing as these technologies mature. The same trend is underway on the PCB fab side. Of course, then there are the tried and tested PCB standards. Those are being updated with new technology or we are in the process of creating new standards. The best area for that would be in this additive process space.

**Matties:** Let's talk markets for a moment. We all have cellphones, and we know that market is growing. What other markets should we be paying attention to?

**Kelly:** Automotive is huge. We're seeing the electrification of vehicles, not just from a drive-train perspective, but from a cockpit perspective. Gaming and entertainment also; the commercial electronics market is what is driving technology advancements today, not aerospace or defense. They are not first movers, and that's by design. They want to make sure it works, it's good, it's strong, and it works for long as it needs to.

**Matties:** We haven't touched on cybersecurity, which must be an area of growing interest.

**Kelly:** Absolutely. There's the new IPC-1792 Standard for Cybersecurity in the Manufacturing Industry Supply Chain, and it tries to marry the data streams and end points within the manufacturing environment—the shop floor and the office. It's basically a combination of OT and IT cybersecurity.

**Matties:** The issue that many companies have, generally, is with the Factory of the Future: big data, implementations, cybersecurity. The smaller companies especially, they don't have the talent on their staff. How do the programs you're offering—technical, professional, or otherwise—help a fabricator navigate those challenges?

**Kelly:** We're very aware that there are some risks, and the migration is still just beginning.

Remember, we just started the Factory of the Future this year. We haven't even done our first full year yet, so we are now raising this awareness and this big picture strategy. We are working on this in a variety of ways. Take IPC EDGE and similar training programs as an example.

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## Remember, we just started the Factory of the Future this year.

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**Matties:** It would be nice to see in 2023 some programs connected to navigating these challenges, because they're still going to exist. When you start looking at limited resources in an inflationary period, people are very cautious as to where they're spending their capital.

**Kelly:** We are definitely trying to build this into the content. Tim Burke from Arch Systems, for example, will be presenting the first F2P course on data analytics. We will pilot this program to determine the kind of draw we can expect. Course details can be found on the IPC APEX EXPO website.

**Matties:** Do you have any final thoughts, Matt, that you want to share regarding the technical program at IPC APEX EXPO?

**Kelly:** We are focused on delivering the industry's premier technical conference. I think that about 40–45% of these classes are being presented by an advanced-degree lead author. Nearly half the conference will be offered by PhDs.

**Matties:** That's great. Matt, thank you so much. Have a wonderful day.

**Kelly:** Thank you. PCB007



# IPC Standards Committees: Thoughts on a Changing Landscape

Feature Interview by the I-Connect007  
Editorial Team

Teresa Rowe, senior director for assembly and standards technology at IPC, updates us on standards committee work: processes, key standards in process, teleconferencing, and international participation. All this work leads up to the standards committee sessions at IPC APEX EXPO in San Diego.

**Nolan Johnson:** Teresa, thanks for joining us to talk about IPC committee work. As we're coming out of change to processes and communication styles, thanks to the pandemic effect, what are you most excited about regarding committee work?

**Teresa Rowe:** Interesting question. Thank you. First and foremost, getting back together with people, being able to meet face-to-face is at the top of my list. We had an opportunity at SummerCom, but with travel restraints, we didn't have as many people as we typically would see. I'm also excited to get my dress shoes out again and use them while walking around APEX EXPO. It's quite the workout when you think

about all the things that happen and all the places you have to be.

**Johnson:** Yes. I think a lot of us have missed the human connection professionally and personally. I think you're right.

**Rowe:** Even turning your video on (on a good hair day) just isn't the same as having people in the same room, seeing their expressions and reactions, and seeing them all together at one time interacting. You don't see that on a phone call, so that will be fun.

**Johnson:** So, there's been a phrase attached to committee work: committee by Zoom. We're all experiencing that in our daily lives, of course. I'm curious to find out from you how that's affecting IPC committee work. How has that changed?

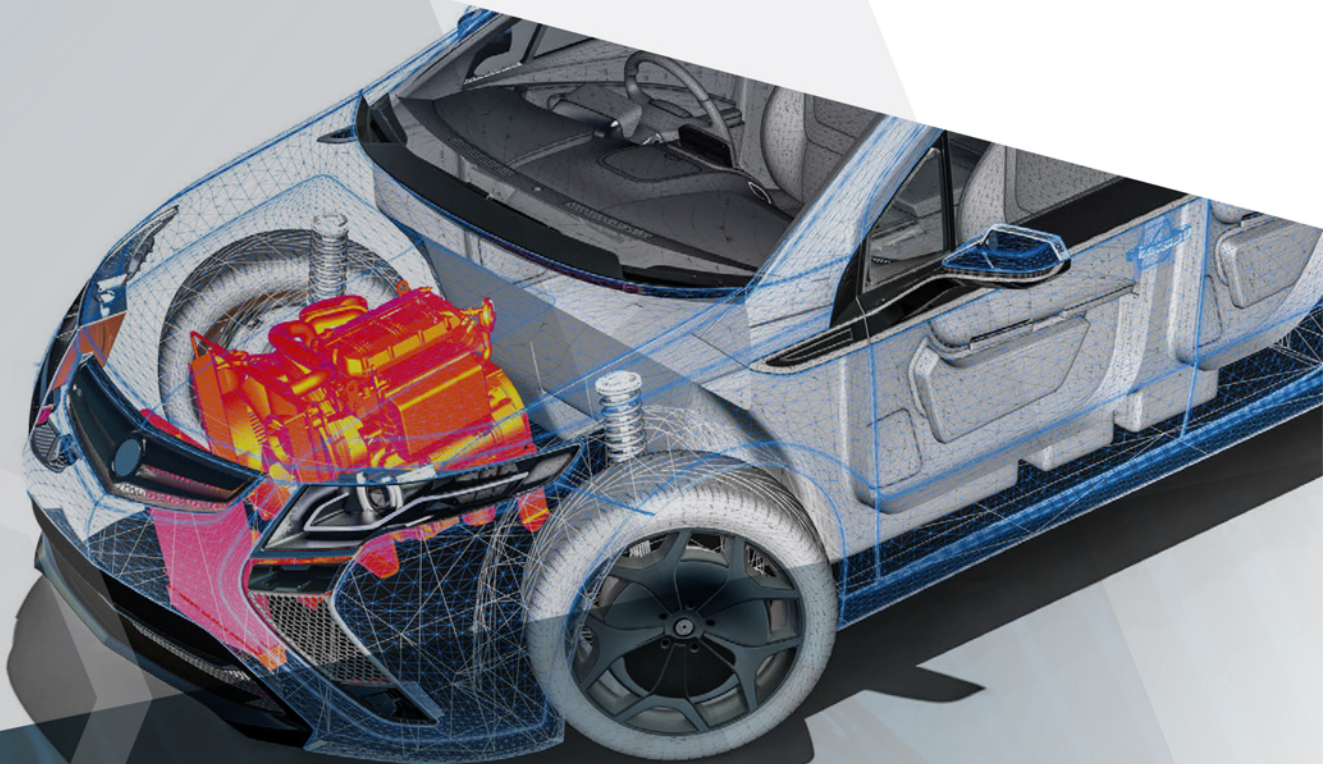
**Rowe:** The process itself hasn't changed, but we find that groups are meeting a lot more frequently and we're getting things done in a different cadence than we did before. I think back to some of the action items that get assigned; normally we would assign an action item, give





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somebody a deadline, collect the data, and then we would get back together at the next face-to-face meeting and review it. Now, we're assigning the action item, meeting to review where we are with the action items, and then meeting again for discussion when someone submits that work. The committees are working very well in this format, and we're seeing a lot of international participation with people who wouldn't typically even be able to travel to APEX EXPO. These are good changes.

**Johnson:** It sounds like part of the dynamic is shorter and quicker iterations through the steps of the process?

**Rowe:** It's shorter as in we see comments rolling in faster, but is the process itself shorter? We're still following all those required steps and we're still sticking to our timeframes that were established during our project identification and TAEC review of our new proposed projects. But we are seeing people reacting and moving at a different rate through that activity, rather than, "Let's focus on a face-to-face effort and then do my own thing and I'll see you again in six months." Now it's, "I have a meeting next month. What can I do by then to at least tell everybody I'm still engaged and focused on this project?"

**Johnson:** Do you see these changes in the process becoming a standard part of the committee work?

**Rowe:** I think it has become part of the standards committee work. People enjoy remaining active in standards development. It takes unique personalities sometimes to work these projects and people want to be involved, they want to be engaged and they want to stay with



Teresa Rowe

their group as they're working the projects. Yes, this has changed the process, but we will continue to use the face-to-face meetings because there's nothing to substitute for that human interaction.

**Johnson:** And yet now there's a whole new dimension of interaction. What are some of the key things that the standards committees are working on?

**Rowe:** Right now, we are working on new revisions of a few documents, including IPC/WHMA-A-620, IPC-J-STD-001, IPC-A-610, and IPC-A-600620—those documents that people know, love, and use frequently—and that's an ongoing, continuing process. We are working on some new things in the environmental area; cleaning, coating, and materials continues to roll along as well as some of our design standards. We're not just focused on one thing, but we are working with all our committees on the projects that they are focused on, they want, and they expect for industry.

**Johnson:** Earlier, you mentioned increased international participation. I'm concluding that because the committees are using more teleconference interaction, that opens the opportunity for greater international participation. How is that changing what you see on committee work?

**Rowe:** In our case, many of our calls are on Teams. Those calls are attracting people who want to be involved in standards development, but who cannot participate because they can't travel for health reasons, company policies, or they can't be away from the office that long. Teams meetings have allowed us to have participation, especially new voices and new ideas in the task groups. That's a good thing and we welcome that.

**Johnson:** What advice would you have for getting involved in committee work?

**Rowe:** Visit our website where we have a designated page for standards development, or send an email to [answers@ipc.org](mailto:answers@ipc.org) and ask to join a committee.

We have our platform, IPC Works, where once you join a committee, you can access the files we're currently working on. Task group members can look ahead and see what we're working on, then participate as their time allows. Anyone can submit comments, but the task group members get to see the comments and the development of perhaps new content based on those comments. If you're interested, I encourage you to request to join a task group, and we'll get you started.

**Johnson:** For somebody just out of college or coming up in this industry, working on standards and committee work might seem a little intimidating. When these folks get involved, what can they expect?

**Rowe:** First, everybody is new the first time they come to a meeting, and this is not about putting someone on the spot in any committee meeting. Some people say very little during a committee meeting; they are there to listen, absorb, and learn, and that's okay, but I would encourage anyone even remotely interested to at least see how the process works to participate. We admit this is not for everyone. Standards development is a unique technical activity, but if you're feeling a little intimidated, I say just dive in and see what it's like.

You mentioned coming out of college and just getting in the industry. IPC offers the Emerging Engineer Program, a three-year program we started a few years ago. Someone is paired up with a mentor, and when they come to APEX EXPO, we get them involved, start introducing them to people, and their mentor takes them around. They have activities to do; we send them to the show floor, and have

fun things to do there as well. We introduce them to other emerging engineers so they can begin to build their own network. In the first year, they're just getting started; by second and third years, we're getting them engaged in standards development actions and activities as well. We've been finding that some of our second- and third-year emerging engineers are running A-teams, projects, and action items to learn the process and get involved on a much larger scale.

**Johnson:** Is that a planned part of the Emerging Engineers Program or is that something that happens organically?

**Rowe:** It's both. It happens because they're interested. Of course, we ask if they want to participate, and if they don't want to, we don't require it. They are all volunteers. But IPC staff talks to our chairs, our leaders of our committees, and we try to get our emerging engineers engaged and involved in these activities for several reasons. This is our upcoming generation joining standards development. We want them to embrace and learn the process and provide feedback on where the processes can be improved. This is a great opportunity for everyone.

**Johnson:** Excellent. Teresa, any closing thoughts?

**Rowe:** I'm excited to see everyone at APEX EXPO. I'm looking forward to it and keeping my fingers crossed that we don't have a major snowstorm in January that prevents people from getting to San Diego safe and sound. We haven't seen one of those weather issues for a long time. I don't want people stuck somewhere trying to get to San Diego. I want them to be able to be at APEX EXPO in person to experience all it has to offer.

**Johnson:** I couldn't agree more. Teresa, thank you very much. **PCB007**



# Keynotes Educate and Entertain

Each year, IPC APEX EXPO features industry's most dynamic, innovative minds to deliver keynote presentations that are both educational and entertaining. IPC APEX EXPO 2022 will feature New York Times columnist, Emmy-winning CBS Sunday Morning contributor, and NOVA host David Pogue. During his keynote on January 25, Pogue will present, "Disruptive Tech: How It Will Affect Your Business and What's Coming by 2026."

In his keynote, Pogue will cover several disruptive technologies from the "quantification of self" movement, augmented reality, wearables, autonomous cars, drones, the Internet of Things, and what he calls "World 2.0."

Drones and robotics, AI, self-driving cars, employee-less stores, flying taxis, wearable medical sensors, software, and components are accelerating the arrival of new consumer technologies—and with them, changes to society and culture. With 30 years of experience reporting technology trends—and the entertaining style that has earned him six Emmys for his CBS Sunday Morning stories—Pogue will take his audience on a wild ride through the cutting-edge science and technology that is powering a next wave of technological innovation. His funny, fast-paced snapshot will bring everyone up to date—with a heads-up on how to succeed in a world we've never seen before.

"With broad appeal to general, business, healthcare, and tech audiences alike, David will bring his expansive knowledge, engaging wit, and perhaps a song or two to the APEX EXPO keynote stage," said Alicia Balonek, IPC senior director of trade shows and events. "The audi-



David Pogue

ences will leave as informed as they are entertained, with an enlightened perspective of the state of technology today and how it's shaping everyone's tomorrow."

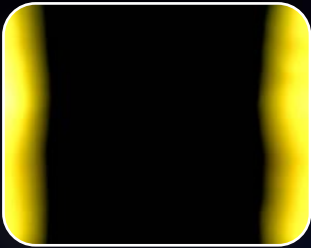
Pogue's keynote is free to all IPC APEX EXPO participants. In addition to Pogue's keynote, John Mitchell, IPC president and CEO, will deliver a keynote on Wednesday, January 26. Drawing on insights gleaned from industry leaders and IPC research, Mitchell will assess the state of electronics manufacturing and identify the trends that will define the industry's financial growth and technological progress in 2022 and beyond. His keynote presentation will touch on the topics that are the focus of boardrooms and shop floors: factory modernization, supply chain resiliency, workforce demands, and environmental stewardship. Be sure to attend to learn more about how to navigate your organization to success in today's dynamic global marketplace. **PCB007**

Meetings and courses will run January 22–27; the technical conference and exhibition will run January 25–27. For more information on schedule and registration options, visit [www.IPCAPEXEXPO.org](http://www.IPCAPEXEXPO.org).

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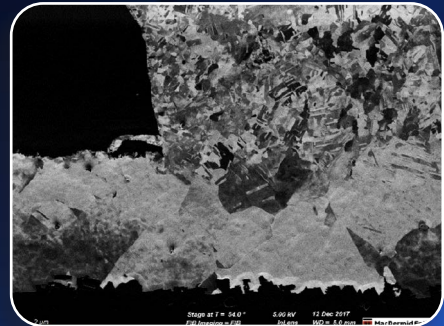
Colloidal



Ionic

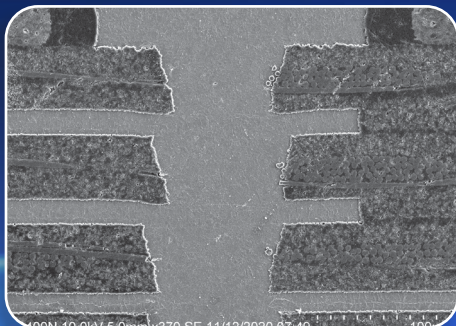
Selection of palladium activator technologies for coverage on a wide range of applications.

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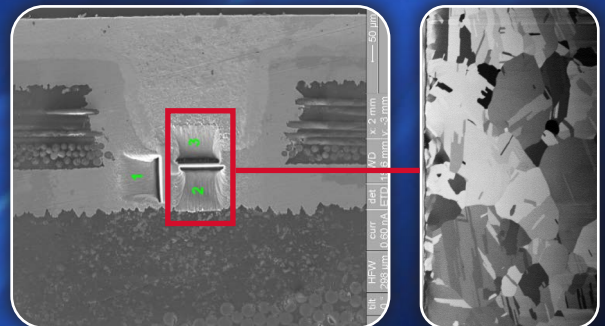
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# **ein** Electronics Industry News and Market Highlights



## **Siemens Reconfirms Commitment to Shipbuilding 4.0 with CESENA Opening ►**

Siemens has inaugurated the Center of Excellence of the Naval Sector (CESENA) in Ferrol, Spain, where state-of-the-art facilities are equipped with the latest technologies to improve all phases of the ship design and construction process with the aim of transforming the entire value chain of the shipbuilding industry and boosting its competitiveness.

## **Empower Semiconductor Signs Global Distribution Agreement with Mouser Electronics ►**

Empower Semiconductor, Inc. announces a new global distribution agreement with Mouser Electronics Inc., the authorized global distributor with the newest semiconductors and electronic components.

## **IDC FutureScape: Top 10 Predictions for the Future of Digital Infrastructure ►**

International Data Corporation's (IDC) top 10 predictions for the Future of Digital Infrastructure point to a digital infrastructure strategy that addresses resiliency and trust; data-driven operational complexity; and business outcomes-driven sourcing and autonomous operations.

## **Study: Semiconductor Supply Chain Remains Vulnerable Without Federal Investment ►**

A new study about the current state of advanced packaging in the semiconductor value chain finds that urgent action is required

to strengthen domestic packaging ecosystem to meet increased production of semiconductor chips, without which the semiconductor supply chain is likely to remain weak and vulnerable.

## **JMA Wireless, Kyocera to Accelerate 5G Deployment Across Japan ►**

JMA Wireless (JMA) and Kyocera Corporation (Kyocera) announced an agreement to jointly develop a 5G millimeter-wave backhaul system. Leveraging Kyocera's wireless base station technology and JMA's XRAN—the only 100% software-based open-RAN (O-RAN) solution on the market—this first-of-its-kind system will accelerate 5G network deployment across Japan.

## **Qualcomm Collaborates with NEC to Develop 5G Open and Virtualized Solutions ►**

Qualcomm Technologies, Inc., and NEC Corporation announced a strategic collaboration in which they are partnering on the development of a 5G open and virtualized distributed unit (DU) powered by the Qualcomm® X100 5G RAN Accelerator Card, to drive the transition towards modern networks.

## **Keysight Enables NEC Europe to Verify Performance of Open RAN Equipment ►**

Keysight Technologies, Inc. announced that NEC Europe Ltd. has selected Keysight to create an advanced radio frequency (RF) propagation environment for verifying the performance of open radio access network (RAN) base stations equipped with massive multiple input multiple output (MIMO) technology.

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January 5-7, 2022





# John Mitchell: Focus on the Future

Feature Interview by Barry Matties  
I-CONNECT007

In a far-ranging interview, Dr. John Mitchell and Barry Matties discuss the upcoming IPC APEX EXPO, IPC programs, and the challenges (and opportunities) facing our industry. If you think Dr. Mitchell's assessment would be pessimistic, you'd be wrong.

**Barry Matties:** I think this next APEX EXPO will be, for many, the first event that they will have attended in-person since about two years ago. Has the last two years impacted the format for it?

**John Mitchell:** The biggest impact really is about making sure everybody is safe at the event. In accordance with the guidelines in California and the San Diego Convention Center, we expect the requirement will be that people show either proof of vaccination or a negative COVID test within 72 hours. (Most people coming from overseas must do that anyway when they get on the plane.) Attendees will find a COVID Q&A on our website that explains our protocols more fully.

**Matties:** Do you expect a lot of international participation?

**Mitchell:** We had some concerns about that a few months ago, but with the U.S. re-opening its borders to international tourists, we're encouraged. Our registrations show that we have people signing up from literally everywhere, even from places where they're going to have to quarantine when they go back. We found that very gratifying and encouraging.

**Matties:** Speaking of registrations, how is that tracking? Are you seeing an increase over the last in-person event or is it an adjusted goal?

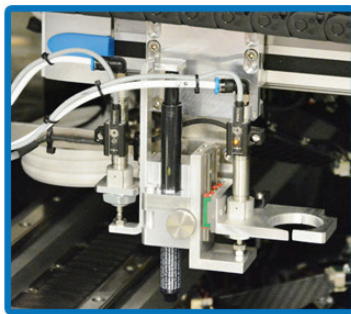
**Mitchell:** I think people are being more cautious right now because they just don't know what's going to happen. The whole Delta variant July caught everybody by surprise. We thought we were getting out of the COVID concerns, and everything was going to be rosy. Then Delta hit, and people thought, "Oh wait, whoa."

That was a few weeks before we opened registration, so I think there's some cautiousness. We have a lot of people saying, "Yeah, we're

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still planning to come,” but they’re not ready to commit. To be clear, I am speaking about individual registrations. Most of the exhibitors have signed up, so we are encouraged by that.

**Matties:** Now, on the exhibitor front, do you expect to see as much equipment on the floor?

**Mitchell:** We hope to. We’ve been instructing and coaching for people not to use Long Beach or some of the more crowded ports but to look for others or just truck it in if you are already in the States. Because, frankly, the port situation is a mess.

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## The biggest impact really is about making sure everybody is safe at the event.

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**Matties:** We know that there are really tough challenges—supply chain, labor, inflation—going on. How will participation for the attendees help them navigate the challenges?

**Mitchell:** I don’t think we’re going to solve all these challenges at APEX EXPO. Whether it’s the labor shortage, parts shortage, transportation costs, or others, we are going to be finding ways to collaborate. To me, the best opportunity to work on the supply chain issues is when you’re meeting face-to-face. One of the intangible values of APEX EXPO is the face-to-face discussions that aren’t necessarily scheduled or built into the program.

When you’re talking to a friend of yours and you say, “Hey, we’ve got this business we’re unable to fulfill,” and they say, “Well, we’ve got these parts we’d love to get to you because we can’t use them anymore. We need different parts,” then magic happens. Collaboration occurs and problems that were intractable

start moving down the solution path. These little microcosms of supply chain work will help some people solve some of their challenges. But it’ll be more micro impacts than macro changes to these large issues.

**Matties:** Do you have any specific presentations or conferences that are geared toward addressing or navigating these issues?

**Mitchell:** In my keynote, I’ll be talking about what we can do to navigate some of these challenges specifically. We’ll talk about what the situation really is vs. what’s being reported. And what, in different regions and different types of companies, we might do to overcome some of those challenges.

I hope that my keynote will spur people to find solutions on the other issues. Now, as far as other programmatic elements that are dealing with these issues specifically, the answer is yes. On the labor front, everybody is having difficulty trying to hire people. Finding talent or even warm bodies, frankly, is a challenge. IPC has amazing online skills development programs that can literally take somebody with no experience in the industry, say working at your local fast-food restaurant, and in two days they could be an operator on a line and effective.

You don’t have to spend weeks trying to train the people anymore. We were fortunate that industry leaders came to us and said, “Here’s what we need. These are the skills we need to teach. Here’s the kind of training we would have you do.” Our team of education specialists took that information, leveraged their experience about knowledge acquisition and retaining information, and built this into a program that meets the industry driven job-specific needs of workers across a broad range of industry roles and skill levels. So basically, very, very quickly you can onboard somebody and get them productive.

Then there are other programs as well, specifically geared toward engineers. We have

## Wednesday Keynote Speaker: John W. Mitchell


President and CEO | IPC

Wednesday, January 26 | 8:00 am - 9:00 am

### Session Description

#### State of the Industry: Electronics Manufacturing Embraces Digital

Drawing on insights gleaned from industry leaders and IPC research, Dr. Mitchell will assess the state of electronics manufacturing and identify the trends that will define the industry's financial growth and technological progress in 2022 and beyond. His keynote presentation will touch on the topics that are the focus of boards rooms and shop floors: factory modernization, supply chain resiliency, workforce demands, and environmental stewardship. Be sure to attend to learn more about how to navigate your organization to success in today's dynamic global marketplace.



new programs offered to those who might not know anything about an assembly operation. We can give them 30 to 40 hours of online content that helps them get grounded in how various parts of the electronics manufacturing process works. Often the industry just relies on shadowing to provide this kind of education which is not very consistent and sometimes doesn't happen at all. With this program, they learn and can also keep going back to that information for a refresher, if needed, when something new comes up. One of the programs, Electronics Assembly for Engineers (EAE), has been very well received. At APEX EXPO, we will share more information about EAE and other courses under development, and I am very excited about that.

**Matties:** When we start looking at inflation, when material input costs started to rise, a lot of the fabricators just compressed and did not pass those on. But you can only do that so long and inflation is not transitory as it turns out. It's here, and it's going to be here.

**Mitchell:** Yes. If you're spending much more on hiring the individuals that are building your materials, then that cost must get accounted for somewhere.

**Matties:** Right. And it's not just the labor, as we know. It's the cost of raw materials and other input cost.

**Mitchell:** Exactly. Chips, parts, materials, transportation, everything. The costs have gone up just about everywhere.

**Matties:** Are there any strategies or programs to help the fabricators look at how to be more efficient, lowering their costs to help combat the inflation that's happening?

**Mitchell:** I know one of the areas that we are really trying to help combat those costs is through our Factory of the Future initiatives. APEX EXPO will showcase the Factory of the Future pavilion on the show floor, hosting leading tech companies in the field. Those companies will provide information on solving real business challenges with technologies that modernize processes throughout factories.

**Matties:** When we look at Factory of the Future, obviously automation is a key part of it. AI comes into play.

**Mitchell:** That's part of it, but also, it's about managing that information in terms of knowing





what to do with it. Now, in most companies we are collecting big data, but we don't have enough of our engineering staff that knows how to do proper data analytics to know what to do with all that data.

**Matties:** Well, the core problem is first identifying the critical data out of that. The other side of combating higher prices is to have better yields.

**Mitchell:** Yes. It's also looking at where you can—and this is obvious—use alternate sources. Right now, people have gotten very comfortable ... I shouldn't say right now. A year or two ago, people were very comfortable with their sources; now, people need to get comfortable with looking at many alternative sources if they want to combat some of these challenges.

**Matties:** But alternate sources, in some cases, are few and far between.

**Mitchell:** I think you're right. But I have seen creativity allowing people to reconsider sources they'd discounted before. Some companies have been helping their suppliers to "level-up" to get to the quality level that they need. This is where you have people looking beyond their

own needs. You're saying, "If I really care for Supplier X and can help them be successful, their business will get better, and, in turn, I've got a supplier that's going to value me and I'm going to have more access to the things I need."

**Matties:** I was reviewing the technical program for APEX EXPO, specifically looking at who is presenting, the type of businesses, and the company names. There's a very nice cross-section between industry suppliers, fabricators, and manufacturers. And you have a lot of OEMs—Intel, Bose, and John Deere, to name a few—all making presentations. To your point, this is an excellent opportunity for the industry to collaborate. Here, they can find information to bring efficiencies into their factories and find out what the challenges are that they need to be preparing for, as if they don't have enough.

**Mitchell:** You can learn from your neighbor. Fortunately, I have the opportunity to chat with, as you guys do, industry leaders all around the world. When we started hosting weekly calls for our executive forum at the beginning of the pandemic, with many people calling in, some had already lived through some of COVID in

China. Industry leaders on the call were able to share those procedures here in North America very candidly, which was very helpful to everyone.

That's the same type of thing that can happen here at APEX EXPO when discussing challenges such as the supply chain issues. There are people who have found ways to figure this out, and by sharing their knowledge in professional development courses, attendees can walk away with such great knowledge from APEX EXPO that they can literally solve problems the next day.

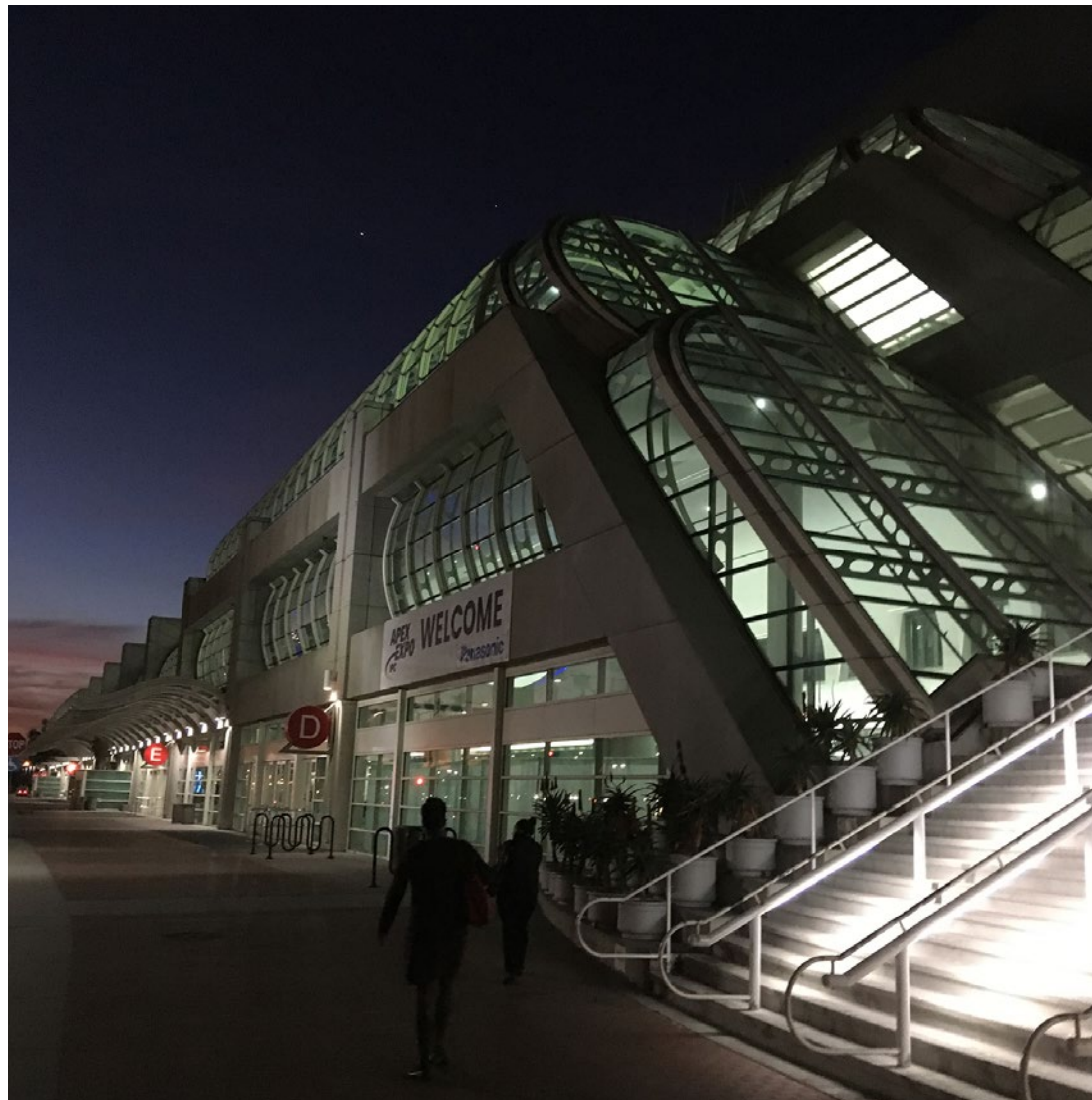
**Matties:** Over the last couple of years, we have developed a new way of doing business, whether we like it or not—the virtual, the Zoom meetings—and as we pointed out earlier in our conversation, this may be the first or one of the first shows that people are attending since the pandemic began. Do you think the attendees are coming with a different goal or priority to this event?

**Mitchell:** Perhaps. I'm curious about this one myself, frankly. I think part of the priority will be to have that face-to-face conversation and to reconnect with different people. One of the hardest things to do virtually is to make new connections because you just don't have that trust that you've developed over the years.

It's easy for me to call you up and say, "Hey

Barry, let's chat via Zoom." That's a super easy thing to do. It's not necessarily an easy thing for me to reach out to somebody I've never met before and have them say, "Yeah, let's have a Zoom chat." But if I've met them before and can make that connection, then I can easier maintain that connection easier.

While it may not always be true, I've found there are certain types of connections that just don't lend themselves to finding a new person you've never heard of in a virtual environment. But coming to a conference like this, where like-minded people—many that you've never met before—are showing up and sharing their experiences, suddenly you can make a connection. Once you've got an additional connection, you gain a whole new branch of network connections that you could work with to help





your business or that you can help. This is when you can leverage the virtual connections more easily.

I hope people have that as one of their priorities, to meet different people. Of course, we want to say hello to all our old friends, but there's going to be a lot of new people there, too. Those connections can be super important because people have gotten very comfortable, as you said, with the virtual way of doing things. Now if they've made a new acquaintance, they can maintain that very easily once they leave APEX EXPO.

**Matties:** What messaging are you providing for those who are not attending APEX EXPO but still want to be able to participate?

**Mitchell:** IPC APEX EXPO is really three events combined in one. You have your exhibition show floor, something that really needs to be experienced in person. Non-attendees could certainly find out who exhibited and how to contact them, but they could do that anyway, right?

Then we have professional development, giving attendees a chance to take a deep dive into a particular subject, and a robust technical education program that offers more than 100 papers in four strong educational tracks. In addition, we will have committee meetings going on essentially all the time.

The standards development committee meetings will be live, but people who aren't there will have the opportunity after the fact to raise comments, concerns and/or points, and share data after the fact, so if they can't make it, they can still impact the standards. On the professional development side, a few presentations' recordings, I believe, will be shared for those who aren't there. But as you said, you were able to peruse the entire agenda for it right now. And if there's interest in those, a specific speaker, there's always the opportunity to reach out. But mostly, we're trying to keep it pretty much a live event.

**Matties:** Good move, I think. Can you give us a preview of your keynote, the theme, what people can expect, and the takeaways?

**Mitchell:** Sure. We're working on it every day, and it will continue to evolve up to the last minute because we want it to be timely and relevant as things can change and shift. But, in general, I will be discussing some of the basic trends—economic, supply chain, or technological—as an opening salvo to setting the landscape for a discussion on how we navigate these choppy waters. How do we chart a path through these treacherous terrains and leverage them toward both immediate success and long-term success?

We'll be taking some of these items that we've talked about—supply chain, labor, transportation costs, parts being unavailable, and part shortages (which I look at as slightly different)—and discuss what organizations should be doing, best practices, etc. I hope those in attendance will be listening to understand: What are the little nuggets that we can take away to help soften the challenges we're facing today? It's an interesting time we're living in.

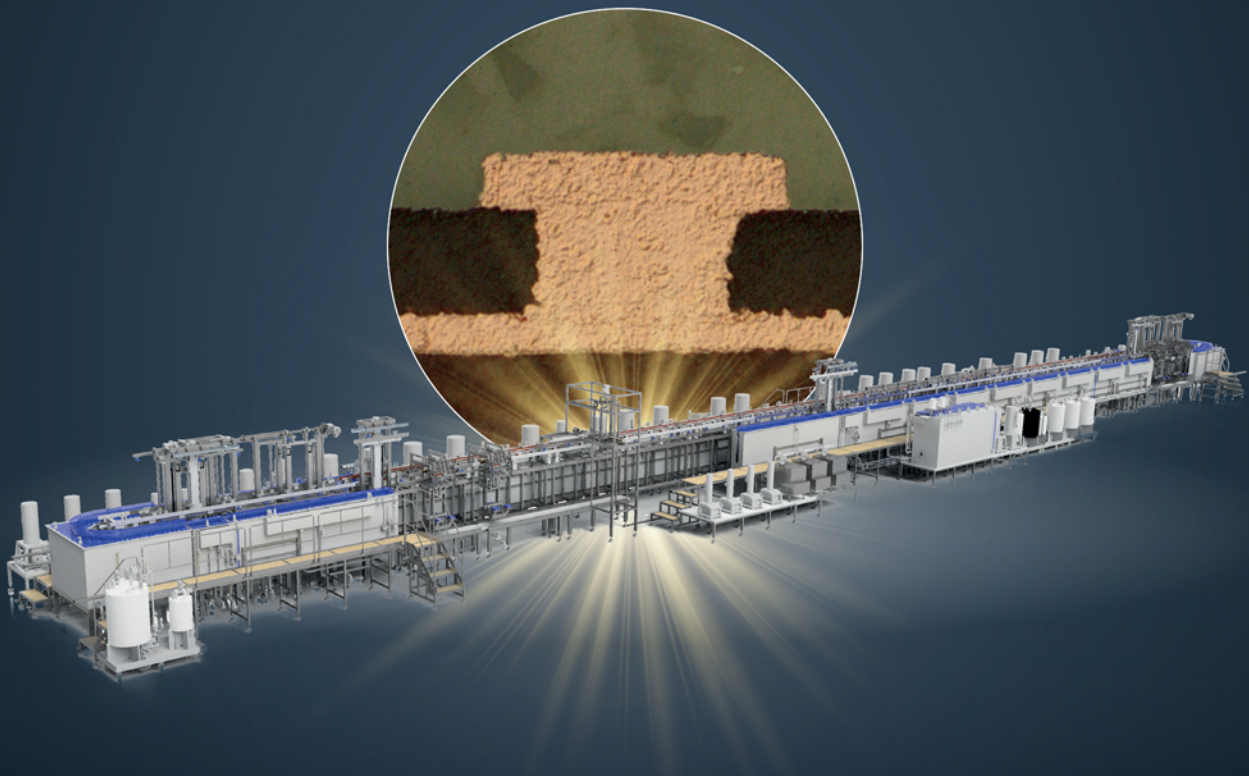
Most companies that I'm talking to are producing more than they have ever produced in their lives, and they *still* have back orders. Yes, there's a shortage, but at the same time, around 80% of the companies I'm talking to are having their best years ever.

**Matties:** We hear the same thing.

**Mitchell:** Despite that, there's more demand. I will be talking about how much of that is sustainable in the long term. Are we actually changing? Do we just need to produce more forever, or is this just a two- or three-year bump for certain things? Will the needs change? It's a tough situation to navigate.

**Matties:** There's an ebb and flow to everything.

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**Mitchell:** That's right. People are making stronger investments. That's another part of what you'll hear me talk about. Another reason for bringing all this up is to talk about how and why to strategically hire. There's very little scrutiny taking place on the people many organizations are trying to hire right now. A lot of people are just saying, "Get me a warm body! We'll train you up and figure it out." That's fine, but the challenge is understanding whether that person is a one-trick pony or are multifaceted. We need talent that can adapt to change.

**Matties:** I was talking to a fabricator who said that when they hire somebody they only expect them to stick around for a couple of years, maybe three at best. Their big challenge is how to train them up fast enough. Hearing about your training program will be very welcomed.

**Mitchell:** I've heard the same thing, which is fascinating.

**Matties:** It's an extremely competitive market and if you're just bringing in a line operator to run an etcher or something to that effect, hiring bonuses are being offered in many places that you are competing against.

**Mitchell:** Yes. The opportunity that I hope to bring home is that those companies that can offer the right incentives to bring in somebody who can stick around have a tremendous advantage of not having as much turnover.

**Matties:** Absolutely. I think that's exactly the right message. If they're not hiring for longevity, there's a problem. I know we're trying to rush bodies in to get jobs done, but there's a big cost for scrap and most scrap is human error.

**Mitchell:** I agree with you. The training programs to help people come up to speed very quickly are critical. There's also some assess-

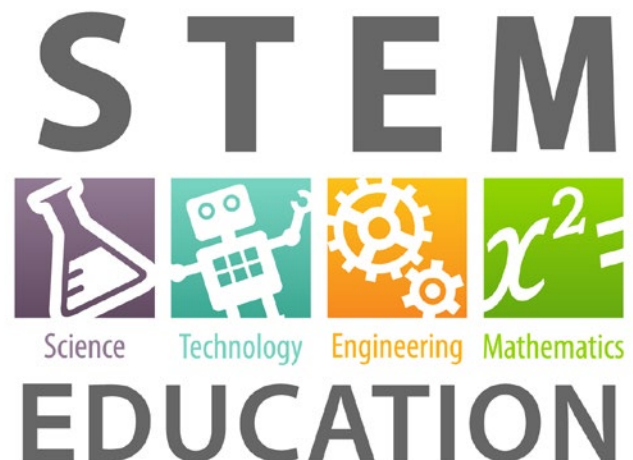
ment we can do as to how capable an individual is. Don't just accept any warm body; do a little bit of assessment.

**Matties:** I don't think you should throw away your hiring standards just because you're in crisis. At the same time, we must develop the future workforce and that's part of IPC STEM and emerging engineer programs. We are a sponsor of the STEM program, so that's something close to our hearts as well.

**Mitchell:** Yes, we're super excited about the STEM programs and we are doing a lot on that front. This is about building the pipeline for the industry. So, when we say there's a skills gap, Dave Hernandez, our VP of education, is quick to point out that there are four issues and IPC is working on all four. One is the pipeline. The second is onboarding. The third one is pathways, and the fourth is upskilling. Pipeline is where the foundation comes in, where we're working to help educate, inform, and engage students in high schools, universities, people changing jobs, about what this industry is, and what it has to offer.

Onboarding is the very quick turn, helping train people in a repeatable fashion that will get them what they need as fast as possible, which is employees that can be productive.

The pathways are about keeping the employees that you have. Is there a pathway for their success? Our design programs provide path-



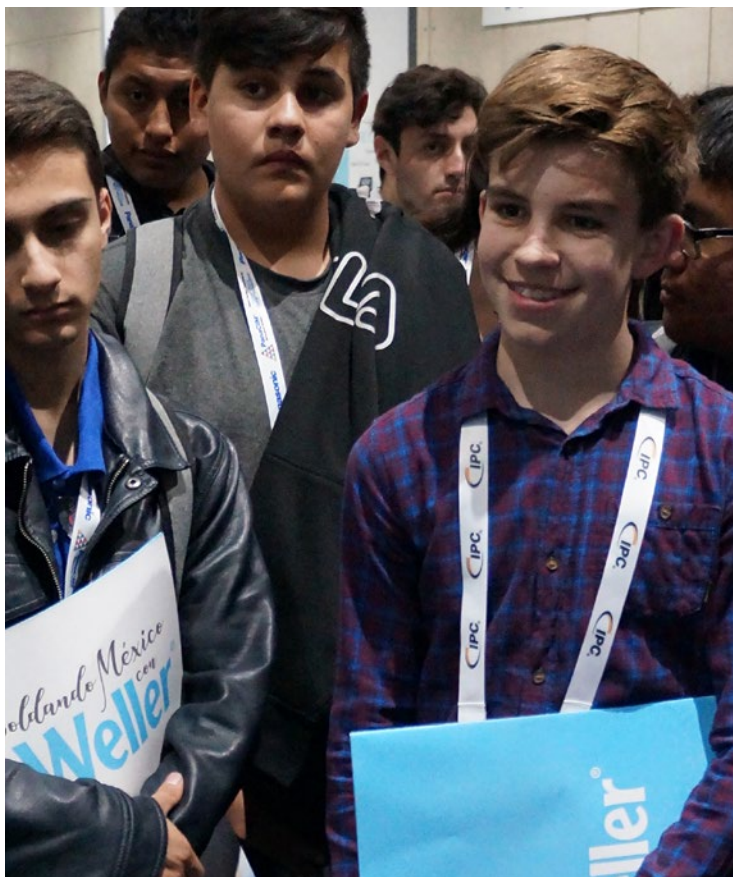
ways. We have this whole hierarchy that, say, if you're new to design, here's the information you need to build the basic skills. Once you have a little bit of experience in design, here are some of the courses. We have online live courses and certification programs that allow you to lift your skills. If you're an advanced designer, there's a whole slew of specializations that you can get training in. That's building a pathway. If you want a career in design, for example, what's your next step, and the next after that? We are providing education pathways along the way.

Upskilling is training workers on new methods, machines, and materials to succeed in an increasingly competitive global market. Our industry changes all the time, and we need to provide courses, information, and education to make sure that engineers have the latest skills available, giving them and their company a leading edge.

That whole suite of educational offerings helps someone as they evolve from those who are new engineers, operators, or technicians to those who need to develop more advanced skills, getting them up to speed and engaged, as well as caring for them along their path in the electronics industry.

**Matties:** It's great seeing these young engineers and the STEM students, frankly, at the show. The enthusiasm in which they're participating is noticeable.

**Mitchell:** Let me share some insight on our volunteers. We see a lot of people reaching retirement age. What happens when they retire? What's left of the industry? What happens to standards committees? We've been doing the Emerging Engineer Program for a while and each year it continues to grow, which we find very gratifying. Not only because of the number of participants, but because you have cross-company mentors, where people are spending



their time to help these newer folks get more experience in the industry.

**Matties:** That makes a big difference right there.

**Mitchell:** It does. Being concerned about having another 60+ years ahead of us, we surveyed how many years of experience each committee member has. I expected to see that 80% have more than 20 years of experience on these standards committees. I was wrong. It's balanced from an industry experience perspective. We thought, "We don't have a problem to solve here." We have people with a little bit of experience, mid-experience, mid-senior, and super senior. That's the perfect combination. We will continue to monitor it, but it was so good to see it wasn't a situation with 80% of the people retiring in the next five years. That's not the case.

**Matties:** That is good news. Now, as you look forward to 2022, what do you think the industry



should be mindful of? What should we really be paying attention to, aside from the obvious challenges?

**Mitchell:** If companies can leverage the success they're currently having, not just for 2022, but to set them up for the next decade, that is what I think industry should be thinking about.

What are the investments they can make now, while they're flush, that will pay dividends for the long term? That could be in terms of machinery, systems, talent, new customers, or new niches they want to explore. There are a lot of opportunities. Those companies that will have the brightest future through the ebbs and flows of the industry are the ones that are preparing right now.

**Matties:** That's not typical thinking in U.S. business, though, when you talk about 10 or 20 years out; people typically look at quarter to quarter.

**Mitchell:** Yes. As we think about the Factory of the Future, there's such a different perspective when we talk to people in North America vs. Europe vs. Asia. North America thinks, "Why should I do this now? Show me how I'm going to get paid on this right now." European companies tend to say, "Of course, we're already doing this."

**Matties:** The smaller the manufacturer, typically the more limited the resources. But oftentimes we're talking to a fabricator here that's low volume, quick turn. They say, "We don't need automation. We just don't need that." Maybe they're right. Maybe they know their business.

**Mitchell:** Maybe, but I also talked to low-volume, quick-turn places that, because of the parts shortage, can't really be quick turn anymore. They're having to shift their thought pro-



cess to more mid-production. Instead of low-volume, it's mid-volume because they've got to do other things with the parts that they have available. Maybe they were doing things for 12 and now they need to do 100 to 1,000 times that.

**Matties:** Exactly. It's not about the quick turn.

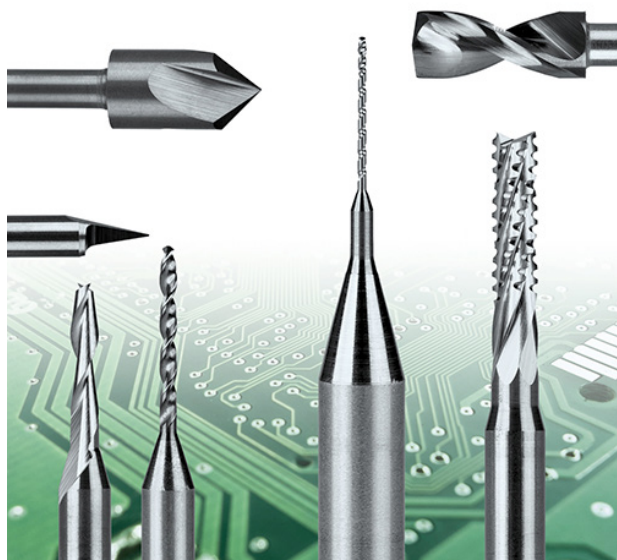
**Mitchell:** It's about, "The stuff needs to work, and I need it in these quantities." Those are some of the things I think people need to be mindful of. Even the smaller companies you mentioned may not have the resources to go after this. But that's where things like implementation of CFX will help. There are ways to retrofit existing machinery. You can send and utilize CFX messages and work with your larger suppliers and customers that are already using those systems without having to buy brand-new equipment everywhere all at once.

**Matties:** Part of the problem is that's a job function—chief process improvement manager—that most companies don't have a dedicated person for. A chief process improvement

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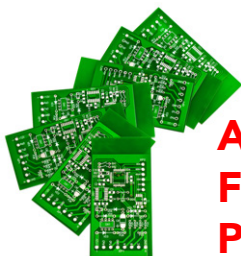
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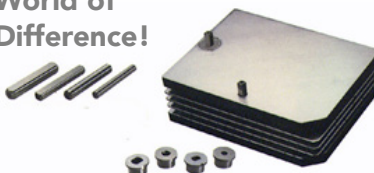
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officer is worth their weight in gold. They can add more to your bottom line than you can imagine in most cases.

**Mitchell:** If you're doing \$10 million worth of business and you get a chief process improvement manager to go through and make you 10% more efficient, you just made a million dollars.

**Matties:** It's not just that the million dollars on the bottom line, it's the added capacity and opportunity that comes with that.

**Mitchell:** You also get employee benefits because they're happier doing things in a smarter way.

**Matties:** I referenced an interview I did with a company in Europe. Ventec hired a guy from the newspaper business who didn't know anything about laminates, but he was a logistics expert. And as you can read in the interview, the company was thinking, "We need to get another building. We're running out of space." He came in, looked at the logistics, reorganized

the factory. Not only did they not need additional space, but they had extra space already within their existing walls.

**Mitchell:** That's our industry's example of the famous hospital Ferrari example. You're familiar with this story?

**Matties:** No.

**Mitchell:** There's a hospital in Europe where their emergency room process was losing patients. People were literally dying because it was just a very complex process going through the ER. The Ferrari race team came in and re-optimized how they did things. These were the guys that can do a pit stop in 4.3 seconds: they change all four tires, refuel, etc. So, the same team walked in, worked with the hospital, and understood what they needed to do. They redesigned the thing. They didn't lose a patient due to process error; basically, the fatality rate dropped by seven times. It was incredible. The crucial point you're making is to look outside the industry for expertise.

**Matties:** I know we can go on, but do you have any final thoughts you want to share?

**Mitchell:** First, I can't wait to see everybody again at APEX EXPO. It's going to be a great event. Second, we want to make sure everybody is being safe out there, so I encourage everybody to follow the best process to make sure that not only themselves, but everybody they're interacting with, is safe. Thank you all for your compliance with what may be challenging rules that we're subjected to. But if we can, let's look past the rules, follow them, and then enjoy the time together, because that's what these guidelines are enabling us to do.

I am grateful for my team members who are working with the industry to make sure this is a successful event. Our staff—whether it's the standards, education, events, or marketing team, all of them—they are all engaged



in making sure that APEX EXPO is successful for the entire industry and every individual who attends. I want to express my gratitude for all the good work they do in working with the participants, whether they're exhibitors, presenters, or standards committee leads, to make sure this can be an event that they will long remember in such a positive fashion.

**Matties:** Thank you very much and I look forward to seeing you at the show.

**Mitchell:** All right, thanks for the time. PCB007

## 2021 Award Winners to Be Honored at IPC APEX EXPO 2022

The IPC APEX EXPO event of 2021 was an entirely virtual event. The following awards were presented during the show, and they will be honored during IPC APEX EXPO 2022 in San Diego. Let's hear it for these men and women who continue to give back to the industry!

For more information about these award winners, visit the I-Connect007 2021 edition of [\*Show & Tell Magazine\*](#).

- The IPC Raymond E. Pritchard Hall of Fame Award:  
Karen McConnell, Northrop Grumman
- Best Technical Paper: Sarah Czaplewski, IBM
- Rising Star Award:
  - Radu Diaconescu, Swie.ie
  - Vlad Koncar, ENDSAIT, University of Lille
- Dieter Bergman IPC Fellowship Award:
  - Michael Ford, Aegis Software
  - Jan Pedersen, Elmatica
  - Hans-Peter Tranitz, Continental Automotive GmbH





# Francisco Fourcade: Meeting During a Pandemic

Feature Article by IPC Staff

How did IPC committee members fare during lockdown? We asked Francisco Fourcade, a master IPC trainer and member of the 5-22A and 7-31B standards development task groups revising two of IPC's biggest standards, IPC-J-STD-001 and IPC-A-610. Francisco lives in Barcelona, Spain, and experienced one of the toughest lockdowns in the world.

When travel restrictions eased, Francisco attended IPC SummerCom 2021, where the inaugural Golden Gnomes were held. As the first recipient of the Outstanding A-Team Member of the Year, Francisco was recognized for participating in several A-Teams, including J-STD-001 A-Team, IPC-A-610 A-Team, Shock and Awe A-Team, Team Kangaroo, Team Iron, Team Bones, and the IPC/WHMA-A-620 Training Committee. He was also an active participant on the J-STD-001/IPC-A-610 Automotive Addendum Working Group.

Here is a snapshot of Francisco's committee experiences during the pandemic.

**IPC:** What was it like to work on these standards under lockdown? The committees could not meet in person, but was there anything else that struck you about working on IPC standards during a pandemic?



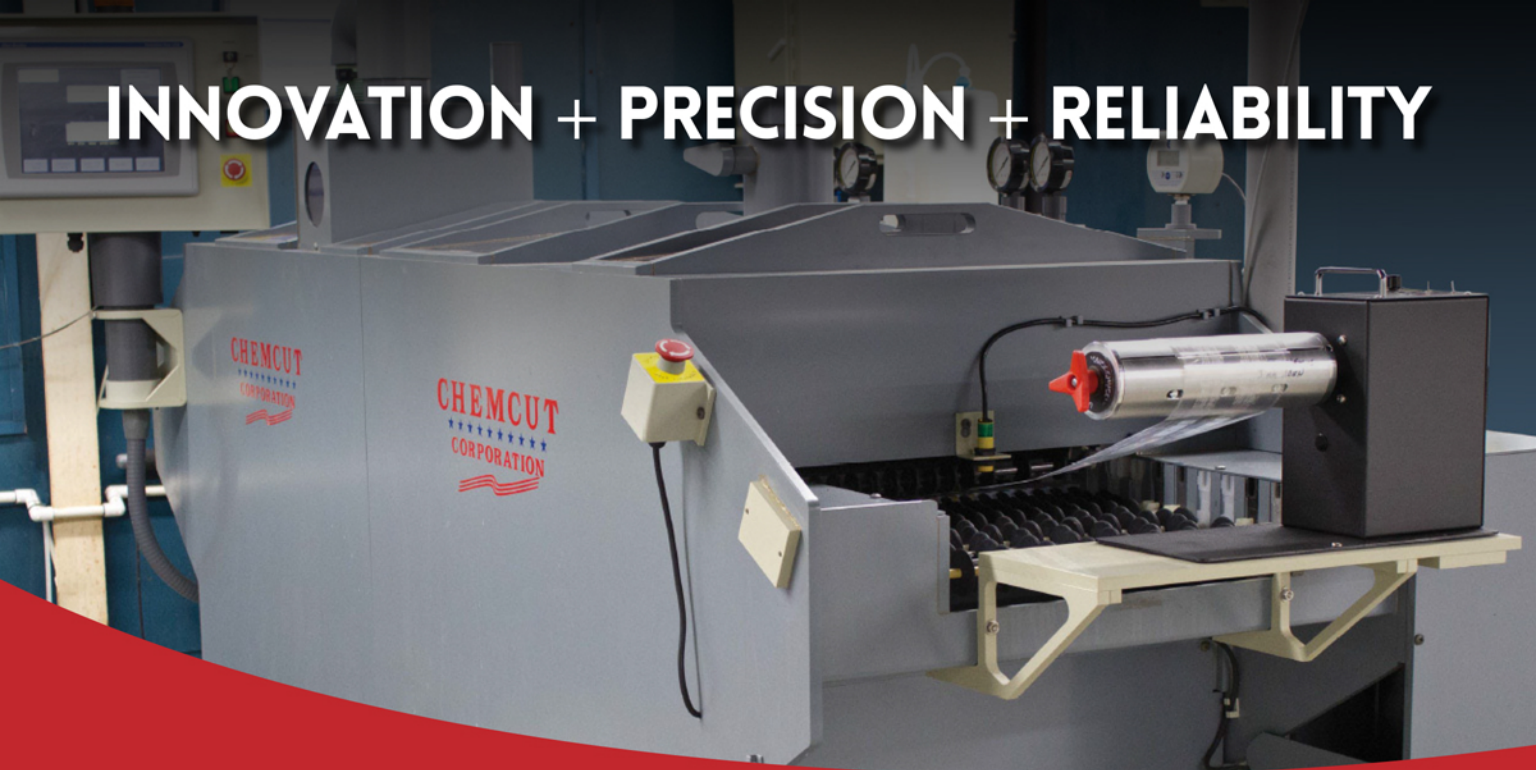
Francisco Fourcade

**Francisco Fourcade:** Under lockdown, between the unprecedented uncertainty and isolation that most of us experienced, staying actively connected was crucial. Working on IPC standards was certainly a good way to collaborate alongside colleagues that were experiencing some form of lockdown as well. We had a lot of participants join from all over the world sharing their knowledge and support in our virtual community.

**IPC:** What was your personal experience? Where were you locked down and for how long?

**Fourcade:** My lockdown took place in Barcelona, Spain. We had boots on the ground running checkpoints with police to enforce one of the toughest lockdowns in the world. Every time you'd leave your house you were required to have a self-signed certificate, dated, specifics with point A and B addresses, and a set of seven defined reasons why you were not home. It lasted 98 days; it was brutal. Fortunately, I live in a small town on the northern coast of Barcelona, so I could walk my dog for a one-kilometer radius, which meant walks on the beach. It was amazing how nature was flourishing everywhere during lockdown; we even got to see dolphins at sea!

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**IPC:** What are some of the significant changes in the standards?

**Fourcade:** Both documents went under some great changes and synergy between them. The most significant change in A-610H was removing target conditions entirely in line with A-620D. Also, some re-structuring of ESD into an appendix and the jumper wires criteria into a new section 13, in which I was personally involved with the Kangaroo team. J-STD-001H brings some critical industry consensus on cleaning, a new appendix for X-ray guidelines, and both documents incorporated new SMT termination criteria: wrapped terminals. The leaders and IPC liaisons did an outstanding job handling all these changes and getting it done.

**IPC:** Why are J-STD-001H and IPC-A-610H important to the industry?

**Fourcade:** These documents are called out

when the industry needs reliable electronics. Their importance is held by the industry itself demanding a standardized baseline to build electronics better.

**IPC:** Should these documents be used together?

**Fourcade:** Users are encouraged to use these documents together to best aid their inspection process. Interpretation leads sometimes to misconceptions of the intended use. As defined by the scope of each document, a user may apply J-STD-001 to their entire manufacturing process, whereas A-610 is applicable only during inspection, mainly for reference and training.

**IPC:** Thank you for all your work on the committees.

**Fourcade:** Thank you. PCB007

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## Additive Reality:

# You've Opened Up the Inkjet Printer Box, Now What?



by Luca Gautero

The moment will come when some of you readers will advance from interest to complete involvement with the technology. This will be a fun ride as you will experience first-hand the concepts seen so far in this column. However, we all know that any reliable technology relies on one healthy, not so exciting, good habit: preventive maintenance.

Preventive maintenance and incidental repairs are not the same, though they might follow the same instructions. Still, this does not mean that these are interchangeable. The last section will mention incidental repairs and why, in my opinion, this is the right technological age to be less averse to these issues.

For now, the focus will be on the good old preventive maintenance, as a habit—or even better—a tiny habit.<sup>1</sup> As a tiny habit, the focus should be on the ability to perform the action or behavior, and on the prompt. The clearer the prompt, the easier it is to begin a task. The more able the person is, the less motivation is needed.

This is why equipment manufacturers write manuals (which facilitate ability) and provide a scheduling routine (facilitating a prompt). A simple copy-paste of the SÜSS MicroTec maintenance manual would fit this column nicely, though this would not be fair to the technology and to the many valuable competing inkjet printing solutions out there. So, here are independent tool maintenance considerations.

To read this entire column, [click here](#).

**Luca Gautero** is product manager at SÜSS MicroTec (Netherlands) B.V.

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# MilAero007 Highlights



## Key Tronic Announces Results for Q1 Fiscal Year 2022 ▶

Key Tronic Corporation, a provider of electronic manufacturing services, announced its results for the quarter ended October 2, 2021.

## Monitoring the High Seas at High Altitude ▶

Raytheon Intelligence & Space demonstrated the SeaVue MR and DAS-4 on the SeaGuardian for the United Kingdom, The Netherlands and 12 other NATO member and partner nations as part of the Joint Warrior demonstration in the fall of 2021.

## Honoring Those Who Served ▶

The I-Connect007 staff takes a moment on Veteran's Day to honor those men and women over the years, who served to protect and defend their country. Just on the I-Connect007 staff, we have loved ones who served in the military, ranging from World War I to present-day active-duty.

## Electronics Manufacturing Outlook Continues to Darken, Prices Increase as Component Shortage Drags On ▶

A new global survey found that the global shortage of semiconductors and other components continues to have serious consequences for electronics manufacturers, leading to rising costs and higher prices.

## Defense Speak Interpreted: What Happened to Our Defense JEDI? ▶

JEDI stands for Joint Enterprise Defense Infrastructure and is the backbone cloud computer

system for Defense to tie the service branches together. To refresh your memory, Defense issued a \$10 billion-plus contract to Microsoft for the massive cloud software effort, and Amazon appealed the award.

## Lockheed Martin, Rafael Partner to Develop SPICE-250 Weapon System for US Military ▶

Lockheed Martin and Rafael Advanced Defense Systems Ltd., of Israel, signed an expanded teaming agreement, allowing the team to jointly develop, market, manufacture and support Rafael's Smart, Precise Impact and Cost-Effective (SPICE™) 250 weapon system for sale in the United States and in Poland.

## The Scientific Journey of NASA's SpaceX Crew-2 on the Space Station ▶

After more than six months aboard the International Space Station, the astronauts of NASA's SpaceX Crew-2 mission returned home. The four crew members traveled back to Earth inside a SpaceX Crew Dragon capsule.

## Army Grants to Bolster Unique, New Semiconductor Fab Facility ▶

More than \$5 million in total funding from the Army Research Office and the Army Research Laboratory will go toward a unique silicon carbide semiconductor fabrication facility at the University of Arkansas. The Army Research Office grant will be used for equipment, and the Army Research Laboratory grant for student and staff compensation, tuition, and materials for supporting collaborative research activities with the Army Research Lab.



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Figure 1: Emily Ramirez and Angelana De Tate.

## IPC STEM Event a Real Motivator for High School Students

Feature Interview by Nolan Johnson  
I-CONNECT007

Many high school teachers might take their students on a field trip to visit a museum, planetarium, or an art gallery. But last year, Mount Miguel High School science teacher Harold Mumford brought his students to the STEM event at IPC APEX EXPO 2020. Mount Miguel, located in Spring Valley just outside San Diego, features a thriving engineering and design program.

I recently asked Mumford to explain how the STEM event affected his students, and how IPC's robot-building activities dovetailed with his students' efforts in robotics in the Matador Engineering and Advanced Manufacturing Program (the school's athletic teams are the Matadors). He also offered updates about the kids who continued to study engineering in college, some on full scholarships.

**Nolan Johnson:** Your students attended the STEM event at IPC APEX EXPO 2020. How is this program relevant to your students?

**Harold Mumford:** The Matador Engineering and Advanced Manufacturing Program is a new engineering program focused on introducing students to the complex integration of humans and machines that drive modern manufacturing. Being invited to the IPC's STEM event in San Diego offered students an incredible opportunity to see cutting-edge integration. Professional presentations and demonstrations helped cement the aspirations of the Matador students who participated in this inspirational event.

Two students (Figure 1), Emily Ramirez and Angelana De Tate, came back from the experience committed to their aspirations to become engineers. Emily is applying to college to become an electrical engineer, and Angelana is applying to become a software engineer.

**Johnson:** Did the event inspire students to consider electronics manufacturing?

**Mumford:** I have no evidence to argue that the IPC student event made all the difference in Matador students' career focus, but I can defi-

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nitely support an argument that the event was the best exploratory experience my engineering students had during their time in the program. Seventeen students participated in the event and all of them have applied to university or community college in STEM programs.

In 2020, Diego Real applied to UCSD's Jacobs School of Engineering and received the Dr. Claire Trumain (a full scholarship) to study aerospace engineering. Kyle, Daniel, Gabino, Charlie, and James are studying engineering design at Cuyamaca College. I know that James and Kyle were impacted by the event, and it helped support their passion for electrical engineering. The great thing about the event was the hands-on experience. The students bonded with their instructors and were very excited to return to school to build on what they learned at the event. They really enjoyed making the LED pins and learning to solder.

**Johnson:** Does this program motivate students to go to college or to a trade school?

**Mumford:** Yes! This is a definitive answer. The student event helps support the goals of our

College to Career programs, and, in the case of IPC's student event, it really made an impression. Students were able to interact with their facilitators and meet real professionals who were generous and gracious. Often, students see the world of work as competitive and unsupportive. Interactions with the professional panelists and facilitators are what make the student experience amazing. Matador engineering stresses the importance of collaboration and has adopted FIRST Robotics' ethos of "gracious professionalism."

Experiencing gracious professionals is important to the students Matador Engineering serves. The experience provides an opportunity for underrepresented students to interact with knowledgeable and competent professionals and witness the diversity they represent. As you can see in one photo (Figure 2), our young women had the chance to work with a female mentor and that was priceless. So, yes, the students are impacted, inspired, and motivated to continue their education with the knowledge that they, too, will be called to give back and mentor others when they become professionals.



Figure 2: Female students from Mount Miguel High School's Matador Engineering and Advanced Manufacturing Program worked with a female mentor at the STEM event as part of IPC APEX EXPO 2020.

**Johnson:** How do you tie this experience into your classroom curriculum?

**Mumford:** Matador Engineering and Advanced Manufacturing's curriculum is simple: We use robots to build robots. This is what we do and how we learn the fundamentals of mechanical, electrical, and programming integration. At IPC APEX EXPO we got a glimpse into cutting-edge robotics and the technology that drives systems and robot integration—robots that serve robots. We see autonomous guided vehicles that stop when they come too close to an obstacle, and we build robots that use sonar and light sensors to navigate an obstacle course or compete autonomously in games.

Preparing students to visualize the future is much easier when they have an opportunity to witness modern manufacturing equipment. And the amazing tour of the IPC convention floor was inspirational and scary; we have a lot to learn to contribute to the next generation of smart machines. Being able to experience the live demonstrations was eye-opening and inspiring, for me and for the students. The precision of modern manufacturing challenges motivated students to take the time to learn and take care of the machines they have access to.

**Johnson:** How likely are students to follow through and go into engineering?

**Mumford:** Of the 17 who attended the 2020 event, 15 have followed through. That is an 88% success rate, and that was in the middle of a global pandemic. Matador Engineering has a 93% completion rate and an 83% college completion rate. Most of the students prepare for and attend post-secondary education in engineering. I have had one student defect from the engineering pathway: Alexis Brooks was accepted to UC Davis on a scholarship in man-



Harold Mumford

agement and marketing. I suppose many electronics firms would love to have her when she graduates.

**Johnson:** Can you give us an update on the students who attended the STEM event at IPC APEX EXPO?

**Mumford:** Sure. Of the students who attended in 2020, the following have had excellent success:

**Wendy Romero**—She completed two college engineering courses while still in high school and was accepted to UC Santa Cruz in mechanical engineering.

**Diego Real**—He won the district's Excellence in Engineering Award, Dr. Claire Trumaine Scholarship, and is majoring in aerospace engineering at UCSD.

**Alexis Brooks**—She took home the district's Excellence in Engineering Award and was accepted into UC Davis on a scholarship, majoring in management and marketing.

**Kojo Miller**—Kojo is majoring in mechanical engineering at San Diego State University.

**Ashly Rodriguez**—She is majoring in mechanical engineering at Chico State University.

**Angelana De Tate**—A top student, Angelana applied to several schools in software engineering, with outcome to be determined.

**Emily Ramirez**—A top student, she applied to several schools in electrical engineering, with outcome to be determined.

**Johnson:** Thank you for your time, Harold. It sounds like you really enjoy teaching.

**Mumford:** Thank you, Nolan. We have some fantastic students. PCB007



# Fabricator and Supplier Exhibitor Survey Responses



**Altix** (Booth 3833)

**Alexandre Camus,**  
*Marketing Manager*



**I-Connect007:** What new and exciting developments are you showcasing at the show?

**Alexandre Camus:** We'll be displaying our ADIX SA NEO direct imaging solution in our booth. We'll also be showing our new ADIX SA DUO via augmented reality technology, which should be quite an experience for the attendees. And with our ADIX RtR DI, we will delve more into our latest technology in roll-to-roll imaging for customers who want to envision roll-to-roll processes in their factories.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Camus:** Our attendees will learn more about our latest progress in imaging design and the reasons why imaging remains a key element in PCB manufacturing. We will be sharing our worldwide experience in imaging and in PCB markets, trends, and technology in imaging technology.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Camus:** We plan to learn more about advanced packaging constraints for U.S. manufacturers during the show. We also plan to continue developing and expanding our network. At IPC APEX EXPO, I believe we'll find that U.S. PCB manufacturers are willing to embrace new and cutting-edge technologies.

## ICAPE Group (Booth 3214)

**Lea Maurel,**  
*Americas Marketing Manager*



**I-Connect007:** What new and exciting developments are you showcasing at the show?

**Lea Maurel:** We now offer extensive services to support your projects from concept to market. We take your ideas and turn them into products. We have just acquired a new PCB factory, and we are celebrating the opening of new business units in five countries while showcasing our brand identity for the first time.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Maurel:** You'll get to meet our experts in person. You'll get the chance to talk about future and current projects and get your questions answered regarding PCBs, technical parts. We can also discuss our own in-house labs.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Maurel:** We'd like to learn more about the EV sector and the high-tech products that our clients manufacture. I'm looking forward to walking the show floor at IPC APEX EXPO.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Maurel:** Come visit us. We're your one-stop solution provider in the electronics industry and we'd love to work with you.

## Chemcut (Booth 3338)

**Kirk Lauver,**  
*Marketing Manager*

**I-Connect007:** What new and exciting developments are you showcasing at the show?

**Kirk Lauver:** Chemcut will be demonstrating EVA robots in our booth. EVA robots are lightweight robots that can be added to conveyorized wet processing and other equipment.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Lauver:** At Chemcut, visitors will see the EVA robots working with an Chemcut 2330 alkaline etcher (obviously dry—no chemicals will be at the show).

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Lauver:** As an exhibitor, we hope to learn about our customer's issues and what future needs they may have. IPC APEX EXPO offers everyone in the industry a chance to learn about the issues that are important to them and their customers.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Lauver:** We're looking forward to seeing everyone at the show. Stop by booth #3338 and say Hi!



## Polar Instruments (Booth 3323)

**Martyn Gaudion,**  
*Managing Director*



**I-Connect007:** What new and exciting developments are you showcasing at the show?

**Martyn Gaudion:** We'll be demonstrating the Speedstack PCB design system, with the latest material library updates along with a raft of usability enhancements for professional stackup design and documentation.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Gaudion:** Attendees who visit the Polar Instruments booth will have the chance to meet face to face and share requirements with the Polar team. If you have any questions, stop by and have your questions answered directly by technologists at Polar.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Gaudion:** IPC APEX EXPO affords us the chance to learn about the newest advances in materials and the latest in high-speed design techniques and materials. If you're a PCB technologist looking for information about PCB design and manufacturing, this show is a must-attend.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Gaudion:** We're all looking forward to getting together with friends and customers in San Diego. We recently exhibited at productronica in Munich after a two-year break from traveling, and it was great to get together and share information face to face. I hope to see you all at IPC APEX EXPO.

## Rogers Corporation (Booth 3433)

**Sheryl Long, Senior Marketing**  
*Communications Manager*



**I-Connect007:** What new and exciting developments are you showcasing at the show?

**Sheryl Long:** We are launching Radix™ 3D printable dielectric, the industry's first low-loss 3D-printable stereolithography material. With the first UV-curable RF material for 3D-printing, engineers will be able to design parts while disregarding the typical manufacturing design constraints.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Long:** Rogers Corporation empowers innovation and breakthroughs in reliability, efficiency, and performance of specialty applications. Attendees will learn about advanced materials and be able to speak with experts.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Long:** Learning about new products and technologies in the electronics manufacturing industry is extremely valuable; it's always great to see what the latest advancements are toward improving quality, reliability, and operational efficiency.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Long:** We're all looking forward to a great show, seeing old friends, and meeting other professionals in the industry. It's been a long time since the last live IPC APEX EXPO.



## **Tritek Circuit Products** (Booth 3924)

**Steve Kenney, President**

**I-Connect007:** What new and exciting developments are you showcasing at the show?



**Steve Kenney:** Tritek has been in business for over 30 years and 2022 is shaping up to be the most exciting year yet for our company. In September, we announced our partnership with AGC Multi Materials America and just recently completed the acquisition of Advanced West, an equipment company. At the show in January, Tritek will be sharing these new developments and outlining how this diverse portfolio of products and services will bring unique and exceptional opportunities to our customer base.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Kenney:** When customers visit the Tritek booth at the IPC show, they will be able to see, first-hand, the changes that we are making in our offerings with the only goal of being a more valuable asset for our customers to take advantage of.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Kenney:** For us, we try and learn from our customers by listening closely to their challenges. Customer challenges become our challenges, so we work with our manufacturer-partners to help develop applicable solutions or apply our own experience and knowledge to help customers achieve their goals.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Kenney:** I believe 2022 is going to be a very exciting year for Tritek, not just because of what we will accomplish for ourselves, but because of what we can deliver to our customers.

## **Insulectro** (Booth 3233)

**John Lee, VP of Marketing**



**I-Connect007:** What new and exciting developments are you showcasing at the show?

**John Lee:** Insulectro is proud to showcase four new suppliers—InduBond® (presses), IBC, Kemmer, and the DuPont chemistry line—for a total of 15 best-in-class suppliers. We have new products in laminates, flex laminates, chemistry, drill room, dry film, lamination assist, and copper foils. We'll have a lot to talk about it at IPC APEX EXPO.

**I-Connect007:** Why should attendees stop by your booth at IPC APEX EXPO, and what can they expect?

**Lee:** Our megabooth (#3233) at the show measures 1,800 square feet and features major supplier-partners DuPont, Isola Group, and InduBond® presses in addition to all our suppliers. Plus, we have expanded our renowned Power Chats Theatre where we deliver over 45 separate 13.5-minute presentations over the EXPO's three days. The booth is always packed with attendees wanting to know what's new, not only in products, but in technology as well.

**I-Connect007:** What challenges or technologies do you hope to learn more about during IPC APEX EXPO?

**Lee:** As a major player in the electronics fabrication sector of our industry, we want to know how the market is evolving, where our customers' interests are, and what the shared vision of the future is.

**I-Connect007:** Do you have any final thoughts to share with attendees?

**Lee:** We have always been fortunate to have a booth where attendees can hang out, learn, and engage in great conversation. We expect this year to be no different. We invite all to join us in celebrating a return to live trade shows and catch a first glimpse of our industry evolving to a new place—hopefully—after a turbulent two years.



# STEM Program on the Grow

## Feature Interview by Barry Matties

I-CONNECT007

In this interview we hear from Charlene Gunter du Plessis, senior director of the IPC Education Foundation, on the state of the STEM program started by IPC a few years ago. The program has been well received and continues to grow. IPC APEX EXPO 2022 will feature the live event with some exciting changes to reach even more students.

**Barry Matties:** The STEM program is an exciting and important component to IPC APEX EXPO. Of course, the 2021 event was virtual with nearly 1,000 participants, and some lessons were learned.

**Charlene Gunter du Plessis:** Yes, it made us realize we can do something else to provide the nec-

essary awareness of the industry and expand it virtually by hosting a career paths discussion in the form of a panel. We hosted another career panel on November 11 and reached more than 3,000 students. For IPC APEX EXPO 2022, in addition to the live program, we will be streaming and broadcasting live parts of the STEM event. We will use Instagram Live, YouTube, and the career panels that take place on Zoom. This will allow us to have more students learn about the industry because that's our goal; we want to continue with our efforts to create awareness and access of careers in the industry.

**Matties:** So, you will have students at the event and stream it as well?

**Gunter du Plessis:** Exactly. It will be a hybrid event. We will have about 200 students at the



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Charlene Gunter du Plessis

We just want a great event that gets students and teachers involved and excited about the industry. Having it both live and streamed is another way for us to expand and reach more people. The IPC board wants us to impact as many students as possible, irrespective of where they are based, and this allows us to do that.

**Matties:** This program started about three or four years ago, right?

**Gunter du Plessis:** Yes. Alicia Balonek and her team did the first one in 2018, with about 50 students participating. When I came on board in 2019, we had 100 students, and doubled it to 200 students in 2020. In 2021, we did two virtual career panels instead of the event. And just yesterday, we had another one with 389 registered teachers who broadcasted it in their classrooms, so we definitely reached thousands of students. We had great panelists from IBM, Lockheed Martin, Digital Instruments, and General Dynamics. We had a great lineup of panelists. We are excited to host more panels in 2022.

**Matties:** For those viewing it online, can students sign up individually, or do they need to go through a classroom?

**Gunter du Plessis:** It doesn't need to be through a classroom. When we hosted a career panel this past February, we had more than 1,000 students who viewed it because their teachers had registered and broadcast it in the classroom. But we also had individual students from the Philippines, Germany, and more. Some students woke up bright and early in the morning hours, like 3 a.m., to join the discussion.

**Matties:** Your outreach is great. You've been doing this since 2018. How are you measuring the effectiveness? What impact are you having, and how is the industry feeling that?

**Gunter du Plessis:** After every event we conduct a survey, and we see a 99.9% satisfaction

convention center, with six to eight recurring participating high schools involved. We will still do a hands-on soldering activity as a track, and students will tour the exhibit floor, but we are reworking the program to utilize the wonderful expertise and knowledge more fully in the industry by connecting students with real people. Therefore, we will collaborate with IPC's Emerging Engineers program as part of that.

They will do a roundtable discussion with the students, which will allow all students, including those not necessarily comfortable with speaking up, to be in a group and ask questions. It's a better way for them to engage, learn, and connect. That will be the focus. We will still do the career panel, and we are securing sponsors. TTM Technology will be the premier sponsor of the career panel luncheon track. We will have career panelists and representatives sharing information. Other tracks are supported by Mycronic, Google is a collaborating sponsor, and I-Connect007 is the official media sponsor.

rate; that's exciting! We have a near-100% success rate in helping a student who was not even familiar with our industry, or hadn't thought of pursuing this career, change their mind. We see them getting their thoughts together, increasing their grades, and getting on the right path to potentially get scholarships for four-year degrees, because some of them don't want to just get a job out of high school. They really want to go the academic route and get that four-year degree.

It opens their eyes to the potential for growth beyond operator level in the electronics manufacturing industry. They can get their employer (potentially an IPC member) to help them further their education, even putting money toward it, so they create a career path and don't just fill a job. We track teachers, asking them about the students who attended the event. Did they actually do what they said in the survey they would do? It's been really uplifting and positive.

We get those success stories from both our STEM events and from our Student Chapter Program as well. From the connections we're making for students, we can track where they end up, which is exciting for us. It's not thousands of people, but it's happening.

**Matties:** What about industry support? Obviously, this is an area that everybody benefits from. Right now, there's an incredible labor shortage, and it looks to continue for a while. Competing industries are putting out some nice incentives, which, perhaps, makes manufacturing not as glamorous as some of the others. How do the fabricators, EMS companies, and others help this effort?

**Gunter du Plessis:** Currently, we are asking the industry for collaboration. We would like them to be willing and open to host students at their facility for tours and an opportunity to talk with people in the industry. Maybe they could participate in a career panel or a formal presentation. COVID restrictions have made it diffi-

cult. Some facilities cannot necessarily house students, especially if they have DoD or specific regulations in terms of the equipment and what they're making. Therefore, we also have the opportunity for companies to sign up for a webinar and reach out to the IPC Education Foundation as a topic expert.

We've done a variety of webinars over the past two years with industry and IPC staff members. Kelly Scanlon did a webinar about conscientious engineering; Patrick Crawford did one; and we had one from Altium about schematic design. All these videos and webinars are recorded, and can be a spinoff for industry members to promote their internships, co-op programs, job shadowing opportunities, mentorships, or anything in terms of a talent pipeline or talent identification effort. We can brand it. We can do all the heavy lifting. We can promote it. The Education Foundation wants to be seen as the vehicle to create connections.

Through the IPC Student Chapter Program, companies can also be on campus, and can provide scholarships to IPC student members if they want to give and get involved. Companies can also host a college chapter. This is where a company within a group of universities or community colleges, that wants to target a specific group of students, can actually host those students. The cost is \$1,000 and they substitute the \$40 membership fee a student needs to pay to be part of the IPC Education Foundation Chapter Program. We have several companies that do this, such as Summit Technologies, Weller, and Calumet, at schools such as Michigan Tech and NC State. Hosting a college chapter allows for easier identification and relationships, and creates a bridge for these companies to the students.

**Matties:** Can you provide us with a list of all the student chapters?

**Gunter du Plessis:** Yes. We have exceeded 50 student chapters. One third are at community colleges, and two-thirds are at universities. We





have some big names, like Purdue University and University of California. Aaron Birney is doing an excellent job leading the chapter program and keeping the momentum alive. Students can take on leadership positions within their chapters as well and get recognized by receiving a chapter leadership scholarship at \$1,000.

We have been giving out five chapter leadership scholarships, with plans to increase that to six this year. It might be something students can put on their resumes, so when industry leaders know about the chapters and what the students are studying, it's an easy way to identify talent.

Wendy Gaston, who previously worked in sales for IPC, moved over to the foundation to help us with relationship building. Our vision is to have hubs, for example, in the Silicon Valley (San Francisco Bay area), because that is where most of our IPC industry members are based. If we can have most of the uni-

versities, community/technical colleges, and high schools involved there, it provides greater support for our local IPC member network. Then we will take that model and create hubs in different regions of the United States.

**Nolan Johnson:** Circling back to international expansion, where did those efforts begin?

**Gunter du Plessis:** That's a very interesting question because we don't necessarily know. In Europe, for example, all the regions are different; they have different academic contexts. We need to change the current chapter model. Each program needs to have a different look and feel to meet the needs of the students in those countries.

Mexico has great potential because IPC is there, and they are translating a lot of the education programs and products into Spanish. Canada is a natural fit, and we have been receiving some interest from African countries



as well. We have a big presence in China, where they don't have the same program, but they do have opportunities for students. The IPC team had to tweak it because they have a specific relationship with specific industry members to support their internship programs, so it looks different. It's going to take some effort to modify it to be the same but also unique to their context.

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## Mexico has great potential because IPC is there, and they are translating a lot of the education programs and products into Spanish.

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**Matties:** You might remember an email I sent to you describing a high school student named Drew who I met earlier this year. He wants to be an engineer, so I sent him a few questions to see how clear he is on what he wants to do.

What is the best way to connect him to the IPC? Many of us meet young people who we think would be good to bring into the industry. How do we help this person? What advice would you give to Drew, in this case?

**Gunter du Plessis:** On our YouTube channel, we have two webinars all about careers. Drew can reach out to those individuals on the panels. Everybody talks about networking and those panel members are very open to it. Drew could even attend one of our live events. If he's in the San Diego area, he can come out to the STEM event.

**Matties:** No, he's not in that area.

**Gunter du Plessis:** You see, that makes it difficult. We would like to do regional events in the future, similar to IPC APEX EXPO, but smaller. There might be career fairs housed

through companies and schools. High school students might have a robotics club at their school, and college students could have an IPC Student Chapter Program, where you can join your peers.

On the career panel yesterday, someone mentioned not just looking at the big companies, but go to your smaller manufacturing companies and ask them if you can get exposure. Be proactive. There are definitely resources available online from us and other companies, as well as internship opportunities for high school students; you don't need to be in college anymore to get an internship.

There are so many scholarships available for students and your chances are better if you are a well-rounded individual and showcase that you want to study, but you are proactive. Another suggestion is finding a YouTube video where you can be a hobbyist. Figure out a project and make something. You can add that to your resume. Everybody is saying that it's not necessarily even the certificate, the diploma, or the degree that potentially will get you the job. It is your experience. You might even talk about trying to build something and how you failed. "It didn't work, but I fixed it like this." That is what makes you stand out in an interview.

**Matties:** There's a wealth of information online, but what we're trying to do here is raise awareness about this industry. In Drew's case, would he be welcome to join the IPC APEX EXPO hybrids, the streaming version, as a high school student for the STEM portion?

**Gunter du Plessis:** Yes. And having a go-to person to guide you can give someone like Drew assurance that he's on the right path. Someone like that might just need a little nudge or guidance.

You need to steward someone like Drew. I know Aaron has been reaching out to individuals, too, because our chapter model is such that you must be part of a chapter to become a



member. We realize it's very difficult in COVID times to do that because you're not on campus. So, how is it possible? To grow a student club or organization, it's all about that connection: "Hey, you need to join this, it's like connecting with your peers." COVID made it so hard and distant. We have opened it up to have an individual member join so that it's not chapter-related, and we have seen an uptake on that.

This means that anyone currently at the tertiary side of education, post-high school, can join. Hopefully they'll be so inspired by the great things they can do once they are in and part of the network that they will eventually start a chapter at a school, if they joined without having a chapter.

**Matties:** This has been really good. Any final thoughts for the upcoming STEM event at IPC APEX EXPO?

**Gunter du Plessis:** On Thursday, January 27, anyone is welcome to pop in where we are hosting the event and find out about volunteering. Maybe someone would be interested to be part of the roundtable discussion, help

students to solder the pin; join in the fun. It's an open event. Hopefully we can do something on a smaller or a larger scale in some of our industry members' backyards, if that is something that they want to get involved in.

**Matties:** Great. And if somebody is interested in sponsoring, what should they do? What does a sponsorship entail?

**Gunter du Plessis:** Currently the sponsorship document can be downloaded from [ipcef.org](http://ipcef.org). We also take in-kind donations. If they're willing to sponsor a T-shirt that's branded with their logo, if they want to donate a water bottle or anything of some sort to support the students, just in general, to get their brand out, we are open to that. We have premier sponsorships at \$5,000 and then collaborating sponsorships that range between \$2,500 and \$1,000.

**Matties:** Thanks to you and your team for all the important work you are doing.

**Gunter du Plessis:** Thank you. PCB007

# Meet Drew, a Student With an Interest in STEM

by Barry Matties

Recently, I met with Drew, and we discussed his plans. Drew is currently a high school student, and he is just beginning his career planning. Here is a transcript of our conversation, edited slightly for clarity.

If you have any advice or tips you'd like to share with Drew, please [click here](#) and we will be sure to pass it on to him.

**Barry Matties:** What type of engineering are you interested in?

**Drew:** I'm not sure what field of engineering I'd be interested in. I enjoy diagnosing issues and fixing them. Something that would focus on that.

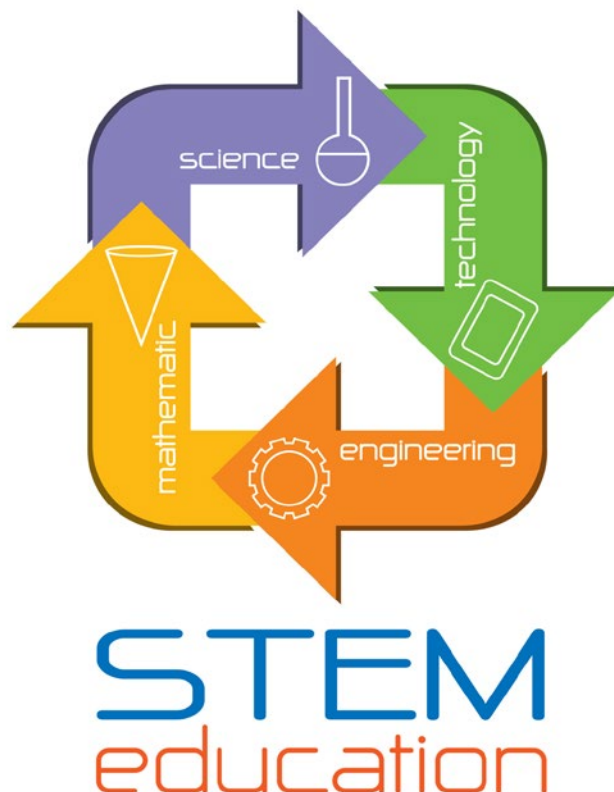
**Barry:** So, when you think about your career, how do you want to spend your career? Do you want more time in front of a computer screen? More time in a manufacturing facility working on improving processes, or perhaps more time traveling to different locations?

**Drew:** I would absolutely love to be very hands on and travel, but I am not shy in front of a computer and have worked as a tech assistant in multiple classrooms in my school. Given the choice I would prefer a more tactile career and I think the travel would be a great perk.

**Barry:** Are you more interested in software, electrical, or mechanical?

**Drew:** I would be very happy with a career in any of these fields. But in order of interest, I would rank them:

1. Mechanical
2. Electrical
3. Software



**Barry:** What sort of annual salary are you hoping to reach?

**Drew:** Six figures would be ideal.

**Barry:** Are you planning to go to college? And if so, have you thought about a major yet?

**Drew:** Yes, I am planning on going to college. As far as majors go, I'm not sure what would suit me the best in my engineering path.

**Barry:** I am curious, what is your strongest subject in school? And what sort of grades do you get?

**Drew:** My strongest subject is math, by far. On my most recent end-of-course test, I scored the highest in my school. However, I excel in most other subjects. English may be an exception to this, but I still score far above average in this subject.

**Barry:** Thank you, Drew. Good luck to you in your career.

**Drew:** Thank you, Barry. PCB007



# Plating Anomalies and Defects, Part 2

## Trouble in Your Tank

by Michael Carano, RBP CHEMICAL TECHNOLOGY

### Introduction

One of the most difficult things about troubleshooting PCB defects is getting to and understanding the root cause of defects. Many of these defects can have multiple origins, and many may not manifest themselves in the process where the defect occurred. Thus are the perils of jumping to conclusions about the defect.

Often, I get involved in solving technical issues and the engineer at the board fabricator or OEM calls the defect an “anomaly.” Not really a good idea to go off trivializing the purported anomaly. Failure to understand the true genesis of the defect will lead to incorrect remedies to these issues. I will now present some of these defects and the possible remedies.

### Copper Plating Separation

The common complaint one hears is “the copper plating is peeling.” Okay, but where? From the surface or from within the via? Did one perform a proper micro-section? Is there an actual separation or is it debris lodged between the substrate and plating copper? And is the separation between the elec-

troless copper and the electrolytic copper, or is it the electroless copper from the base copper? How often does this problem continue due to an inability to get to the root cause? These are the questions one must answer in order to work properly. Figure 1 shows a real example of a blistered or peeling deposit. The question is, what is the actual separation? Is it really a loss of adhesion of the plated deposit to the substrate or is it an inclusion of some sort? How about debris, drill dust, or dry film chips?

In this situation, there could be debris on the surface of the copper foil or residues left behind from insufficient surface preparation or problems in developing the photoresist. In addition, these separations may be caused by

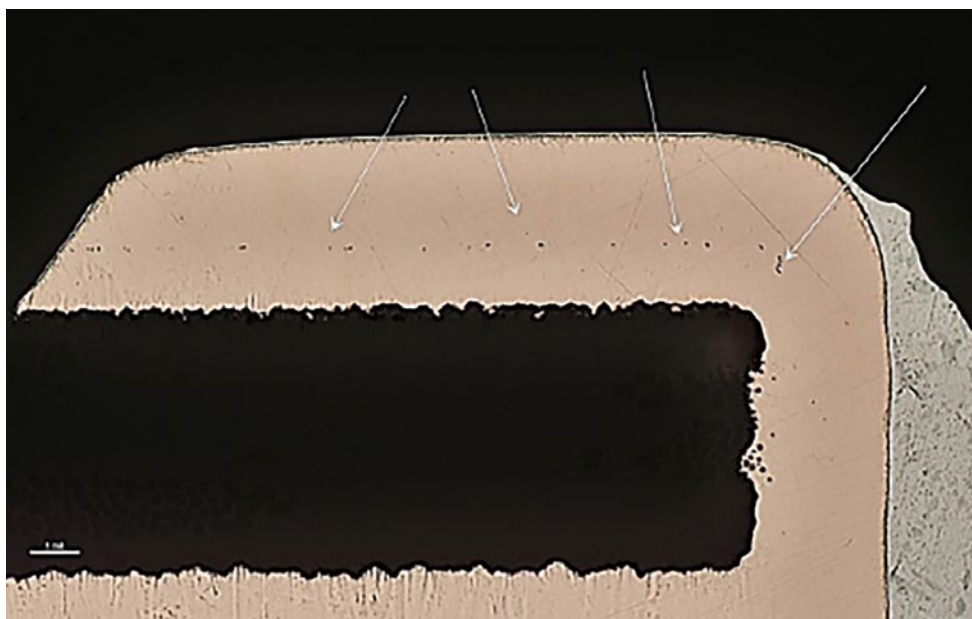


Figure 1: Arrows point to apparent separations or loss of adhesion of the plated copper.



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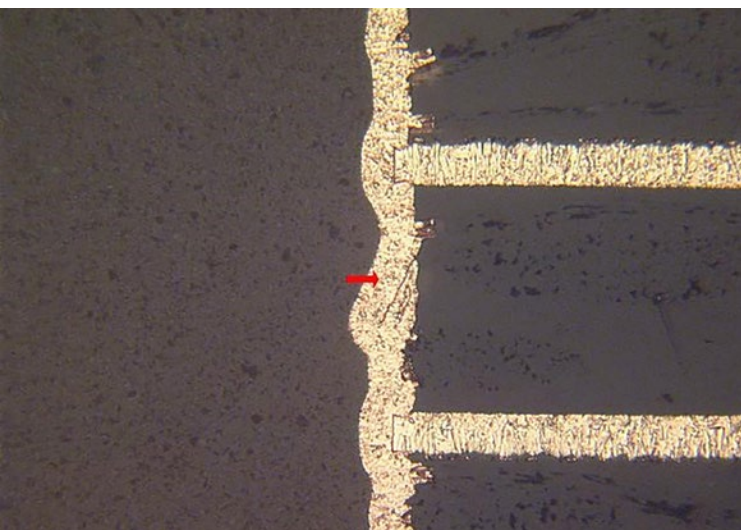


Figure 2: Arrow pointing to a bulge in the plated copper.



Figure 3: Example of HWP.

drill dust due to poor vacuum draw in the drilling operation. The cross-section in Figure 2 depicts another issue. Is this a plating blister or separation? Or another type of defect?

Is the genesis of the bulging copper anything to be concerned with? Thinking this through a bit, there are a few points to consider. First, it is possible that during the electroless copper process, the copper deposit blistered or separated in mid-cycle. This can happen for several reasons:

- Excessive plating rate of the electroless copper
- Highly stressed copper deposit
- Laminate/resin either has smear remaining or hole wall not sufficiently micro-roughened from the desmear/etchback process
- Possibility of drill dust/debris in via

Now the question is, where is the origin of the blister? The electrolytic copper has been applied, apparently encapsulating the blistered deposit. There have been past occasions such as this described above whereby the fabricator will say all is okay with this since the blister has been covered by the electrodeposited copper. This, of course, is wrong. A blister can fracture or break off in mid-stream plating and cause at the very least a voided via.

So, don't confuse a blistered deposit that fractures or breaks away with another defect known as hole wall pullaway (HWP).

## Hole Wall Pullaway (HWP)

While several of the root causes of HWP apply as well to a blistered copper deposit, there are significant differences. HWP is a loss of adhesion of the plated deposit from the hole wall surfaces (Figure 3).

A more typical example of HWP is depicted in Figure 3. The deposit pulled away from the hole wall but did not fracture or flake off. Nonetheless, this is a defect and must be remedied. The root cause of HWP is very similar to those that lead to flaking and blistering. I consider this at the very least a "process indicator." This means that the desmear and metalization processes need attention. Of course, if the hole wall pullaway causes a violation of hole wall minimum diameter or leads to other violations in hole diameter dimensional requirements, then this is a cause of concern and will result in non-conformance.

So, one is dealing with the origin of the blister or peeling deposit prior to electrolytic copper plating. Table 1 lists the most common causes for this type of defect.

A precautionary note: Don't confuse HWP with resin recession (Figure 4). Resin reces-



**Table 1:** The most common causes of HWP.

Cause	Look at	Remedy
Excessive catalyzation	Dwell times, temperatures	Reduce time and temperatures in catalyst
Smooth topography on resin	<ul style="list-style-type: none"> <li>• Desmear process not able to produce a topography</li> <li>• Excessive solvent penetration</li> <li>• Insufficient rinsing after cleaner/conditioner step</li> <li>• Inadequate etching of the resin-poor topography</li> </ul>	<ul style="list-style-type: none"> <li>• Review resin type—higher Tg resins are more difficult to desmear—excessive lamination temperatures and cure times over cross link material</li> <li>• Make sure cleaner conditioner is free-rinsing—consider reducing concentration and dwell times</li> <li>• Measure weight loss of the test coupons after desmear</li> </ul>
Electroless copper rate too high	<ul style="list-style-type: none"> <li>• Check Rate coupons—is deposition rate higher than normal?</li> <li>• Check operating temperature of electroless copper solution</li> <li>• Check concentrations of the key additives—copper, sodium hydroxide, formaldehyde (HCHO), stabilizer</li> </ul>	<ul style="list-style-type: none"> <li>• Check specific gravity of electroless copper solution—solution bail-out to bring specific gravity in range</li> <li>• Reduce operating temperature</li> <li>• Analyze and adjust concentrations to recommended levels</li> </ul>

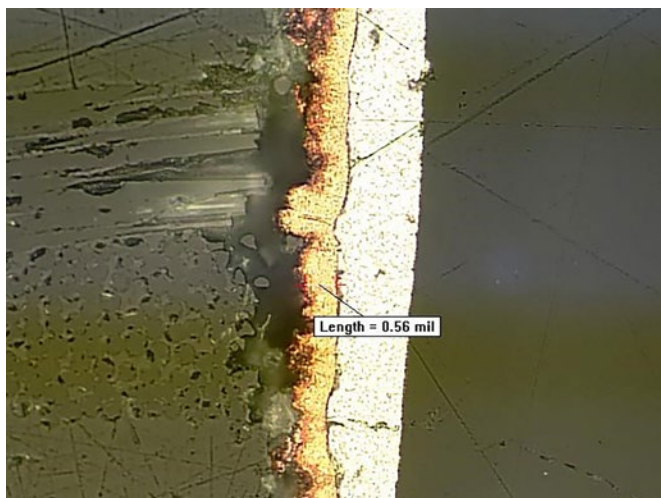


Figure 4: Example of resin recession.

common sense usually applies. Basically, one must first:

- Identify the problem or problems (be as specific as possible)
- Determine possible causes (look for links to those other less obvious processes)
- Methods and procedures to test to see which causes apply
- Test the assumptions
- Implement corrective action

While this sounds like an oversimplification, this approach is required to properly identify and attack the problem at hand. A structured routine is really what is required. Remember the most critical success factor is being able to get to the root cause of the problem. Stop the finger pointing and get the different process teams to work together. **PCB007**

sion is a material-related issue where the resin has recessed or shrunk back away from the plating. This is evident generally after thermal stress. According to the IPC 600 H, resin recession is permissible.

I am a true believer in the inter-relatedness of processes and the origin of process-related defects. It is helpful to keep a few things in mind when troubleshooting a process issue. To be successful at troubleshooting a problem,



**Michael Carano** is VP of technology and business development for RBP Chemical Technology. To read past columns or contact Carano, [click here](#).

# The **Value** of Training Committees

Feature Article by Zenaida Valianu  
IPC

IPC certification programs, built around IPC standards, play a key role in bringing value to the electronics industry. Created and approved by industry, the programs are developed by training committees comprised of subject matter experts and trainers from around the world. Committee members volunteer their time and expertise to improve the existing standards-based certification programs and to develop new programs based on industry needs. These committees support the IPC Education Team in developing, updating, and maintaining the training program materials, and provide industry expertise to the development, evaluation, and revision of the certification program.

The TPAC Committee advises and supports the IPC Education Team on the development, maintenance, and implementation of the training programs. This committee also reviews proposals for new training programs and advises IPC on scope, feasibility, development, and implementation; advises and supports IPC in ensuring compliance of education programs to national and international standards; and complies with relevant accreditation requirements.



Zenaida Valianu

The training committees will meet at IPC APEX EXPO 2022 January 24–25 to discuss program updates and translation activities, and review the feedback received from the industry on the certification programs. These committees will also explore additional training tools, methods, and/or processes that will enhance the training and learner experience.

There are 45 volunteers who actively participated in the development of the 610H, 001H, 620D-S and 001H Space and Military Addendum certification programs, and 14 volunteers who translated the 610H and 001H programs in Italian and Spanish. These remarkable individuals will be presented with awards at the Wednesday, January 26 luncheon, in appreciation of their outstanding contribution toward the development of the certification programs.

## Here are the meeting details:

**V-TPAC Training Programs Advisory Committee,  
10 a.m. to noon Tuesday, January 25**

This committee is comprised of all training committee and subcommittee chairs. This closed meeting (by invitation only) will start





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by reviewing the training task group(s) successes and challenges for 2021 and continue with discussions on program updates, future strategies, and developments.

**7-31BT IPC-A-610 Training Committee,  
8 to 10 a.m. Wednesday, January 26**

This committee provides recommendations for the IPC-A-610 training and certification program. This meeting will celebrate the release of revision H certification program and will review comments received from the industry on the newly released program.

**7-34T 7711/21 Training Committee,  
3:15 to 5 p.m. Wednesday, January 26**

This committee is meeting to review the course content and to determine updates needed to be integrated into the next revision training and certification program, based on the changes from 7711/7721D standard working draft.

**7-31FT IPC/WHMA-A-620 Training Committee,  
3:15 to 5 p.m. Tuesday, January 25**

This training group provides recommendations for the IPC/WHMA-A-620 training and certification program. This meeting will address comments received for both 620D and 620DS (Space and Military Addendum) certification programs and will establish objectives for the next revision training and certification program.

**7-31AT IPC-A-600 Training Committee,  
10:15 to noon Monday, January 24**

This committee will address comments received for the IPC-A-600K training and certification program and explore opportunities for improvement for the next revision training program.

**D-33AT 6012 Training Committee,  
1:30 to 3 p.m. Monday, January 24**

This committee will review submitted comments to the IPC-6012E training and certification program and will discuss the IPC-6012E Amendment 1 changes.

**5-22BT J-STD-001 Training Committee  
10:15 a.m. to noon Wednesday, January 26**

This committee provides recommendations for the J-STD-001 training and certification program. This meeting will celebrate the newly released programs—J-STD-001H and J-STD-001H Space and Military Applications—and will review comments received from the industry on these programs.

If you are wondering how training and certification programs are developed, please consider joining one of our committees. Committee participation takes place in meetings, by teleconference, and/or by email. We welcome your expertise and participation. To learn more about joining a committee, please visit [ipc.org](http://ipc.org). **PCB007**

Zenaida Valianu is IPC training manager.



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<sup>1</sup> IPC. (2017). Findings on the Skills Gap in U.S. Electronics Manufacturing.

# Revving Up Design

Feature Article by Patrick Crawford  
IPC

During IPC APEX EXPO 2022, we are dedicating one portion of the show floor to PCB design. Inspired by the tenets of the IPC-2231A DFX Guidelines document—in short, good design takes all subsequent electronics manufacturing steps into account—we wanted to bring PCB design to the show floor, which is traditionally more focused on exhibiting fabrication and assembly technologies.

Yes, everything starts with design.

There will be an event in the Design@APEX booth every day of the exposition, starting on Tuesday, January 25 with our IPC Design Competition 2022 Finals. The competitors are currently working on their preliminary designs, and the finalists will be invited to compete in a layout competition at APEX. I'll be moderating the event a la a PGA Tour commentator (sports jacket and all) and we'll have some interactive Q&A with the competitors, as well as some special guest judges who will stop by to say hello.

Wednesday will be a Day of DFX with sessions dedicated to that cross-section of manufacturing and design. Starting in the early afternoon, we will host an Ask Me Anything (AMA) with some of IPC's top design committee volunteers, where we plan to spark a dialogue among attendees about how they can design and manufacture their products bet-



Patrick Crawford

ter by implementing DFX principles. The rest of the afternoon will feature 30-minute talks intended for passersby to drop in and learn more about IPC's involvement in the many facets of DFX—design for fabrication, manufacturing, test, environment, etc.

Both the AMA panel roster and a comprehensive schedule of talks will be published in the first week of January.

Finally, Thursday will be dedicated to STEM, specifically, how PCB design affects the entire electronics manufacturing industry and how students can get involved as they graduate from high school and move onward with their education. Our friends at Altium have put together a great group of individuals who are involved in their Upverter Education and Training departments who will be standing by in the Design@APEX booth to speak with students during their show floor tours. I'm personally very excited for this as I'm passionate about introducing more students to electronics and science in general. **PCB007**

**Patrick Crawford** is the manager of design programs and related industry programs at IPC, and an I-Connect007 columnist. To read past columns or contact him, [click here](#) or email [PatrickCrawford@ipc.org](mailto:PatrickCrawford@ipc.org).

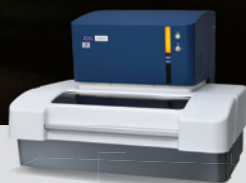


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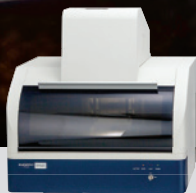
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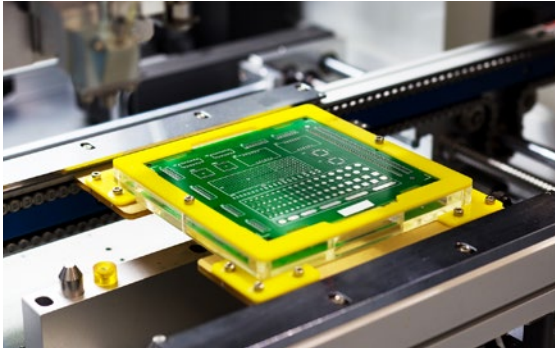


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## New Methods for Quantifying PCB Design Weaknesses and Manufacturing Challenges

Gerry Partida explains, “The industry is at a new point in evolving how we look at building boards. Our industry has historically built boards and then tried to find a test for them. Then, when they found a test for it, they figured out that it needed to be analyzed before they built the board.”

## AT&S Continues Strong Growth Course; Revenue Up 30% in 1H of 2021/22



Consolidated revenue rose by 29.7% to € 697.6 million in the first half of 2021/22

(PY: € 537.8 million). Adjusted for currency effects, the increase in consolidated revenue even amounted to 34.8%.

## NCAB Discusses Recent Merger with Elmatica

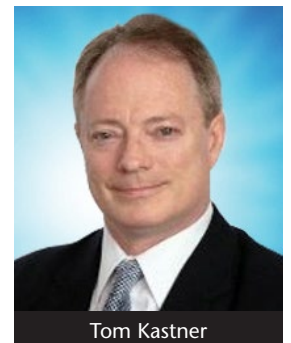
I-Connect007's Nolan Johnson catches up with Anders Forsén, chief financial officer at NCAB Group, to get an



update on the recently announced acquisition of Elmatica by NCAB. In this audio interview from the NCAB headquarters in Sweden, Anders details how he sees Elmatica and NCAB working together to deliver a stronger solution for customers.

## Punching Out! What Does Private Equity See in the North American PCB Sector?

In the past few years, the investment by private equity (PE) firms into the PCB and EMS sectors has been increasing rapidly. Just in the past few months, APCT and Summit Interconnect have changed PE owners, American Standard Circuits was acquired by a PE firm, and Lenthor Engineering was acquired by a PE-backed firm. According to our firm's data base, out of the top 10 independent PCB manufacturers in North America, two are public (TTM and FTG) and five are owned by PE firms.



Tom Kastner



## Fein-Lines: End-User Technology Show Season Ramps Up

There are several technology trade shows on the horizon, including IPC APEX EXPO, AltiumLive, NEPCON Japan, and SEMICON West. There are many others, but the ones coming up primarily focus on end-user technology rather than the design, components, and manufacturing processes used to make the end product.

## Real Time With... productronica: SÜSS MicroTec on Supply Chain Options

Dr. Luca Gautero, product manager at SÜSS MicroTec, discusses marketing strategies for inkjet printing of solder mask, and

explains how collaborative development along the supply chain has introduced new options for the designer and demonstrated the real benefits of this technology to the OEM.



## RBP Discusses New Management and Plans for the Future



Ernie Litynski, president of RBP Chemical Technology and Dan Carey, incoming executive vice president, brief Nolan Johnson on

the recent organizational changes that brought Carey on board. Both Litynski and Carey outline how they see these changes benefiting their customers and partners, including in the defense and aerospace sectors.

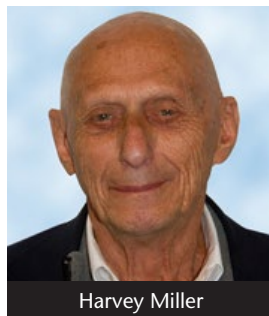
## Cicor Acquires British Contract Manufacturer Axis Electronics

Cicor Group announces the acquisition of 100% of the shares of the UK-based Axis Electronics Ltd. (Axis). With this first acquisition within the recently announced growth strategy, Cicor strengthens its position in the strategic target markets and expands its European footprint with a site in the UK.

## Schweizer Electronic Posts Sales Growth in Q3 2021

Schweizer Electronic AG reports that new orders in the first three quarters of 2021 were significantly higher than in the same period last year and in the first three quarters of 2019.

## Happy 99th Birthday to Harvey Miller!



Harvey Miller

PCB manufacturing industry veteran Harvey Miller celebrates turning 99 years old. The founder of Fabfile Online often jokes that he wants to break the Guinness World Record for longevity set by Jeanne Louise Calment, who died at 122 in 1997. Harvey is still very active at 99, and at the rate he's going, he just might

wind up making it to 123 years old. Let's raise a glass in Harvey's honor. To your health, Harvey!

For the latest news and information, visit [PCB007.com](https://www.pcb007.com)



# Career Opportunities



## Is your team growing?

**Find industry-experienced candidates at I-Connect007.**

For just \$750, your 200-word, full-column ad will appear in the Career Opportunities section of all three of our monthly magazines, reaching circuit board designers, fabricators, assemblers, OEMs, suppliers and the academic community.

In addition, your ad will:

- be featured in at least one of our newsletters
- appear on our [jobConnect007.com](http://jobConnect007.com) board, which is promoted in every newsletter
- appear in our monthly [Careers Guide](#), emailed to 26,000 potential candidates

Potential candidates can click on your ad and submit a resume directly to the email address you provide, or be directed to the URL of your choice.

**No contract required. Just send over your copy and company logo and we'll do the rest!**

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**I-Connect007**  
GOOD FOR THE INDUSTRY



# Career Opportunities



## Sales Engineer Germany, Austria, Switzerland, Southeastern Europe e.g. Italy

Ucamco is looking for a sales engineer for our front-end software in the German-speaking area (Germany, Austria, German Switzerland) as well as adjacent markets in the South and East.

Ucamco is a market leader in PCB CAM, pre-CAM software and laser photoplotters with more than 35 years' experience developing and supporting leading-edge, front-end tooling solutions for the global PCB industry.

### Responsibilities:

- Selling software solutions
- Selling support contracts and upgrades
- Developing and implementing customer acquisition plan
- Organizing and taking part in roadshows, seminars, exhibitions
- Follow up of current customers and sales
- Contributing insights into the marketing plan
- Reporting to Ucamco's sales director

### Requirements:

- Fluent in German, good knowledge of English; other languages a plus
- Frequent traveling to prospects and customers—live contact is important
- Feeling for technical software
- Motivated to succeed as a solution seller
- Strong empathy for the customer
- Self-starter, able to work independently, organized
- Honest, trustworthy, dependable, credible
- Sales and technical expertise in PCB industry a big plus
- Knowledge of market and customer base in German speaking area a big plus
- Used to working from home office
- Traveling to headquarters in Gent (Belgium) for sales and customer meetings
- Good feeling for software is more important than strong sales experience

This is a salary-based position with a commission plan, company car, expense reimbursement, and benefits like health insurance.

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## Galvanic Systems Director

Whelen Engineering Co. seeks FT Galvanic Systems Dir. in Charlestown, NH to lead technical team to optimize GreenSource Fabrication, LLC Division's first-gen equip. by applying PCB mfg. concepts per cust reqs. Ensure process engg. meets co.'s needs; develop and validate process changes; plans to improve process capability using statistical & root cause analysis & eval'ing equip, including Atotech equip, thru design of exper & testing; travel int'lly 15-25% to eval biz plan & strategy to markets. Min reqs: U.S. Bach degree or foreign equiv. in chem sci or chem engg; knwl of entire PCB mfg. process, including process flows, indiv. processing steps, & tooling, w. knowledge of PCB pattern plating, including subtractive etching processes, additive processes, and printable techs as demo'd by 12 yrs' exp. in PCB industry; Theoretical knwl of PCB Plating Processes, including MLB, HDI, and SLP-type PCB fab processes, as demo'd by 10 yrs' exp w. PCB plating processes; 5 yrs' exp working w. Atotech Equipment prod lines & their specialty chems; Prior work exp in R&D enviro. including app of lab analysis concepts and knowledge of cross section and wave form patterns.

Apply to: Corinne Tuthill,  
ctuthill@greensourcefab.com or at  
Greensource Fabrication, LLC,  
99 Ceda Rd, Charlestown, NH 03603

[apply now](#)

# Career Opportunities



## Service Engineer Schmoll Laser and Direct Imaging

**Reports to: Field Service Manager**

**Location: North America**

### SUMMARY:

Provide expert-level service on multiple laser drilling and direct imaging product lines. Maintain high customer satisfaction, timeliness, accuracy, efficiency, cost effectiveness, and safety.

### DUTIES AND RESPONSIBILITIES:

- Install, commission, and maintain Schmoll products at customer sites. Perform modifications and retrofits as needed.
- Troubleshoot, diagnose, and calibrate products via telephone or at customer sites.
- Handle a wide variety of problems, issues, and inquiries.
- Provide training for customers and others in the effective operation, calibration, and maintenance of all products.
- Lead the project management team for retrofit/upgrade requests and recommendations for Schmoll equipment until the end of commissioning and final payment.
- Assist customers with potential optimization of their machine operations and work with clients on application improvements.

### QUALIFICATIONS:

- Must possess a valid driver's license, clean driving record, major credit card (for business travel), and passport.
- Ability to read and interpret technical documentation, compile reports, and compose routine correspondence, define problems, collect data, and draw a valid solution.
- Must be able to travel extensively, partly international, to support customer needs. While Burkle makes every attempt to avoid Sunday and Friday evening travel, sometimes it is required.

[apply now](#)



## Technical Marketing Specialist Waterbury, CT

### JOB DESCRIPTION:

Responsible for providing technical knowledge and support to marketing communications professionals. Cross training and acting as liaison between the Innovation and the Marketing Communications teams for both Circuitry Solutions and Semiconductor Solutions.

## Chemist 1 Waterbury, CT

### JOB DESCRIPTION:

Perform analysis—both chemical and mechanical—of customer-supplied samples. These include both structural and chemical testing using various instruments such as SEM, Instron, ICP, and titration methods. Perform various failure analysis functions, including, but not limited to, chemical analysis, SEM analysis of customer parts, and cross-section evaluation.

## Applications Manager Waterbury, CT/New England Region

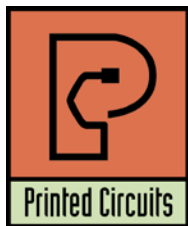
### JOB DESCRIPTION:

Applications Manager in the Electronics Specialties/Circuitry Solutions group to provide applications process knowledge, training and technical support of new products leading to sales revenue growth. Requires working through the existing sales and technical service organizations to leverage this knowledge globally. Experience in multilayer bonding along with dry film and solder mask adhesion processes a plus.

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# Career Opportunities



## Printed Circuits, a fast-growing printed circuit board fabricator, offers:

- Excellent opportunities for advancement and growth
- Dynamic manufacturing environment
- Excellent health, dental and other benefits
- Annual profit-sharing plan
- Signing bonus
- Additional incentives at the leadership level
- Clean facility with state-of-the-art manufacturing equipment
- Highly collaborative corporate and manufacturing culture that values employee contributions

### Laminator Technician

#### Nature of Duties/Responsibilities

- Layup cover lay
- Layup rigid flex
- Layup multilayer/CU core boards
- Oxide treat/cobra treatment of all layers/CU cores
- Shear flex layer edges
- Rout of machine panel edges and buff
- Remove oxide/cobra treatment (strip panels)
- Serialize panels
- Pre-tac Kapton windows on flex layers (bikini process)
- Layup Kapton bonds
- Prep materials: B-stage, Kapton, release sheet
- Breakdown: flex layers, and caps
- Power scrub: boards, layers, and caps
- Laminate insulators, stiffeners, and heatsinks
- Plasma cleans and dry flex layers B-stage (Dry)
- Booking layers and materials, ready for lamination process
- Other duties as deemed necessary by supervisor

#### Education/Experience

- High school diploma or GED
- Must be a team player
- Must demonstrate the ability to read and write English and complete simple mathematical equations
- Must be able to follow strict policy and OSHA guidelines
- Must be able to lift 50 lbs
- Must have attention to detail

### Wet Process/Plating Technician

Position is 3<sup>rd</sup> shift (11:00PM to 7:30AM, Sunday through Friday)

#### Purpose

To carry out departmental activities which result in producing quality product that conforms to customer requirements. To operate and maintain a safe working environment.

#### Nature of Duties/Responsibilities

- Load and unload electroplating equipment
- Fasten circuit boards to racks and cathode bars
- Immerse work pieces in series of cleaning, plating and rinsing tanks, following timed cycles manually or using hoists
- Carry work pieces between departments through electroplating processes
- Set temperature and maintains proper liquid levels in the plating tanks
- Remove work pieces from racks, and examine work pieces for plating defects, such as nodules, thin plating or burned plating
- Place work pieces on racks to be moved to next operation

- Check completed boards
- Drain solutions from and clean and refill tanks; fill anode baskets as needed
- Remove buildup of plating metal from racks using chemical bath

#### Education and Experience

- High school diploma or GED required
- Good organizational skills and the ability to follow instructions
- Ability to maintain a regular and reliable attendance record
- Must be able to work independently and learn quickly
- Organized, self-motivated, and action-oriented, with the ability to adapt quickly to new challenges/opportunities
- Prior plating experience a plus

### Production Scheduler

#### Main Responsibilities

- Development and deployment of a level-loaded production plan
- Establish manufacturing plan which results in "best possible" use of resources to maximize asset utilization
- Analyze production capacity of manufacturing processes, equipment and human resource requirements needed to produce required products
- Plan operation manufacturing sequences in weekly time segments utilizing production labor standards
- Maintain, align, and communicate regularly with internal suppliers/customers and customer service on key order metrics as per their requirements
- Frequently compare current and anticipated orders with available inventory and creates replenishment plan
- Maintain master distribution schedule for the assigned facility, revise as needed and alert appropriate staff of schedule changes or delays
- Participate in periodic forecasting meetings
- Lead or participate in planning and status meetings with production, shipping, purchasing, customer service and/or other related departments
- Follow all good manufacturing practices (GMPs)
- Answer company communications, fax, copy and file paperwork

#### Education and Experience

- High school diploma or GED
- Experience in manufacturing preferred/3 years in scheduling
- Resourceful and good problem-solving skills
- Ability to make high pressure decisions
- Excellent written and verbal communication skills
- Strong computer skills including ERP, Excel, Word, MS Office
- Detailed and meticulous with good organizational skills
- Must be articulate, tactful and professional at all times
- Self-motivated

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# Career Opportunities



## Sales Manager

### New Business Development (m/w/d) – Sales Territory: Germany

CML Group is a global leader in the Printed Circuit Board industry, specialized in PCB manufacturing and sustainable PCB supply solutions. Our products are made to the highest quality and reliability standards, including automotive requirements.

For the expansion of our target markets, we need you to generate new business, drive new projects from RFQ stage and manage the customer relationship.

#### Your responsibilities:

- Develop new customers and build long-term customer relationships
- Understand the customer requirements and acquire new contract enquiries from all market sectors
- Proactive market and customer research
- Identify new potential electronic industry sectors
- Result-oriented sales management including support and consulting on new projects
- Independent management and organization of your accounts
- Price and contract negotiations with customers and contractual partners

#### Your profile:

- Several years of professional experience in sales and key account management
- Knowledge of printed circuit board production/industry would be an advantage
- Fluent in Business English and willingness to travel internationally
- Flexible and an open-minded mentality
- Strong communication skills, team player
- Self-motivated, well-organized, professional
- Your home base is in Germany

Interested? Looking forward to your application!  
Please send your application to [hr@cmit.support](mailto:hr@cmit.support).

For more information visit  
[www.cml-globalsolutions.com](http://www.cml-globalsolutions.com)

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## Customer Service Representative, UK

We are looking to expand our UK Customer Service/Internal Sales team. As Customer Service Representative you will provide great sales and customer service support and respond to the needs of clients from industries including Aerospace, Defence, Automotive and Pharmaceutical. Duties include:

- Maintain & develop relationships with new and existing customers
- Make rapid, accurate cost calculations and provide quotations
- Accurately input customer orders through bespoke MRP System
- Liaise with colleagues at Chinese HQ and other Overseas Business Units to manage domestic and international requirements
- Assist sales team with reporting, sales analysis and other items at their request

#### Skills and abilities required for the role:

The ideal candidate is a proactive self-starter with a strong customer service background. Friendly, approachable, and confident, you should have a good phone mannerism and be computer literate.

- Previous experience in a Customer Service background, ideally management or supervisor role
- Experience with MRP Systems
- Good working knowledge of Microsoft Office Tools such as Outlook, Excel etc.

#### What's on Offer:

- Excellent salary & benefits commensurate with experience

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

Please forward your resume to [HR@ventec-europe.com](mailto:HR@ventec-europe.com)

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# Career Opportunities



Fuji America Corporation is a rapidly growing electronics assembly equipment distributor. We support the factories of the future and smart factories globally. We offer an exciting and challenging career for a software support engineer and an applications engineer who want to join our growing company.

## Software Support Engineer

As a software support engineer for Fuji America Corporation, you will be a customer-facing technical advisor with the opportunity to solve technically complex problems for our proprietary software. As a trusted advisor to our customers, you will have influence over a broad range of solutions that create business value. As a valued member on our team, the software support engineer will use advanced troubleshooting methods and tools to solve technically complex problems. These highly complex, escalated problems require broad and in-depth product knowledge, as well as exceptional troubleshooting skills.

- Field installation of proprietary software/automation equipment throughout North America
- Field troubleshoot, repair, training, and process support of proprietary software
- Provide remote and on-site technical support
- Troubleshoot Windows 10/Windows server installing, configuration, and support
- Networking experience—setting up and supporting networks.
- Exposure and/or experience with Oracle or Microsoft SQL server databases
- Strong verbal communication skills with both customer and other technical depts.
- Flexibility to travel and perform job assignments on short notice
- Strong aptitude with current computing applications and networking processes

### Experience

- Bachelor of Science in computer science or related field preferred

## Applications Engineer

As an applications engineer, you will be responsible for doing cycle time and studies in preparation to make recommendations of Fuji products for customers' applications. Support implementation of activities within the technical center such as customer visits, demonstrations, evaluations, testing, inspection of Fuji products, including peripheral equipment from other vendors.

- Assist sales representatives in technical aspects relating to machine and software functions and utilization.
- Assist sales representatives and customers with providing CTA (Cycle Time Analysis) to them for recommending Fuji products to customers' specific applications. This includes the sFAB machine as well as all other SMT machines.
- Schedule and perform product demonstrations on all available types of equipment and software to potential and existing customers.
- Test and evaluate existing as well as new technologies on equipment and software performance and reliability.
- Assist in the coordination of any new FAC projects by utilizing your full potential.
- Responsible for the setup of the equipment and its demonstration for various trade shows.
- Assist FAC staff in any technical issues which may require attention.
- Assist in the coordination of design and manufacture of customs tooling for placement equipment.
- Perform inventory checks every six months according to the schedule and manner regulated by the company, if applicable.

### Experience

- Minimum five years programming/computer experience
- Bachelor's degree preferred

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# Career Opportunities



## PCB Field Engineer– North America Operations

ICAPE Group is a European leader for printed circuits boards and custom-made electro-mechanical parts. Headquartered in Paris, France, we have over 500 employees located in more than 70 countries serving our +2500 customers.

To support our growth in the American market, we are looking for a PCB Field Engineer.

You will work in our North America technical center, including our U.S. technical laboratory, and will be responsible for providing technical and quality support to our American sales team.

You will have direct customer contact during all phases of the sales process and provide follow-on support as required.

### RESPONSIBILITIES INCLUDE

- Feasibility recommendations
- Fabricator questions and liaison
- Quality resolutions
- Technical explanation (for the customer) of proposals, laboratory analysis or technology challenges

### REQUIREMENTS

- Engineering degree or equivalent industry experience
- 5 years' experience with PCB manufacturing (including CAM)
- Excellent technical understanding of PCBs
- Experience with quality tools (FAI, PPAP and 8-D)
- Good communication skills (written and oral)

Communication skills are essential to assist the customer with navigation of the complex process of matching the PCB to the application.

### SALARY

Competitive, based on profile and experience. Position is full time in Indianapolis, Ind.

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**American Standard Circuits**

Creative Innovations In Flex, Digital & Microwave Circuits

## CAD/CAM Engineer

### Summary of Functions

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

### Essential Duties and Responsibilities

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

### Organizational Relationship

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

### Qualifications

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

### Physical Demands

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

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# Career Opportunities



## Rewarding Careers

Take advantage of the opportunities we are offering for careers with a growing test engineering firm. We currently have several openings at every stage of our operation.

The Test Connection, Inc. is a test engineering firm. We are family owned and operated with solid growth goals and strategies. We have an established workforce with seasoned professionals who are committed to meeting the demands of high-quality, low-cost and fast delivery.

TTCI is an Equal Opportunity Employer. We offer careers that include skills-based compensation. We are always looking for talented, experienced test engineers, test technicians, quote technicians, electronics interns, and front office staff to further our customer-oriented mission.

## Associate Electronics Technician/Engineer (ATE-MD)

TTCI is adding electronics technician/engineer to our team for production test support.

- Candidates would operate the test systems and inspect circuit card assemblies (CCA) and will work under the direction of engineering staff, following established procedures to accomplish assigned tasks.
- Test, troubleshoot, repair, and modify developmental and production electronics.
- Working knowledge of theories of electronics, electrical circuitry, engineering mathematics, electronic and electrical testing desired.
- Advancement opportunities available.
- Must be a US citizen or resident.

[apply now](#)

## Test Engineer (TE-MD)

In this role, you will specialize in the development of in-circuit test (ICT) sets for Keysight 3070 (formerly HP) and/or Teradyne (formerly GenRad) TestStation/228X test systems.

- Candidates must have at least three years of experience with in-circuit test equipment. A candidate would develop and debug our test systems and install in-circuit test sets remotely online or at customer's manufactur-

ing locations nationwide.

- Candidates would also help support production testing and implement Engineering Change Orders and program enhancements, library model generation, perform testing and failure analysis of assembled boards, and other related tasks.
- Some travel required and these positions are available in the Hunt Valley, Md., office.

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## Sr. Test Engineer (STE-MD)

- Candidate would specialize in the development of in-circuit test (ICT) sets for Keysight 3070 (formerly Agilent & HP), Teradyne/GenRad, and Flying Probe test systems.
- Strong candidates will have more than five years of experience with in-circuit test equipment. Some experience with flying probe test equipment is preferred. A candidate would develop, and debug on our test systems and install in-circuit test sets remotely online or at customer's manufacturing locations nationwide.
- Proficient working knowledge of Flash/ISP programming, MAC Address and Boundary Scan required. The candidate would also help support production testing implementing Engineering Change Orders and program enhancements, library model generation, perform testing and failure analysis of assembled boards, and other related tasks. An understanding of stand-alone boundary scan and flying probe desired.
- Some travel required. Positions are available in the Hunt Valley, Md., office.

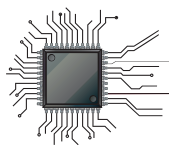
Contact us today to learn about the rewarding careers we are offering. Please email resumes with a short message describing your relevant experience and any questions to [careers@ttci.com](mailto:careers@ttci.com). Please, no phone calls.

We proudly serve customers nationwide and around the world.

TTCI is an ITAR registered and JCP DD2345 certified company that is NIST 800-171 compliant.

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# Career Opportunities



## MivaTek

Global

### Product Manager

MivaTek Global is preparing for a major market and product offering expansion. Miva's new NG3 and DART technologies have been released to expand the capabilities of Miva's industry-leading LED DMD direct write systems in PCB and Microelectronics. MivaTek Global is looking for a technology leader that can be involved guiding this major development.

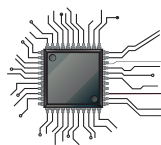
The product manager role will serve as liaison between the external market and the internal design team. Leadership level involvement in the direction of new and existing products will require a diverse skill set. Key role functions include:

- **Sales Support:** Recommend customer solutions through adaptations to Miva products
- **Design:** Be the voice of the customer for new product development
- **Quality:** Verify and standardize product performance testing and implementation
- **Training:** Conduct virtual and on-site training
- **Travel:** Product testing at customer and factory locations

Use your 8 plus years of experience in either the PCB or Microelectronic industry to make a difference with the leader in LED DMD direct imaging technology. Direct imaging, CAM, AOI, or drilling experience is a plus but not required.

For consideration, send your resume to [N.Hogan@MivaTek.Global](mailto:N.Hogan@MivaTek.Global). For more information on the company see [www.MivaTek.Global](http://www.MivaTek.Global) or [www.Mivatec.com](http://www.Mivatec.com).

apply now



## MivaTek

Global

### Field Service Technician

MivaTek Global is focused on providing a quality customer service experience to our current and future customers in the printed circuit board and microelectronic industries. We are looking for bright and talented people who share that mindset and are energized by hard work who are looking to be part of our continued growth.

Do you enjoy diagnosing machines and processes to determine how to solve our customers' challenges? Your 5 years working with direct imaging machinery, capital equipment, or PCBs will be leveraged as you support our customers in the field and from your home office. Each day is different, you may be:

- Installing a direct imaging machine
- Diagnosing customer issues from both your home office and customer site
- Upgrading a used machine
- Performing preventive maintenance
- Providing virtual and on-site training
- Updating documentation

Do you have 3 years' experience working with direct imaging or capital equipment? Enjoy travel? Want to make a difference to our customers? Send your resume to [N.Hogan@MivaTek.Global](mailto:N.Hogan@MivaTek.Global) for consideration.

#### More About Us

MivaTek Global is a distributor of Miva Technologies' imaging systems. We currently have 55 installations in the Americas and have machine installations in China, Singapore, Korea, and India.

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# Career Opportunities



Arlon EMD, located in Rancho Cucamonga, California, is currently interviewing candidates for open positions in:

- **Engineering**
- **Quality**
- **Various Manufacturing**

All interested candidates should contact Arlon's HR department at 909-987-9533 or email resumes to [careers.ranch@arlonemd.com](mailto:careers.ranch@arlonemd.com).

Arlon is a major manufacturer of specialty high-performance laminate and prepreg materials for use in a wide variety of printed circuit board applications. Arlon specializes in thermoset resin technology, including polyimide, high Tg multifunctional 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: 2015 registered, and through rigorous quality control practices and commitment to continual improvement, we are dedicated to meeting and exceeding our customers' requirements.

For additional information please visit our website at [www.arlonemd.com](http://www.arlonemd.com)

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## Sales Representatives

Prototron Circuits, a market-leading, quick-turn PCB shop, is looking for sales representatives for all territories.

Reasons you should work with Prototron:

- Serving the PCB industry for over 30 years
- Solid reputation for on-time delivery (99% on-time)
- Excellent quality
- Production quality quick-turn services in as little as 24 hours
- AS9100
- MIL-PRF- 31032
- ITAR
- Global sourcing
- Engineering consultation
- Completely customer focused team

Interested? Let's have a talk.

Call Dan Beaulieu at

207-649-0879

or email to

[danbbeaulieu@aol.com](mailto:danbbeaulieu@aol.com)

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# Career Opportunities



## SMT Operator Hatboro, PA

Manncorp, a leader in the electronics assembly industry, is looking for a **surface-mount technology (SMT) operator** to join their growing team in Hatboro, PA!

The **SMT operator** will be part of a collaborative team and operate the latest Manncorp equipment in our brand-new demonstration center.

### Duties and Responsibilities:

- Set up and operate automated SMT assembly equipment
- Prepare component kits for manufacturing
- Perform visual inspection of SMT assembly
- Participate in directing the expansion and further development of our SMT capabilities
- Some mechanical assembly of lighting fixtures
- Assist Manncorp sales with customer demos

### Requirements and Qualifications:

- Prior experience with SMT equipment or equivalent technical degree preferred; will consider recent graduates or those new to the industry
- Windows computer knowledge required
- Strong mechanical and electrical troubleshooting skills
- Experience programming machinery or demonstrated willingness to learn
- Positive self-starter attitude with a good work ethic
- Ability to work with minimal supervision
- Ability to lift up to 50 lbs. repetitively

### We Offer:

- Competitive pay
- Medical and dental insurance
- Retirement fund matching
- Continued training as the industry develops

[apply now](#)



## SMT Field Technician Hatboro, PA

Manncorp, a leader in the electronics assembly industry, is looking for an additional SMT Field Technician to join our existing East Coast team and install and support our wide array of SMT equipment.

### Duties and Responsibilities:

- Manage on-site equipment installation and customer training
- Provide post-installation service and support, including troubleshooting and diagnosing technical problems by phone, email, or on-site visit
- Assist with demonstrations of equipment to potential customers
- Build and maintain positive relationships with customers
- Participate in the ongoing development and improvement of both our machines and the customer experience we offer

### Requirements and Qualifications:

- Prior experience with SMT equipment, or equivalent technical degree
- Proven strong mechanical and electrical troubleshooting skills
- Proficiency in reading and verifying electrical, pneumatic, and mechanical schematics/drawings
- Travel and overnight stays
- Ability to arrange and schedule service trips

### We Offer:

- Health and dental insurance
- Retirement fund matching
- Continuing training as the industry develops

[apply now](#)

# Career Opportunities

## SIEMENS

### Siemens EDA Sr. Applications Engineer

Support consultative sales efforts at world's leading semiconductor and electronic equipment manufacturers. You will be responsible for securing EM Analysis & Simulation technical wins with the industry-leading HyperLynx Analysis product family as part of the Xpedition Enterprise design flow.

Will deliver technical presentations, conduct product demonstrations and benchmarks, and participate in the development of account sales strategies leading to market share gains.

- PCB design competency required
- BEE, MSEE preferred
- Prior experience with Signal Integrity, Power Integrity, EM & SPICE circuit analysis tools
- Experience with HyperLynx, Ansys, Keysight and/or Sigrity
- A minimum of 5 years' hands-on experience with EM Analysis & Simulation, printed circuit board design, engineering technology or similar field
- Moderate domestic travel required
- Possess passion to learn and perform at the cutting edge of technology
- Desire to broaden exposure to the business aspects of the technical design world
- Possess a demonstrated ability to build strong rapport and credibility with customer organizations while maintaining an internal network of contacts
- Enjoy contributing to the success of a phenomenal team

*\*\*Qualified applicants will not require employer-sponsored work authorization now or in the future for employment in the United States. Qualified Applicants must be legally authorized for employment in the United States.*

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### Logistics Assistant

Koh Young America is looking for a Logistics Assistant to assist and oversee our supply chain operations. Working alongside a Logistics Specialist, you will coordinate processes to ensure smooth operations using a variety of channels to maximize efficiency. You must be an excellent communicator and negotiator well-versed in supply chain management principles and practices. Also, you should be meticulous with a focus on customer satisfaction. These attributes are ideally complemented by a Bachelor's in Supply Chain Management or equivalent professional experience in the manufacturing industry.

This position is in our Duluth, Georgia, headquarters, where we serve our customers within North and South America. We offer health, dental, vision, and life Insurance with no employee premiums, including dependent coverage. Additionally, we provide a 401K retirement plan with company matching, plus a generous PTO policy with paid holidays.

Koh Young Technology, founded in 2002 in Seoul, South Korea, is the world leader in 3D measurement and inspection technology used in the production of microelectronics assemblies. Using patented 3D technology, Koh Young provides best-in-class products in Solder Paste Inspection (SPI) and Automated Optical Inspection (AOI) for electronics manufacturers worldwide.

[apply now](#)



# Career Opportunities



## IPC Instructor

Longmont, CO; Phoenix, AZ;  
U.S.-based remote

*Independent contractor,  
possible full-time employment*

### Job Description

This position is responsible for delivering effective electronics manufacturing training, including IPC Certification, to students from the electronics manufacturing industry. IPC instructors primarily train and certify operators, inspectors, engineers, and other trainers to one of six IPC Certification Programs: IPC-A-600, IPC-A-610, IPC/WHMA-A-620, IPC J-STD-001, IPC 7711/7721, and IPC-6012.

IPC instructors will conduct training at one of our public training centers or will travel directly to the customer's facility. A candidate's close proximity to Longmont, CO, or Phoenix, AZ, is a plus. Several IPC Certification Courses can be taught remotely and require no travel.

### Qualifications

Candidates must have a minimum of five years of electronics manufacturing experience. This experience can include printed circuit board fabrication, circuit board assembly, and/or wire and cable harness assembly. Soldering experience of through-hole and/or surface-mount components is highly preferred.

Candidate must have IPC training experience, either currently or in the past. A current and valid certified IPC trainer certificate holder is highly preferred.

Applicants must have the ability to work with little to no supervision and make appropriate and professional decisions.

Send resumes to Sharon Montana-Beard at  
[sharonm@blackfox.com](mailto:sharonm@blackfox.com).

[apply now](#)



## Plating Supervisor

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

Competitive benefits package.  
Pay will be commensurate  
with experience.

Mail to:  
[mfariba@uscircuit.com](mailto:mfariba@uscircuit.com)

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# Career Opportunities

## Now Hiring

### Director of Process Engineering

A successful and growing printed circuit board manufacturer in Orange County, CA, has an opening for a director of process engineering.

#### Job Summary:

The director of process engineering leads all engineering activities to produce quality products and meet cost objectives. Responsible for the overall management, direction, and coordination of the engineering processes within the plant.

#### Duties and Responsibilities:

- Ensures that process engineering meets the business needs of the company as they relate to capabilities, processes, technologies, and capacity.
- Stays current with related manufacturing trends. Develops and enforces a culture of strong engineering discipline, including robust process definition, testing prior to production implementation, change management processes, clear manufacturing instructions, statistical process monitoring and control, proactive error proofing, etc.
- Provides guidance to process engineers in the development of process control plans and the application of advanced quality tools.
- Ensures metrics are in place to monitor performance against the goals and takes appropriate corrective actions as required. Ensures that structured problem-solving techniques are used and that adequate validation is performed for any issues being address or changes being made. Develops and validates new processes prior to incorporating them into the manufacturing operations.
- Strong communication skills to establish priorities, work schedules, allocate resources, complete required information to customers, support quality system, enforce company policies and procedures, and utilize resources to provide the greatest efficiency to meet production objectives.

#### Education and Experience:

- Master's degree in chemical engineering or engineering is preferred.
- 10+ years process engineering experience in an electronics manufacturing environment, including 5 years in the PCB or similar manufacturing environment.
- 7+ years of process engineering management experience, including 5 years of experience with direct responsibility for meeting production throughput and quality goals.

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## Now Hiring

### Process Engineering Manager

A successful and growing printed circuit board manufacturer in Orange County, CA, has an opening for a process engineering manager.

#### Job Summary:

The process engineering manager coordinates all engineering activities to produce quality products and meet cost objectives. Responsible for the overall management, direction, and coordination of the engineering team and leading this team to meet product requirements in support of the production plan.

#### Duties and Responsibilities:

- Ensures that process engineering meets the business needs of the company as they relate to capabilities, processes, technologies, and capacity.
- Stays current with related manufacturing trends. Develops and enforces a culture of strong engineering discipline, including robust process definition, testing prior to production implementation, change management processes, clear manufacturing instructions, statistical process monitoring and control, proactive error proofing, etc.
- Ensures metrics are in place to monitor performance against the goals and takes appropriate corrective actions as required. Ensures that structured problem-solving techniques are used and that adequate validation is performed for any issues being address or changes being made. Develops and validates new processes prior to incorporating into the manufacturing operations

#### Education and Experience:

- Bachelor's degree in chemical engineering or engineering is preferred.
- 7+ years process engineering experience in an electronics manufacturing environment, including 3 years in the PCB or similar manufacturing environment.
- 5+ years of process engineering management experience, including 3 years of experience with direct responsibility for meeting production throughput and quality goals.

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# Career Opportunities



## Are You Our Next Superstar?!

Insulectro, the largest national distributor of printed circuit board materials, is looking to add superstars to our dynamic technical and sales teams. We are always looking for good talent to enhance our service level to our customers and drive our purpose to enable our customers build better boards faster. Our nationwide network provides many opportunities for a rewarding career within our company.

We are looking for talent with solid background in the PCB or PE industry and proven sales experience with a drive and attitude that match our company culture. This is a great opportunity to join an industry leader in the PCB and PE world and work with a terrific team driven to be vital in the design and manufacture of future circuits.

View our opportunities at  
Insulectro Careers ([jobvite.com](https://www.jobvite.com))

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**eptac**  
TRAIN. WORK SMARTER. SUCCEED.

## Become a Certified IPC Master Instructor

Opportunities are available in Canada, New England, California, and Chicago. 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. EPTAC Corporation is the leading provider of electronics training and IPC certification and 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 enthusiasm for education, drop us a line or send us your resume. We would love to chat with you. Ability to travel required. IPC-7711/7721 or IPC-A-620 CIT certification a big plus.

### Qualifications and skills

- A love of teaching and enthusiasm to help others learn
- Background in electronics manufacturing
- Soldering and/or electronics/cable assembly experience
- 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 schedule
- IRA retirement matching contributions after one year of service
- Training and certifications provided and maintained by EPTAC

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# Career Opportunities



## APCT, Printed Circuit Board Solutions: Opportunities Await

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

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

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

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

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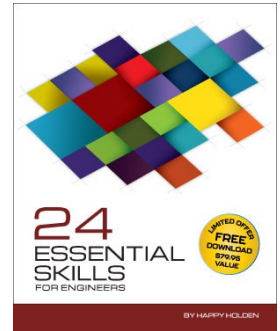
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For information, please contact:  
BARB HOCKADAY  
[barb@iconnect007.com](mailto:barb@iconnect007.com)  
+1 916.365.1727 (PACIFIC)

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GOOD FOR THE INDUSTRY

## Latest Book from Happy Holden: *24 Essential Skills for Engineers*

This book is a blueprint of the strategies that Happy has used for decades to overcome engineering challenges. Each chapter is devoted to a skill that engineers do not typically learn in college, such as problem solving, design of experiments, product and process life cycles, Lean manufacturing, and predictive engineering. You won't find all this information in one publication anywhere else. Happy has done all the hard work for you. All you have to do is read this book and take notes. **Get your copy now!**



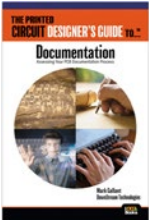
## I-007eBooks The Printed Circuit Designer's Guide to...



### Thermal Management: A Fabricator's Perspective

*by Anaya Vardya, American Standard Circuits*

Beat the heat in your designs through thermal management design processes. This book serves as a desk reference on the most current techniques and methods from a PCB fabricator's perspective.



### Documentation

*by Mark Gallant, Downstream Technologies*

When the PCB layout is finished, the designer is still not quite done. The designer's intent must still be communicated to the fabricator through accurate PCB documentation.



### Thermal Management with Insulated Metal Substrates

*by Didier Mauve and Ian Mayoh, Ventec International Group*

Considering thermal issues in the earliest stages of the design process is critical. This book highlights the need to dissipate heat from electronic devices.



### Fundamentals of RF/Microwave PCBs

*by John Bushie and Anaya Vardya, American Standard Circuits*

Today's designers are challenged more than ever with the task of finding the optimal balance between cost and performance when designing radio frequency/microwave PCBs. This micro eBook provides information needed to understand the unique challenges of RF PCBs.



### Flex and Rigid-Flex Fundamentals

*by Anaya Vardya and David Lackey, American Standard Circuits*

Flexible circuits are rapidly becoming a preferred interconnection technology for electronic products. By their intrinsic nature, FPCBs require a good deal more understanding and planning than their rigid PCB counterparts to be assured of first-pass success.

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# PCB007

M A G A Z I N E

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