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Supply 'Pain' Management

After two years in survival mode, it's time for electronics manufacturers to go on the offensive. Finding relief from pain points should be a mix of both strategic and tactical responses. In this issue, we examine a variety of steps being taken in the industry, from the halls of government to the manufacturing floor—all meant to relieve the pressure and move you forward.



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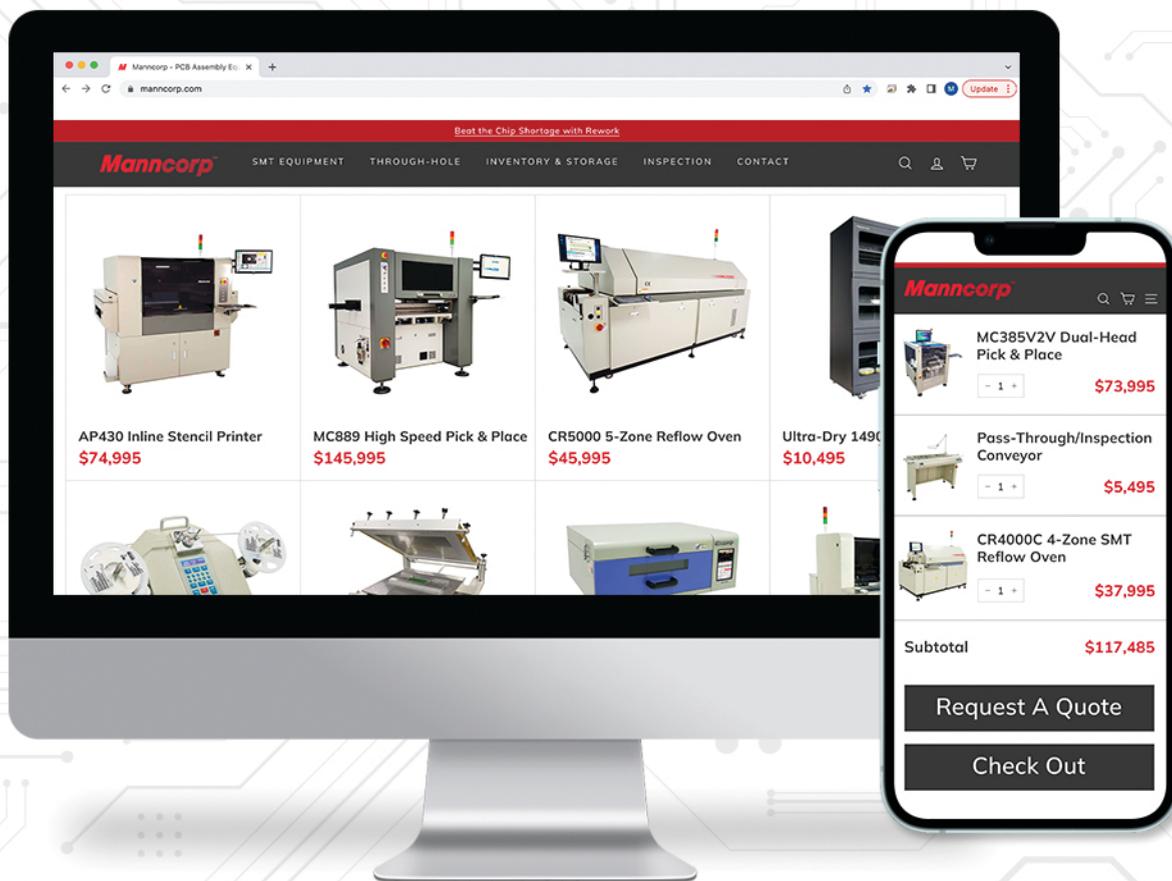
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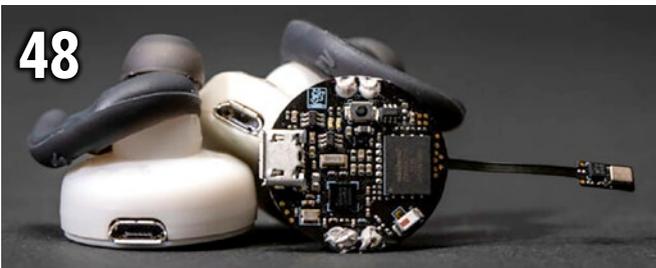
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Supply ‘Pain’ Management

Nolan’s Notes

by Nolan Johnson, I-CONNECT007

We’re all feeling the discomfort, aren’t we? Things are getting squeezed and stretched. While the correct amount of that “something” is hard to put your finger on, there’s stress in the PCB manufacturing and assembly process.

It reminds me of coming home from the hospital with my first born. He was 28 days early, and naturally, his early arrival threw off all our birth preparations. For example, we attended the last session of our Lamaze class with a newborn in a baby carrier. Never have I seen sharper, dagger-eyed stares than from that class full of moms-to-be.

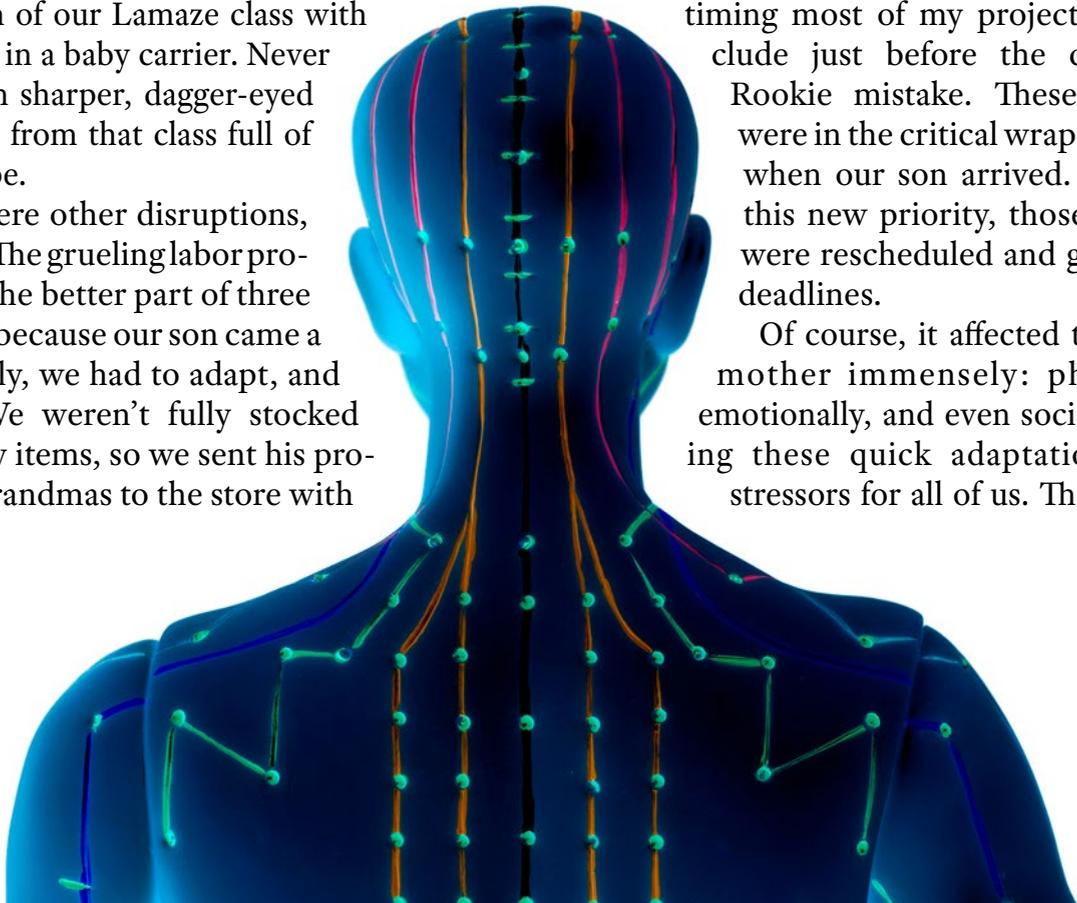
There were other disruptions, of course. The grueling labor process took the better part of three days. And because our son came a month early, we had to adapt, and quickly. We weren’t fully stocked up on baby items, so we sent his prospective grandmas to the store with

a list and a credit card to fill in the gaps. That takes some trust, doesn’t it? At times, they had to get creative.

Once home, our newborn needed some special care. While he didn’t need intensive care in the hospital, understandably he showed symptoms of a slow start-up to his digestive system. You can imagine the learning curve as we cared for our precious son.

This affected my work, too. I had been timing most of my projects to conclude just before the due date. Rookie mistake. These projects were in the critical wrap-up phase when our son arrived. But with this new priority, those projects were rescheduled and given new deadlines.

Of course, it affected the baby’s mother immensely: physically, emotionally, and even socially. Making these quick adaptations were stressors for all of us. The changes



ran from our highest-level family strategies (investments, features in our home, even careers) to the most tactical (whose turn was it to change his diaper?).

One of the techniques we used to aid her recovery from labor was acupuncture. Though a bit mysterious as to how/why it works, even some “acupuncture agnostics” use it as a treatment method for pain management. It certainly helped the mother of my children through her postpartum. Still, how is it that a point-solution soothes the body elsewhere? How is it that a new bit of pressure here can ease a pain point over there? Based on a desire to get some relief from pain, many folks seem satisfied to just trust the mystery.

This was the thought behind our cover image: Putting the squeeze in one area of the supply chain should, in theory, bring relief in another. Finding relief for business pain points can be a mix of strategic and tactical responses. For this issue, we examined a variety of steps being taken in the industry, from the halls of government to the manufacturing floor; all meant to ease EMS pain points.

As our team discussed the best way to illustrate the theme of this issue, the acupuncture image hit every point we wanted to make. To ease a wider, more general pain point elsewhere, a series of focused, short-term “micro-pains” can be employed to bring relief.

On the manufacturing floor, for example, one of the key pain points is component availability. As you will learn from the interviews and articles in this issue, there are methods for adjusting. Each method brings a small bit of pain in the form of process changes, learning new software tools, or validating new suppliers. Each step is a leap of faith, a decision to trust that the outcome will be better than the current situation.

To aid in the conversation, IPC Chief Economist Shawn DuBravac shares vital information on the state of the economy and your business in relation to it, while USPAE executive director Christopher Peters offers help to “thrive”

in electronics manufacturing. And as I mentioned earlier, the discussions on Capitol Hill are crucial to our microelectronics industry. Thus, this issue includes an interview with Travis Kelly, president of PCBAA, and U.S. Rep. Blake Moore, R-Utah, who is co-sponsoring HR 7677, the Supporting American Printed Circuit Boards (SAPCB) Act of 2022. If you’re in this industry and not already following this proposed legislation, now is the perfect time to get caught up.

On a strategic/tactical level, we have a distributor’s perspective from the counterfeiting team at Digi-Key, insight on new sourcing software tools from CalcuQuote, and a no-holds-barred argument for the urgency of cybersecurity from Divyash Patel, owner of MX2 Technology.

I want to make special mention of the column by Dr. Jennie Hwang, who reports on her trip to the Berkshire Hathaway shareholder’s meeting. What she learned makes for a useful mind-setting exercise for industry pain management.

Ultimately, our industry pain, just like the labor pains that brought forth my first child, is more than simple physical pain. We’re working through huge changes to our environment and our place within it, which can be emotionally painful as well. Sometimes, as our cover image reminds us, our willingness to embrace change is a critical part of the supply “pain” management idea.

We’re always open to your suggestions for topics. Many of these topics have come from conversations with our readers. We encourage you to reach out with your ideas, news, and questions. **SMT007**



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

In Search of Wisdom

SMT Prospects & Perspectives

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

After two-year COVID-19 hiatus, I made a point to attend the Berkshire Hathaway (BH) shareholders annual meeting in person, so I could listen to legend Warren Buffett and observe the dynamic of the aspiring people from all walks of life.

The event was full of high-spirited, eager attendees; and was quite festive as well. Buffett, now age 91, and his long-time business partner Charlie Munger, age 98, are as sharp, quick-witted, and as humorous as ever. Their deep and profound thought processes and broad-based knowledge are inspiring. It was a completely worthy trip; and I personally felt intellectually nourished. Their investment wisdom is vividly manifested by the indisputably phenomenal results: From 1964–2021, S&P 500 overall gained marks at 30,209%. In com-

parison, the Berkshire Hathaway overall gain reached 3,641,613%¹.

The most intriguing part of the event was the Q&A session. The five-hour session offered myriad insights and learning opportunities. Questions from the shareholders (both in person and remotely) touched on a wide array of topics and scattered all over the map, from investment to life, from nuclear war to the energy industry, and from public company board practice to cryptocurrency. Below are select excerpts, which I believe are of interest to our industry readers.

Invest in Yourself

In this unprecedentedly uncertain time, as we face rampant inflation with a draconian increase in the cost of goods and services in



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our daily lives, not to mention the geopolitical tensions, it is understandable and fitting to search for advice or wisdom.

Notably, there was a recurring question citing the current economic and political environments. Although the questions were articulated in different ways, in essence, it was to ask for advice on where to invest and how to succeed in life in this day and age.

Thoughts from Warren Buffett:

- “Invest in yourself to reap rewards even when inflation bites.”
- “The abilities you have can’t be taken away from you. They can’t actually be inflated away from you. The best investment, by far, is anything that helps develop yourself, and it’s not taxed at all.”

Thoughts from Charlie Munger:

- “The best thing you can do is to be exceptionally good at something.”
- “You want to be the best at what you do: Be the best engineer, the best doctor, the best dancer.”

“Investing in yourself” to relentlessly get better is truly enduring advice to all of us.

Investment, Market Moves, and Cash

Munger quipped, “Cash is oxygen!”

Both Buffett and Munger believe one should always retain a certain amount of cash. In business, when the economy stumbles, an adequate level of cash sustains the business through the tough times, such as the major recent economic fallout in 2000, 2008, and 2020.

They agreed that BH is holding too much cash lately (\$146.2 billion as of January 2022, as opposed to their pre-set desired amount of \$30 billion). Buffett attributed this large cash holding to the lack of appealing and justifiable businesses to acquire or to invest in. Buffett self-claims being a bargain-hunter. In his Annual Letter, he called himself “your bargain-hunting chairman.”

Munger shared his sentiments:

- “Investment does not take high IQ, just a good attitude.”
- “Market is crazy, but I made more money because of crazy gambling in the market.”
- “It’s a gambling parlor.”
- “I find speculative bets obscene.”
- “I never made a decision (to buy or sell) by looking at the market moves, not timing the market.”

To the Aspiring

A college student “won the lottery” by getting to ask a question. She introduced herself and stated this was her fifth time attending the BH annual meeting. Buffett took it to heart, and heartily commended her. About 80 years ago, at the age of 11, he bought his first stock by using all his savings of \$114.

After her introduction, she asked for advice on how to achieve happiness and success. Buffett advised:

- “Nobody can take away your talents.”
- “Find people you can trust.”
- “Keep learning.”

Munger’s advice: “Find out what you are not good at and avoid all of them.”

Multidiscipline

The statement, “If you only know one discipline, it’s like a hammer looks at everything as a nail.” To me, that tells it all.

Life

Munger amusingly said:

“Easy to get wrong. Easy to over-do an idea.”

“You would be a better person in your second half of life than your first half, so I would like to be judged by the second half of my life.”

That Moment

A voracious reader, Buffett mentioned he tried to read all the books in the library when he was a young man. One day, he picked up a

book telling him everything he was doing was wrong.

“Suddenly, I was looking at things differently,” he said. “It happens only a few times in life; things are just re-arranged with new insights.”

The pair showed a picture that looks like a duck; and when you give another glance it looks like a rabbit. Indeed, those epiphany moments are to be cherished and can be life-changing.

Teaching

Buffett stated that he has taught for almost 70 years (which I did not know), enjoying working with students of all ages and finally having retired from that pursuit in 2018 (at age of 87). In his annual letter to shareholders, he wrote: “Teaching, like writing, has helped me develop and clarify my own thoughts.”

Munger calls this phenomenon “the orangutan effect.” He said, “If you sit down with an orangutan and carefully explain one of your cherished ideas, you may leave behind a puzzled primate, but you will exit thinking more clearly.”

How true! Having engaged in teaching professional development courses for the workforce’s continuing education for over three decades, I vividly and wholeheartedly appreciate the above statements, and enjoyed Munger’s witty humor.

Energy industry

Munger believes in the oil and gas industry, saying in part, “...the United States should produce more.” Buffet said, “We should be very happy that we can produce 11 million barrels a day, or something of the sort, in the United States, rather than being able to produce none and having to find 11 million barrels a day somewhere else in the world.”

Munger further cracked, “In this regard, nobody shares my view; it does not bother me because they are all wrong.”

Nuclear War

The powerful duo expressed no knowledge or opinions about it, but quoted Albert Einstein: “I do not know with what weapons World War III will be fought, but World War IV will be fought with sticks and stones.”

Corporate Governance Issues

In recent years, the corporation’s stock-buyback has been on the corporate board agenda as well as a controversial political debate. Buffett says stock-buyback is a good thing for shareholders when it’s done at the right price and at the right time as it’s buying a known existing business, among other factors. From his annual letter to shareholders, he wrote, “When the price/value equation is right, this path is the easiest and most certain way for us to increase your wealth. Repurchases are modestly beneficial to the seller of the repurchased shares and to society as well.”

Repurchases are modestly beneficial to the seller of the repurchased shares and to society as well.

Buffett illustrated an example: In 1998, BH bought 150 million shares of American Express, which counted for 11.2% of American Express. As a result of American Express’s stock buyback program, BH owns 20% of AE in 2022. This is good for the investors.

Over the years, Buffet consistently expressed his experiences regarding the role of public company directors: “Many directors of public company boards are classified as independent directors, as required, but they are not independent in action.”

Having served on the board of publicly-traded companies (NYSE-, NASDAQ-, and TSX- listed companies), I strikingly echo his sentiments through my hands-on personal experiences and observations. Indeed, many corporate directors do not perform as independent directors, unfortunately.

GAAP

Buffett does not believe that the required GAAP accounting practice reflects a company's intrinsic value. Evidently, he is not a fan of current GAAP rules that all corporations are using and prefers focusing on operating earnings. I also deeply share his views and wisdom in this regard.

Buffett does not believe that the required GAAP accounting practice reflects a company's intrinsic value.

Cryptocurrency

Both Buffett and Munger do not believe in cryptocurrency; they lauded China's smarts in banning crypto. Munger lamented, "By saying this, 25% of the population would dislike us."

Power Lunch

This year marks Buffett's final Charity Auction Lunch. The lunch started in 2000 with a minimum bid of \$25,000. The last lunch winning bid went for \$4.6 million to cryptocurrency entrepreneur Justin Sun in 2019. This year's lunch (after a two-year hiatus due to COVID) fetched a record winning bid of \$19 million by an anonymous bidder (as of June 20), who will meet Buffett at New York City steakhouse Smith & Wollensky in the coming months.

Buffett and Munger are such a compelling duo who complement and synergize their

intellect and compound their knowledge as in compound-interest. So admirable.

All in all, my attendance was time well-spent. More importantly, feeling intellectually nourished is a good feeling. **SMT007**

References

1. Berkshire Hathaway Inc. Annual Report, 2021.

Appearances

Dr. Hwang will deliver a professional development course, "An Overview of PoP and BTC Package and Assembly: Material, Process and Reliability, Part 1 & Part 2," Aug. 22 and 23, 8 to 11 p.m. EDT, at the 20th Electronic Packaging Convention, Asia, 2022.



Dr. Jennie S. Hwang—an international businesswoman and speaker and a business and technology advisor—is a pioneer and long-standing leader to SMT manufacturing since its inception as well as to the development and implementation of lead-free electronics technology. Among her many awards and honors, she was inducted to the International Hall of Fame—Women in Technology, elected to the National Academy of Engineering, named an R&D Star to Watch, and received a YWCA Achievement Award. Having held senior executive positions with Lockheed Martin Corp., Sherwin Williams Co., and SCM Corp., she was the CEO of International Electronic Materials Corp. and is currently CEO of H-Technologies Group, providing business, technology, and manufacturing solutions. She has served on the board of Fortune-500 NYSE companies and civic and university boards; the Commerce Department's Export Council; the National Materials and Manufacturing Board; the NIST Assessment Board; as the chairman of the Assessment Board of DoD Army Research Laboratory and the chairman of the Assessment Board of Army Engineering Centers; and various national panels/committees and international leadership positions. She is the author of 600+ publications and several books and is a speaker and author on trade, business, education, and social issues. Her formal education includes four academic degrees, as well as the Harvard Business School Executive Program and Columbia University Corporate Governance Program. For more information, visit JennieHwang.com. To read past columns, [click here](#).



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Drilling Down on Counterfeit Parts

Feature Interview by the I-Connect007 Editorial Team

The I-Connect007 Editorial Team spoke with Digi-Key senior managers Levy Olson (product management) and Kelsey Lawrence (operational excellence) about parts availability and how to manage the challenges of the ongoing shortages in supply. Levy and Kelsey share some intriguing statistics on counterfeit parts and discuss how Digi-Key ensures their extensive inventory is stocked with authentic parts.

Nolan Johnson: Recently, I took an organized tour of EMS houses in San Jose. At each stop, I would ask, “How’s business going?” And the answer was always, “Great! If we can find the parts.”

In one warehouse, I noticed a bunch of loaded pallets. The tour guide explained that

was \$2 million worth of parts waiting for the arrival of another \$500 worth of parts so they could build the board. I’m sure the numbers were meant metaphorically but still, that’s their reality on the floor.

As a major global distributor for both prototypes and production, Digi-Key undoubtedly has some insight on what’s happening. What are the dynamics at play here?

Levy Olson: We’ve been hearing a lot of just that. There are specific components which have very long lead times that are holding up production. Internally, we jokingly refer to them as the “golden screw.” If you have that part, you can build those products. Semiconductors seem to be one product group affected more than the others. Unfortunately, semiconductor is where

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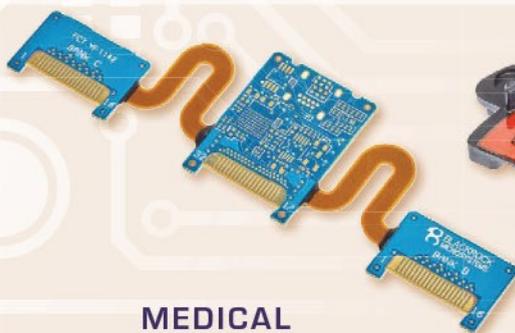
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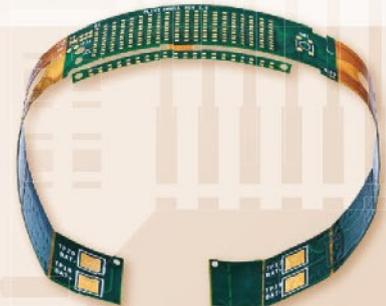
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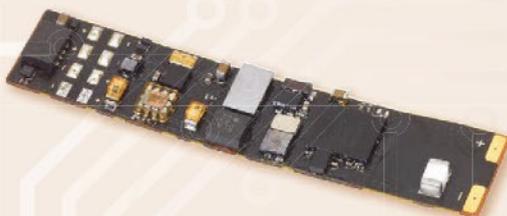
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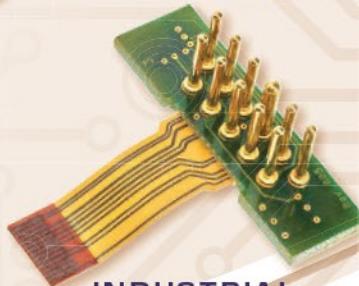
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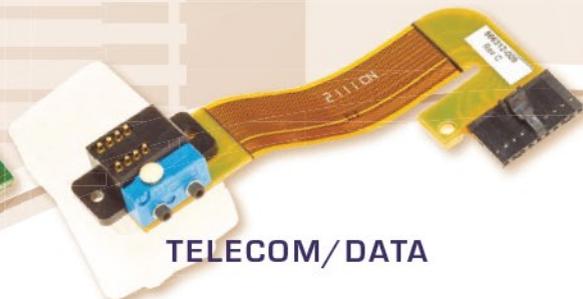
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Levy Olson

it does get harder to find a direct replacement. If it's a microcontroller, for example, it's pretty much impossible.

Johnson: We can read, even in the mainstream media, about semiconductors. You hear all the news about Intel and other manufacturers announcing new U.S. semiconductor manufacturing facilities, as well as globally, to create more capacity and resilience. At the same time, the projected demand curve for semiconductors still outpaces the planned build out. Do you see it getting better, Levy?

Olson: I think it's going to get better, but it might take a little while. We talk about shortages, but in the last two quarters in a row, Digi-Key has received the most product ever. So, it's not necessarily that the shortages within the market are because the manufacturer isn't making product, it's because demand is so high.

What happens to demand in the next six to 12 months will determine what happens to the supply of the products. We're starting to see pockets and lead times coming down a lit-

tle bit. Nothing quite substantial, but different technologies have their different challenges. We're seeing some instances where lead times are getting a little better.

Johnson: So even though production hasn't ramped up yet, lead times are improving. What's your sense of why that is?

Olson: Throughout COVID times, there was a lot of talk about factories unable to produce because they were shut down; we aren't seeing as much of that lately. Now we're seeing factories operate at a high output level. There's just such a strong demand.

Johnson: The factories are running, but do logistics and distribution continue to be an issue?

Kelsey Lawrence: Coming into Digi-Key, you mean? Yes, in some cases, but I wouldn't say that we see a lot of that complaint coming from the customer. I know that, occasionally, we'll get requests for corrective action in which we're asked to push back to suppliers. During times like this, suppliers will say something like, "This is how the industry is right now. I can't give you corrective action to tell you exactly why our lead times are delayed or why the product was delayed getting to you or getting to the customer. This is how it is everywhere right now." We're hearing some of the dissatisfaction, but I think it's common. People are used to seeing this everywhere, so they are setting their expectations accordingly.

Johnson: I would presume that you're managing delays on shipping from manufacturers to you for stocking in your warehouse?

Lawrence: We're at the mercy of the supplier. If that demand is too high, there's not much we can do about it. Most of the time we're in the same boat as everyone else.

Johnson: I have been hearing discussion about extra testing of components upon receipt. Because EMS companies are sometimes having to get more creative about how they're sourcing their parts, that pushes them closer than they feel comfortable to gray market sources. And yet, they need to get the business out the door. That creates an opportunity for a counterfeiter to step in.

Lawrence: Oh, for sure.

Johnson: What does Digi-Key do to ensure that you have all legitimate parts in your inventory? How do you do that?

Lawrence: Our customers rely on us for our integrity in stocking a quality product. First, we procure our product directly from the manufacturer, as an Authorized Distributor. We're not getting stock from any sources we don't trust.

For us, the biggest risk for counterfeit is customer returns. For example, we've already shipped the product which we know is authentic and genuine, and we receive a claim on that product, whether it be a report of failure in the product or simply customers saying, "I ordered the wrong part. I don't need this." When that returned product hits our dock, we have a control-plan for counterfeit mitigation. We are certified to AS 6496 standards in terms of counterfeit mitigation and prevention.

Our customer returns department verifies physical product based on how it looks visually, part markings when they exist, labeling, packaging, product traceability and so on. Traceability is probably our biggest means of identifying potential suspect counterfeit product and mitigating the risk that counterfeit product enters our inventory. So, we have traceability verification all the way from the initial receipt to shipment to the customer. Any time something comes back, we're re-verifying to make sure that it's actually the same product we shipped. That means verifying against



Kelsey Lawrence

paperwork, and against the physical attributes on the product. If anything at all is identified as a potential concern, we use a separate set of custom steps to have product verified by one of our product distribution technicians. These technicians have 14 additional steps that they go through, verifying what the parts look like under a microscope and what the product looks like physically.

If there's a concern, we launch a full-blown investigation for counterfeit, which involves outreach to the customer, and outreach to the original manufacturer to partner with us and create a case. If we do have any type of suspicion, we quarantine the product for five years. The customers do not get that product back. We ensure that it's not reintroduced into the supply chain.

Johnson: That's a long process.

Lawrence: It is a time-consuming process, but it proves beneficial to those customers who may have been on the receiving end, as well as our suppliers, should we find someone is wrong-

fully misrepresenting their product. I think it's helpful for everyone to see how seriously Digi-Key takes it.

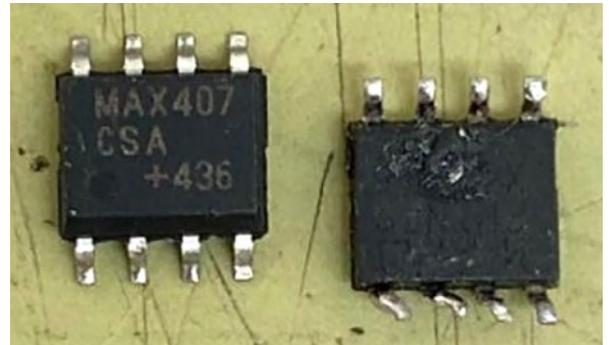
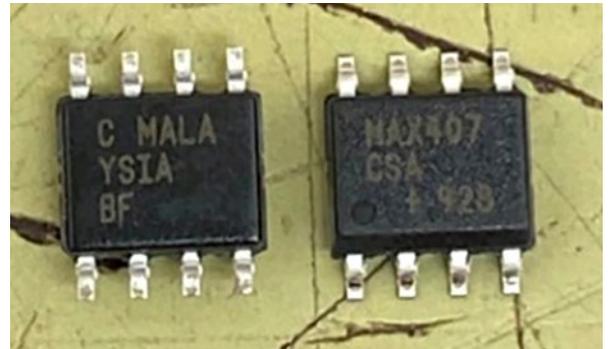
Johnson: Can you quantify how much counterfeit activity you have going through Digi-Key? How many of those investigations do you have open at a time?

Lawrence: You'll be really surprised with my answer. Honestly, this year, we've had four full-blown counterfeit investigations.

Johnson: That's all? I expected a much higher number than that.

Lawrence: I attribute the number being so small because we have a robust investigation process. Prior to allowing a customer to return a product, we run it through a preemptive investigation to determine—based on photos and information they're providing us—the date and lot codes. If customers say something's failing, that's usually the first key information we need, in addition to the date and lot codes so we can verify the traceability and start that verification process. If we can't verify that provenance, we don't allow them to return failing product. If they're adamant and can somehow prove they got these parts from Digi-Key, we will take them back, but that tags them already as under scrutiny.

In the case where we can prove—which generally we do—that Digi-Key did not ship the suspect or confirmed counterfeit product the customer claims we shipped to them, we will quarantine the product and report it to the GIDEP website (Government-Industry Data Exchange Program). GIDEP is a cooperative activity between government and industry. Digi-Key utilizes GIDEP to gain preview to, and to report, suspect and confirmed counterfeit activity. Publicizing the information on GIDEP is our way of assisting others in the electronics industry with the information needed to prevent and mitigate similar activity in the supply chain.



A Case Study

The top photo depicts what the customer claims they purchased directly from the manufacturer in 2020. The photo on the bottom depicts what the customer claims they purchased from Digi-Key in 2018. Digi-Key verified we had never received the date code in question (+436) from the original manufacturer. This was confirmed via Traceability reporting of Date Codes received into Digi-Key's facility.

These were products shipped back to us and determined suspicious. Returned product depicted some bent leads, parts were scratched, dented and had possible burns. Parts looked to contain deformities (inconsistent texture). The concluded analysis was: Digi-Key testified these parts appeared to be counterfeit but did not take responsibility for shipping counterfeit product. We verified Digi-Key had not received, stored or shipped the product in which the customer returned to Digi-Key, using product traceability. These parts are currently in quarantine. (This example is from an existing historical case Digi-Key has posted to GIDEP.)

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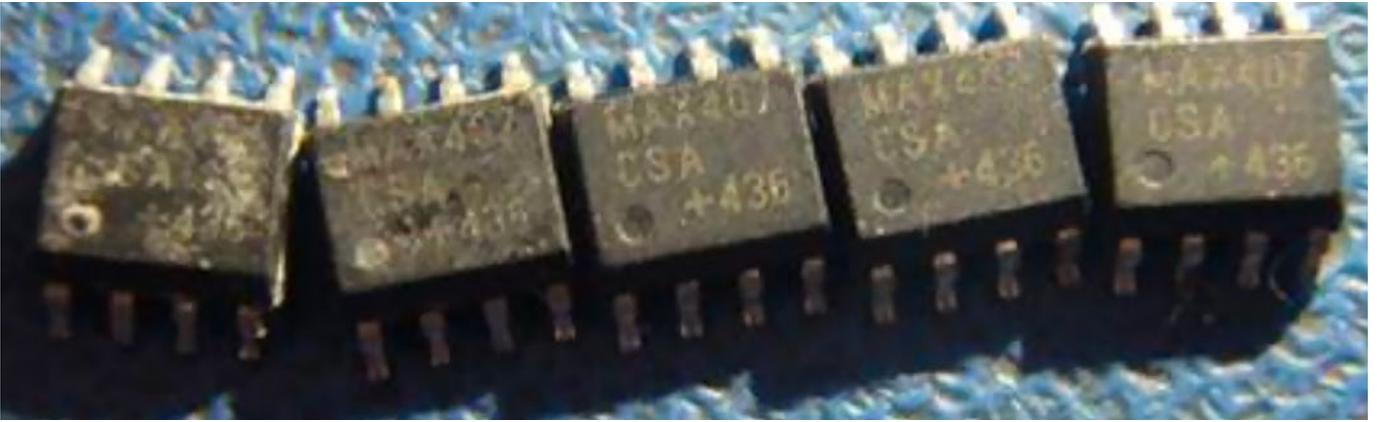
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These photos were taken by Digi-Key upon receipt of the product (RMA) from the customer.

Olson: And from what I've seen, it seems like customers are less apt to try to return parts due to the shortages. Like you said, there's \$2 million sitting there in the EMS warehouse ready to be consumed. I have a suspicion that we haven't seen as many return attempts as we do in a typical year.

Andy Shaughnessy: Do you have any tips for someone for whom you're trying to design a board when they need components with a 50-week lead time, for example? Do you have recommendations? How do you communicate that?

Olson: We have a technical support team for customers. If they're looking for an alternative part, we can help with product selection. Of course, our top-running parts are out of stock because they're the most popular parts. But when it comes to those newer designs, we still have a lot of stock available. And maybe there are parts that weren't as popular that become useful now.

There are a lot of parts on our website, and being able to find the right one can sometimes be a bit tricky. Some people call them "sleeping beauties." They're parts that really haven't done well for whatever reason, but now that the demand has chewed up some of the highest running parts, those parts suddenly are doing very well. If there are parts that you absolutely need, I would just encourage you to place them

on back order with us because we are very regimented. I would recommend reaching out to us and saying, "This is what I'm wanting to do. What do you have in stock that allows us to do that?" It might not be the first choice, but it could get you off the ground and running.

Johnson: Digi-Key has historically done quite a lot of business in cut-tape especially for prototype small quantities. But that's not all you do. You supply to production as well, but cut-tape happens to be the forefront, to most of the engineering community for Digi-Key.

How do you manage those two unique needs for the same parts? How do you balance that?

Olson: It's tough. Typically, the manufacturer will allocate a certain number of parts. When those parts are in very high demand, in certain cases Digi-Key tries to limit how many parts a customer can purchase at a time, which helps us spread the inventory around—more people can get some parts vs. one customer getting all the parts. We're not going to take parts that were destined to you and give them to a high-volume production buyer. Whoever is in line first, gets the parts.

If customers are watching the inventory on our website and every day it's at zero, they might conclude that we're not getting any parts. That's not the case—it's just that we're distributing those parts out through the back-orders, so that inventory flow doesn't reflect



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on the website. We're getting those parts, you just don't see them. That's where placing a back order with us is a good way to increase the likelihood that you get those parts.

Barry Matties: Are you looking for new sources as well? Are additional sources making themselves known to you?

Olson: It's within our counterfeit policy to only purchase from our contracted suppliers. We would never buy microchip parts from non-microchip sources. They would have to be at least to the level of counterfeit standard that we have for us to purchase from them. We get solicitations from new sources all the time and, because of our counterfeit policy, we turn them down.

That said, this year is probably one of the largest years for supplier additions that we've ever had, with 250 suppliers already added.

Matties: Is this new market capacity or is this just shifting capacity to distribute to Digi-Key?

Olson: The vast majority will be new markets—lines from suppliers and products that we haven't offered or haven't offered in the past.

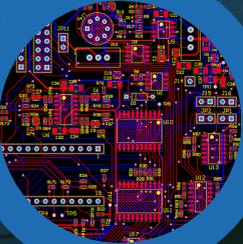
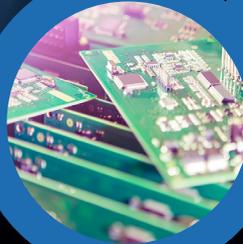
Johnson: This has been really helpful. Thank you, Kelsey and Levy.

Lawrence: Awesome. Thank you, guys.

Olson: Thank you. SMT007

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Soldering for QFPs and Other Gull Wing **Leaded Parts**

Knocking Down the Bone Pile

by Bob Wettermann, BEST INC.

There are multiple methods for hand soldering QFPs as outlined in the IPC 7711.21 Rework and Repair of Printed Circuit Assemblies process guidelines document. QFPs have several challenges related to their hand soldering especially when the component has a high lead count. The methods for hand soldering QFPs listed under IPC 7711 5.5 include the following:

- Top of the lead
- Point-to-point method
- Solder paste method hot air system
- Hook tip wire layover
- Blade tip with wire solder
- Adhesive-backed stencil with solder paste and hot air method

While these are a head-spinning number of techniques, the following discussion will compare the more widely used techniques: point-to-point, drag, and adhesive-backed stencil.

Point-to-Point Soldering

The point-to-point method is the one with the most history behind it. Point-to-point soldering is a manual soldering process in which individual solder connections are soldered one connection at a time (Figure 1). The method usually consists of using a chisel tip connected to the soldering hand piece. First, locate the correct tip. The size of the chisel tip should be such that it can properly create the

“heat bridge” between the land and the component lead. A good rule of thumb is to have the tip 60–70% of the pad width. The component should be properly inspected to make sure the leads are coplanar and that they are not damaged and bent. Upon proper inspection, the component should be aligned with the pads and be held with a pair of tweezers or an orangewood stick. Next, liquid flux appropriate for the assembly is applied at two opposite corners and the component is tack-soldered in place such that it does not move off the pads. Flux is applied to the remaining lead/land rows and creates a heat bridge between the land on the PCB, the soldering iron tip, and the component lead adding in solder to form the proper solder fillet. Finally, the fillets are inspected per the class required of the assembly.



Figure 1: Point-to-point soldering of a QFP.

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Figure 2: Using a “hoof” tip to drag solder a fine pitched QFP (IPC 7711 Method 5).

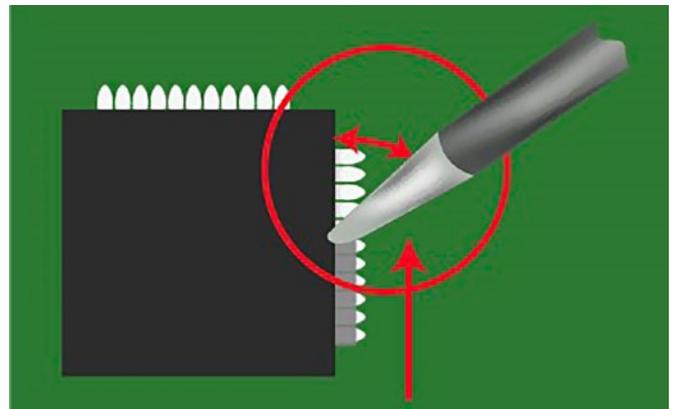


Figure 3: Drag soldering angle.

Drag Soldering

Drag soldering is a manual soldering process that uses a special soldering iron tip with a concave surface “spoon” or “hoof” shape to hold molten solder (Figure 2). This ball of molten solder is then “dragged” across the leads of the QFP, letting the surface tension and natural wetting forces of the solder deposit the correct amount of solder on each of the leads. When using the drag soldering technique, it is most effective with multi-leaded, very-fine pitched components. As with the point-to-point soldering technique, make sure the opposite corners of a package are tacked into place such that the component is aligned and cannot be moved off the pads. Apply enough solder to cover approximately one-third of the tip. For finer pitch parts apply less solder. Now flux the leads on each side of the component. Start from a row that has not been tacked in position. Bring the tip down at an angle to the point where the tip of the lead meets the land so that the edge with the solder on it is on the land, but the face is tilted away from the component. Hold the tips so the shaft runs parallel to the row of the leads. The angle between the side of the tip and the side of the component

can be up to 30 degrees (Figure 3) depending on operator preferences. Start running the tip down the toes of the leads.

The variables to control are pressure (very light) and speed. The operator should glide across the leads with no pressure, with the speed determined by the thermal mass of the board. Follow this process on all sides, cleaning and inspecting after soldering to the appropriate inspection criteria and class. Make sure the tip is tinned prior to putting it back into the holster.

Adhesive-backed Stencil

In some applications, less experienced soldering technicians can place an adhesive-backed stencil and solder a fine-pitched gull wing device in place (Figure 4). To begin, make sure

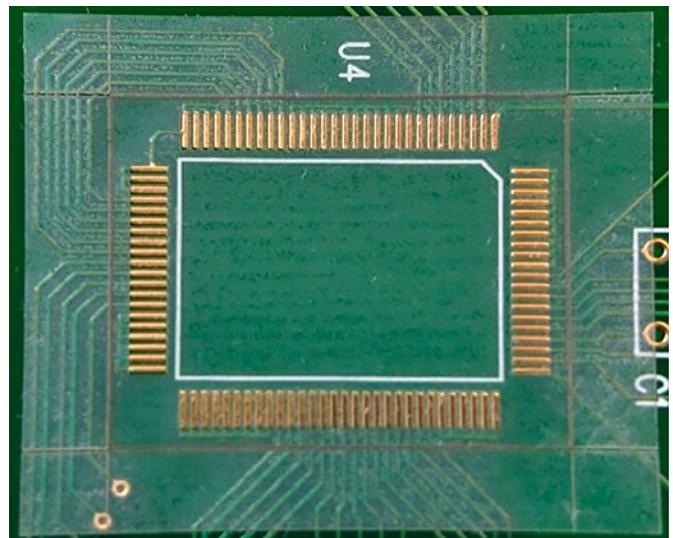


Figure 4: Adhesive-backed stencil aligned and placed onto PCB (IPC 7711 Method 5).

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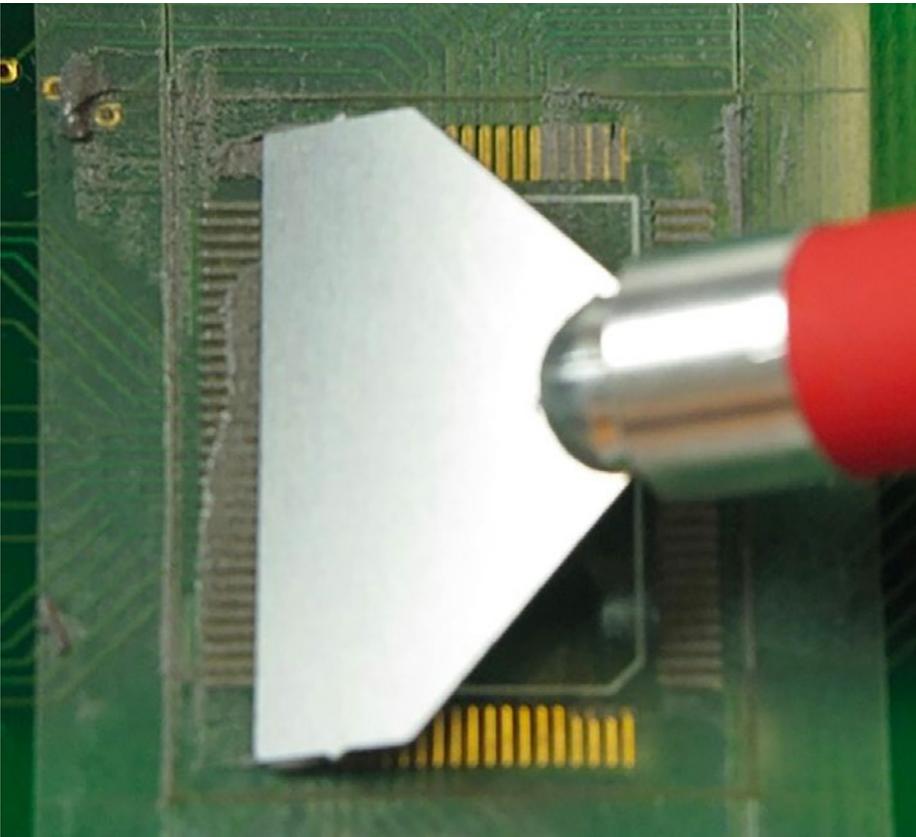


Figure 5: Solder paste squeegeed through apertures of the stencil.

the site location is clean and dry prior to placing the adhesive-backed stencil. Peel the stencil from the release liner and align it with the lands on the PCB. Roll solder paste through the apertures of the stencil by using a small hand-held squeegee (Figure 5). The squeegee can be moved back and forth several times before removing the stencil. Now carefully place the component onto the bricks of the solder paste printed at the rework location. Reflow the solder paste using a hot air or infrared heat source. Clean and inspect per the guidelines of the work.

Summary

In the point-to-point soldering technique, a technician will be soldering each connection individually, which allows for adjustment of the applied heat, dwell time, and solder volume to suit each particular connection. This technique gives the technician a lot of discre-

tion regarding the rework process, but also reduces the uniformity and consistency of the solder connections. The downside of the point-to-point soldering method is that it is time-consuming and tends to burn out tips more quickly.

In drag soldering, a highly skilled technician can move through components much more quickly. However, it is imperative to have a high-quality solder station and iron with active tip temperature monitoring and control, as well as plenty of liquid flux (may not be suitable for all applications). When done properly, the drag soldering technique results in more uniform solder fillets.

Finally, the stencil approach requires the use of a custom-made stencil while reducing the soldering skill level of the technician. Each of these methods can be used to effectively solder a QFP in place. The method chosen is a function of the soldering skill level of the technician and the pitch and lead count of the component. **SMT007**

Resources

1. IPC 7711.21 *Rework and Repair of Printed Circuit Assemblies*, Revision C 2020.



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

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Q4 Concerns: Hold On to Your Hats

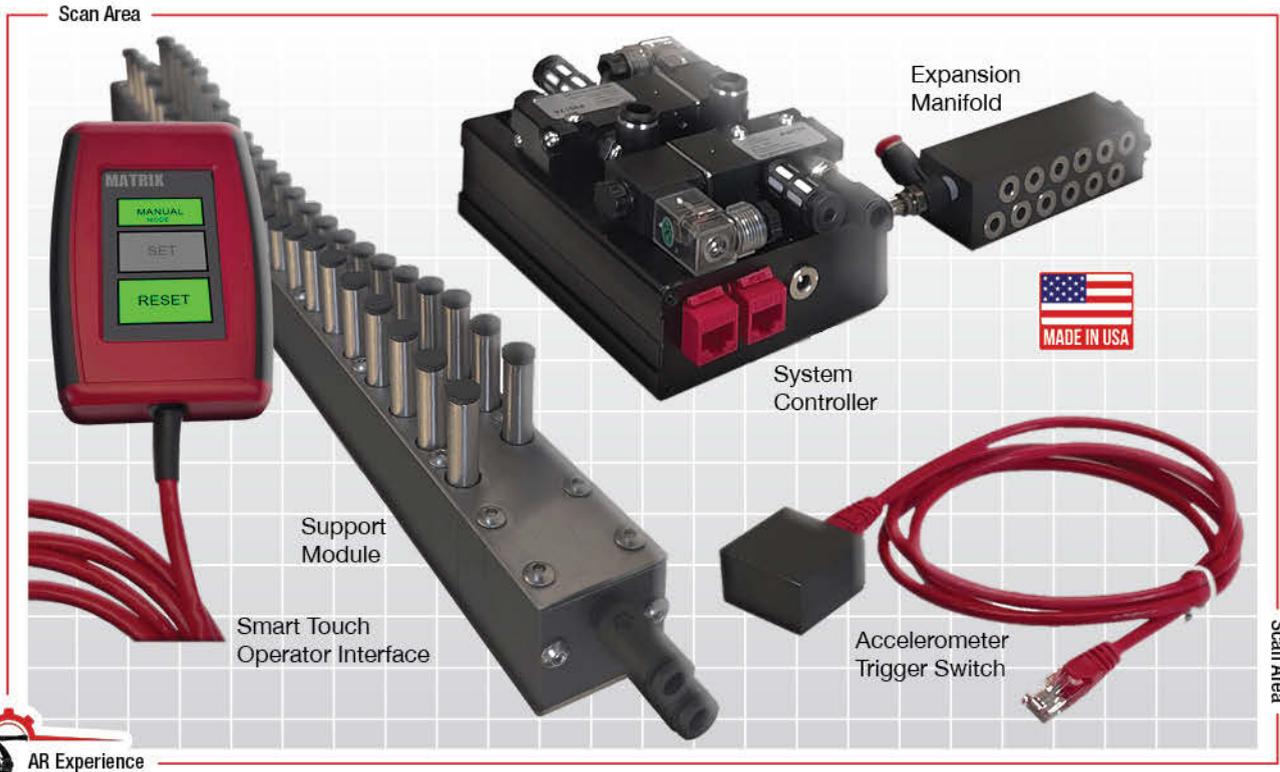
Feature Interview by Nolan Johnson

I-CONNECT007

IPC Chief Economist Shawn DuBravac has plenty to share about the state of the U.S. economy and how the electronics manufacturing industry might weather the storms of high inflation, rising interest rates, and low unemployment. It's an interesting situation to find ourselves in as the flurry of opinion on a 2023 recession starts to take shape. Does it make sense to invest in PCB fab now? And how does the rest of the world feel about it? Shawn gets to the bottom line.

Nolan Johnson: Shawn, the economic outlook hasn't been too rosy. I'm hoping our discussion today will provide some perspective for what to expect, especially for manufacturers in Q4.

Shawn DuBravac: I would characterize it as the playing out of dueling narratives. For context, in March 2020, we went into a very steep, quick, deep recession. This was a pronounced, unprecedented recession. Had it continued, it would have been by far the worst economic environment we have ever seen. Companies—and the federal government—responded to that abruptness very quickly. In the auto sector, you saw them cut production significantly, driving it essentially to zero in anticipation of a very deep recession. The government, through both fiscal and monetary policy, brought in unprecedented amounts of support for the economy. With no confirmation about how long it would last, we had several stimulus measures.



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Shawn DuBravac

That stimulus drove demand, but you also saw shifting demand because people were moving away from services toward durable goods. They moved away from going to the theater. They moved away from the amusement parks. They moved toward products that they could put in their homes. At the same time, every business had to go online, so the demand for cloud storage and hardware shot up. These things were tied together when you started to pull the string.

Where does that leave us today? COVID remains a major concern, but in much of the world, we're operating alongside it. People have gone back to buying and partaking in services. Demand for travel and hospitality has been very strong. And there has been an equally abrupt shift in the purchase of lots of these durable goods that did so well in the first 18 months. If you look at the big retailers, like Target, Walmart, Best Buy, they're all feeling over-inventoried on the consumer side. At the same time, you have unprecedented inflation rates that are impacting consumers. It's a narrative of shifting focus, priorities, and desires among consumers, and the headwinds that they face.

When you look at other parts of the industry, though, demand still looks at least somewhat resilient. There's pent-up demand for what I'll call supply, pent-up demand for production capacity. That produces this residual demand, a backlog that can feed future months. Now, that can change very quickly. But if you look at the industrial side of the economy, the demand is very strong. They have not been able to meet demand. It looks like that strength should continue at least through the fourth quarter of this year and probably into 2023. I've talked to big industrial companies, and I'm sure you have these conversations too. They're saying, "We have backlogs that will take us well into 2023." Thus, there ends up being these two competing narratives. In one narrative, demand is slowing. In the other, demand remains solid because of a strong backlog of orders that are waiting to be fulfilled.

For the consumer narrative, high inflation is what gets the headlines. We have officially ended the bull market and we have started a bear market. Every day there's a crypto platform that implodes and that is keeping the attention. But operating behind that is an economy that thus far looks resilient. Unemployment is obviously very low, and the demand for those areas that our industry supports is holding up quite well—industrial, for one; and clearly defense demand should remain strong. The defense industry has drawn down inventories because of support for Ukraine. At the same time, there's concern about other geopolitical uprisings or other geopolitical dislocations. There is a demand, at least in the U.S., to build up some of that defense industrial capacity, and defense inventory to have ammunitions and equipment available to us should we need it.

Johnson: What I would expect a vice president of sales in the PCB marketplace to respond back with, "Okay, so our production schedule may end up with some holes for our consumer clients, but there is industrial business to fill that space. We're still going to be at capacity."

DuBravac: Yes, at least initially, that's what it looks like. Now, the Catch-22 would be part shortages. If I can't get certain things, if I know that I've got a six-month wait on certain key components, then I may wait on PCB orders. So, I think if you look at our book-to-bill numbers over the last few months, when order flow seems to ebb a little bit, I think some of that is EMS companies saying, "I'm not going to order right now because I can't get these other three things that I need to get. I need all my components to come in." The economics are such that they need it all to come in the back door at the same time. They don't want to be holding inventory. They can't carry it.

Right now, everything is fine with bank lending and lines of credit, but it's an important area to watch. Managing the cash flows is what a lot of businesses are doing. It's almost like the manufacturing is second to making sure you've got cash flow to cover it. My sense is that order flow has been a result of part shortages and longer lead times. Some of that will probably continue. A big risk factor is China's zero COVID policy. Even though Shanghai and other areas were shut down for nearly two months, the ports did okay. There were definite delays, but not as severe as it could have been. It could have been really bad if things were shut down for many months.

Let me address the auto industry, which is significantly under-inventoried. That won't change this year, and the auto sector will be working to get back into what they would consider a healthy inventory position for much of 2023. Obviously, the different segments of the electronics supply chain have unique dynamics at play. For example, when it comes to the auto sector, anything in the electric vehicle supply chain is in high demand. EVs are essentially oversubscribed and sold out everywhere. Even a recession is unlikely to dent that category.

There is pent-up demand because auto manufacturers aren't dedicating as much capacity to EVs as there is demand for that segment.

Johnson: Shawn, do you see this as an opportunity to be investing in capacity?

DuBravac: The great challenge with investing in additional capacity is the amount of uncertainty around future demand. That's what holds companies off from really building out greater capacity. Some companies, like TTM which recently announced a new facility in Malaysia, are making the commitment to build out capacity. Other companies are strategically adding capacity as well, especially where it looks like a very long season of demand—EVs, for example, if you were doing anything in that space, then you have some assurance. There's a lot of momentum suggesting that adding capacity now will just be the start of capacity coming on in this space. For others, though, it's challenging to add capacity when there's uncertainty about future demand.

The great challenge with investing in additional capacity is the amount of uncertainty around future demand.

Johnson: Such as looking at your supply chain. You can add the capacity, but will you be able to get the incoming components you need to make it work, for example?

DuBravac: Definitely. There are a lot of challenges when we think about adding capacity. Adding more physical assets is just a piece of it; labor is another. Labor costs are definitely a constraint on adding capacity. If I need more workers, can I find and retain them? Can I deploy that capital in a very productive way?

Johnson: With everything going on, is now

a good time to add capacity? It's hard to figure out. It's a cloudy crystal ball. There are plenty of reasons to argue that now is a good time to invest in this industry. There is pent-up demand. Electronics are used increasingly in products. We know that there will be a step function in what needs to be produced for automotive alone, let alone other parts of the industry. You see the U.S. government start to understand the need to be strategic with the industry to achieve a healthy domestic manufacturing sector. We've also learned about supply chain resilience. It would seem like this is a reasonable time. You've got private equity firms that seem to be getting involved. As a smaller shop in this space, is this a good time to be seeking out additional investment, capital, or help?

DuBravac: I think it could be a good time to seek outside investment. It remains to be seen how external capital will change and if that will become harder to come by. Monetary policies are tightening, and that will reduce liquidity by design. Presumably, there will be less funding available, so it will become harder. To me, the ideas around resiliency makes a lot of sense. There will be growing demand to produce products and other pieces of the production cycle closer to the market that you are trying to serve. Building strategic capacity makes a lot of sense right now, and private investors are looking for long-term returns.

For example, not just building out capacity in terms of how much you can produce but in areas that have strong demand. Whether that's more sophisticated, more complex electronics, or whether that's some of these areas we've already hit on when we think about the defense, industrial, auto, but especially around some of the more sophisticated and technical

pieces. There are long-run opportunities there. As you pointed out, the demand is growing. To satisfy that demand, we must add capacity over time, and companies that are looking to gain share will be adding capacity broadly; companies that are looking to be more influential in these markets will be adding "strategic capacity" that's focused broadly on some of the complex, highly technical pieces of the supply chain.

Johnson: It's an interesting situation to be in.



We're starting to see the U.S. government and Congress line up and send the message that we need to bring this infrastructure back, both in semiconductors, and PCB, with what's going on there. That level of funding can make a huge difference in our industry. At the same time, we're a free market in the United States. It needs to be compelling for private investment. That's how our economic system runs well. But it's about knowing the right time to invest, because we have not been a desirable place to spend money in the past.

DuBravac: When I've had conversations with the U.S. Commerce Department—and IPC's Vice President of Government Relations Chris Mitchell is obviously in constant conversation with them, so he would be a good source—they're looking at how to incentivize private investment. They recognize that any amount of support that the Commerce Department or the federal government provides would be limited; not just how to move beyond creating subsidies, but to really create long-lasting investment.

What they would like to do is almost match private investment so that it can, in ways,

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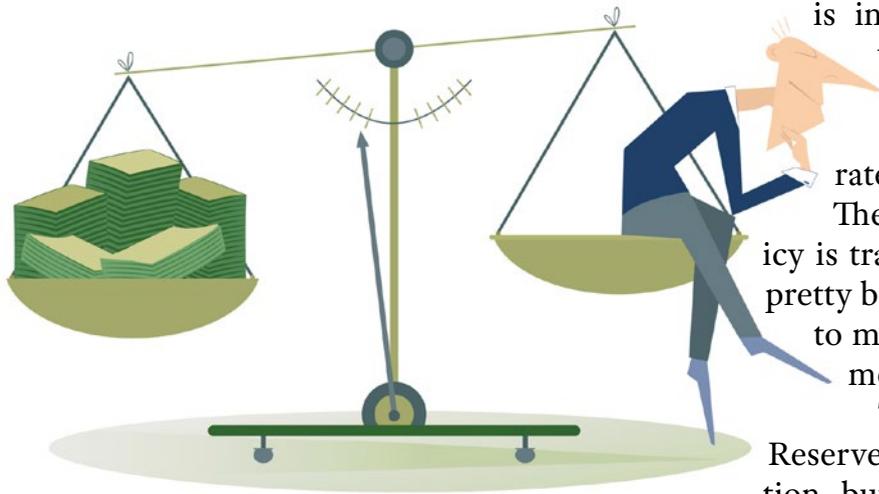
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increase the rate of return for private investors. Then you start to get attractive rates of return that would draw in private equity and others that are historically looking for much higher rates of return, like 30-, 40-, 50%-types of rates of return. It's hard for them to be convinced to move into certain parts of manufacturing where it doesn't look like those rates of return could be realized. But if the investment is matched and essentially subsidized by public finance, by government, then those types of rates of returns become available. Washington is looking at that.

The U.S. Commerce Department is really trying to understand the electronics industry. What's driving decisions within electronics manufacturing from the OEMs all the way up the supply chain. What meaningful levers could we use to make smart decisions that create universal win-win situations for investors, manufacturers, and ultimately, consumers at the other end of the supply chain.

Johnson: Our readers are working on their strategic plans for 2023. What's your advice to them right now?

DuBravac: As much as the last 24 months have been a challenging environment, the next 24 months will be equally challenging, but for different reasons. The probability that we end up in a recession is growing. The Federal Reserve

is in a very difficult spot right now, where there is a very strong economy, very high inflation, and very strong motivation to raise interest rates aggressively to lower inflation.

The problem is that monetary policy is transmitted into the economy with a pretty big lag. So, as interest rate hikes tend to materialize, we see the full effects six months or so after they've raised rates.

The challenge for the Federal Reserve is to raise rates to combat inflation, but they'll only know where they are six months from now. The challenge is that they'll be raising rates into a slowing economy, and that they'll ultimately overshoot and tighten too much too quickly. Normally, if inflation rates weren't this high, they could take time. They could raise rates slowly and allow those rate hikes to have full transmission into the economy. But they don't have that luxury now. Companies are making decisions in an economic environment where it looks like the probability of recession is growing. I say there's probably a 50% chance we're in a recession next year. If you look at any of the CEO surveys, they say the probability is higher. From our own sentiment survey that we published for June, almost 80% of executives are concerned about a recession in 2023.

That cloud hangs over investment, capacity, and other decisions that executives are making right now. That's why the underlying industry that companies are in is becoming so important. If you are in the right space, you won't feel the economic downturn quite as significantly. The jury is still out as to the extent of any recession, how strong or muted it might be. If we have a shallow recession in 2023 and we move out of that, then I don't think that's too much to worry about. If we're in an environment where we have high inflation rates and low growth rates, that becomes a problematic environment because you've got workers who are wanting higher salaries, but the underlying growth isn't there to support higher salaries. Going into this

environment, the industry or subsectors that you're in become very important.

Johnson: That becomes an exercise in strategic planning to figure out whether you need to invest, pivot, or exactly what you need to find the right spot for you based on your skill set.

DuBravac: This year, as companies enter that strategic planning period, it is especially important that companies review their portfolio not just from their assets, but where their production capacity is going. What are their portfolios of products and services that they are producing.

Johnson: You mentioned that the Federal Reserve doesn't have the advantage of time to make slow changes and let them play out entirely. They don't have that opportunity this time around. Can you explain?

DuBravac: It goes back to this idea that it takes about six months for interest rates to be fully transmitted into the economy. In a normal environment, if you felt like things were overheating a little bit, you raise interest rates, then wait and see how that plays out. If it has the desired effect where it slows growth, keeps prices well contained without raising unemployment, then you're good. If you find that, after two or three months, it's not really having the full effect that we need, then you can raise interest rates again, and maybe you move another 25 basis points. You have time in which to raise interest rates over a longer time horizon as well as you can do smaller moves. When you're looking at 8% inflation and very low unemployment—the situation we're in—the Fed is betting that the economy can endure pretty high interest rate increases over a short period of time without stalling and without falling into recession.

I know the Fed is looking at job openings. Normally, the Fed is trying to balance these two mandates of low unemployment and low

inflation. In some ways, they compete against each other because you can get low unemployment with low interest rates, but you don't typically get low inflation with low interest rates. It's the opposite. The Fed is betting that they can raise interest rates and it won't stall the economy, but it will cause companies to not be looking for so many jobs. It will moderate the labor market through the job openings. But on the tech side, companies are already announcing hiring freezes. Netflix has done some layoffs. You have some companies that are already into the layoff stage.

The Fed is betting that they can raise interest rates and it won't stall the economy, but it will cause companies to not be looking for so many jobs.

Johnson: Intel just did this recently.

DuBravac: It's surprising news from a company like Intel where you've got strong demand. The struggle for the Fed is it will need to move rates aggressively higher to combat inflation, and they won't know the full impact of those rate hikes for some time. By the time they are fully absorbed in the marketplace, we could be in a meaningful recession, which would then force them to reverse course, if they could, but that will be very difficult to do if inflation is still high. They're going to potentially get stuck in this Catch-22.

Now, the good thing about the U.S. is that we do have strong underlying growth, so the Fed's problem is very different than central banks in other parts of the world. The Fed's problem is high inflation, but in an environment where



there is still strong growth. Europe is looking at high inflation in an environment where there isn't strong growth. They must move much more delicately and be much more tentative than the United States.

We're probably looking at another 50-basis point hike here at the next meeting, but there are definitely talks. I haven't looked at the future's market to see what's priced in, but there are talks of maybe they'll move 75 basis points given the inflation numbers that we got recently. My sense is the Fed feels like they have the luxury of being able to move aggressively because unemployment is low and there are many job openings. The rest of the economy, the rest of the world, doesn't have that luxury. Things are slowing. Asia is not facing quite the inflation rates that we have here, but Europe is definitely slowing at the same time that they have very high inflation rates. That's a very difficult environment to be in.

Johnson: In closing, I wanted to talk about the emergence of some very focused advocacy groups in the United States—USPAE and PCBAA. Obviously, the IPC has been involved in advocacy on a global level, which includes some in the U.S. Do you feel these organizations are having an impact?

DuBravac: Yes. My read on Washington is that they are more receptive than ever, and that you have some people who are really wanting a good outcome, and really wanting to understand our industry. There's a desire to understand the factors that cause it to grow or move, and the forces that will drive investment, to understand the nuances of our industry. I don't know that I've really felt that in the past.

Johnson: Is there anything else you would like our readers to understand about the current economic climate or another topic?

DuBravac: I would point to some of IPC's research. That sentiment content we publish every month gives a good sense of how the industry is feeling. You see the mix of emotions. They report high and rising costs. They report pricing pressure when it comes to materials and components as well as labor. At the same time, they talk about strong pent-up demand in terms of backlog. This last month, we saw that profit margins are coming under pressure. This is a challenging environment for manufacturers—how to price in an environment where your costs are rising is a challenge, and companies haven't been in this environment for a very long time so they're learning. That's a piece that they definitely need to incorporate. Some of the data shows that. Concerns around inflation and recessions from the most recent study were very interesting as well.

Johnson: Great. Thank you, Shawn. **SMT007**

The heat is on!

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Volume 2



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MilAero007 Highlights



Ventec's Book on Thermal Management: The Summer Sequel You've Been Waiting For ▶

I-Connect007 is excited to announce the release of the second title in Ventec's series on thermal management, *The Printed Circuit Designer's Guide to... Thermal Management with Insulated Metal Substrates, Volume 2*. This second volume covers the latest developments in the field of thermal management, particularly in insulated metal substrates.

Foundations of the Future: Making Connections in Milwaukee ▶

The IPC Education Foundation was fortunate to attend two events in the Milwaukee, Wisconsin, area. Wendy Gaston, business development manager, represented the IPC Education Foundation at these events, and it was wonderful to learn more about her experiences at them.

Standard of Excellence: Respect for the Most Preferred Partnership—Your Employees ▶

There are many types of partnerships in business, but without a doubt the most important one is with our employees. Considering today's labor shortages, it's critical that we establish true and appealing partnerships with our employees.

Time to Get Serious About CMMC Readiness ▶

Divyash Patel of MX2 Technology is a leading cybersecurity expert who's sounding the alarm about getting your company into a state

of readiness. But he's not yelling fire in a theater. Whether it's aligning with DoD's CMMC, or just ensuring your company's data and processes are protected, Divyash can see what's coming. "This is a must-have compliance program," he says. "It needs to be taken seriously and maintained."

One World, One Industry: Opening New Opportunities in Mexico ▶

IPC and WHMA have long supported the electronics assembly and wire harness manufacturing industries in Mexico, but recent regional growth coupled with supply chain disruptions necessitated a closer relationship. Lorena Villanueva, the new director of IPC Mexico, will be based in Mexico City and her presence will help IPC provide better support, training, and engagement with Mexico-based companies and personnel.

Zentech Appoints Rich Fitzgerald, Experienced EMS Leader, as Chairman of the Board ▶

Zentech Manufacturing is pleased to announce that Rich Fitzgerald has joined the business as Chairman of the Board.

Ultra Selected in Six of Seven Categories for USAF ABMS \$950M IDIQ Contract ▶

Ultra has been awarded a \$950 million ceiling indefinite-delivery/indefinite-quantity contract for the maturation, demonstration, and proliferation of capability across platforms and domains, leveraging open systems design, modern software, and algorithm development in order to enable Joint All Domain Command and Control (JADC2).

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A Framework for Managing Supply Chain Disruption

Feature Article by Chintan Sutaria
CALCUQUOTE

Recently, the 200-plus companies that use our software to power their digital supply chain processes have been, half-jokingly, pondering the same line during period customer success meetings: “If only CalcuQuote could create parts out of thin air.” It was asked often enough that we made it into our April Fool’s Joke of 2022¹.

Since our inception in 2014, we have been solving supply chain challenges. Before it became a running joke of creating parts from

thin air, we saw the data signaled trouble ahead. The data showed that component shortages would increasingly worsen until the flow of materials became unreliable, so we decided to devote a significant amount of our resources to solving this very serious issue. I’ve put together a framework that can be applied to supply chain disruptions and which demonstrates how a more digitally connected supply chain can help.

The Framework

There are four stages of supply chain disruption. As disruptions become more prolonged, they require different solutions.

Stages of Supply Chain Disruption

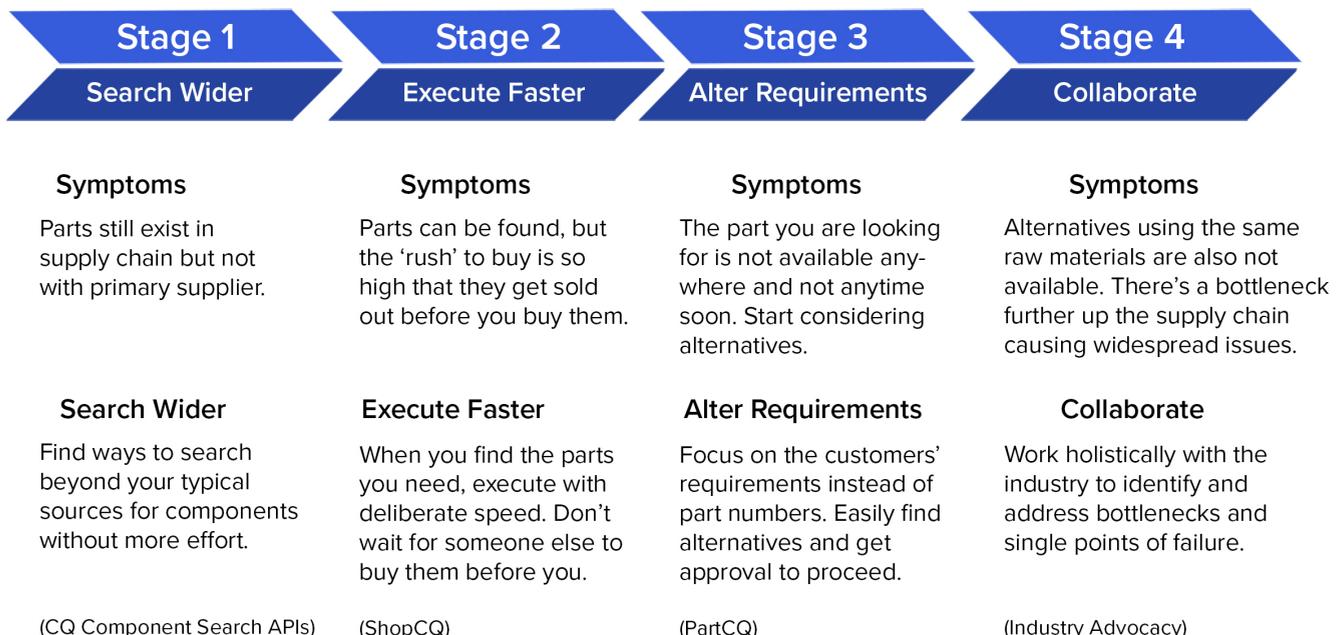
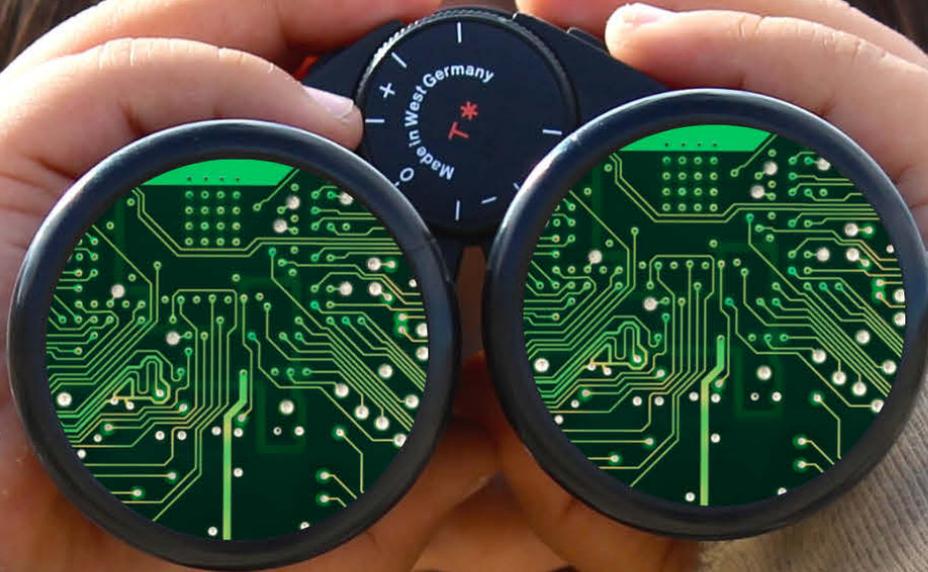


Figure 1: It’s useful to recognize the stages of a supply chain disruption.

Printed Circuit Boards **LOOK NO FURTHER**



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Stage 1: Search Wider

This stage of supply chain disruption is characterized by components still being available in the marketplace, but not necessarily easy to locate. Maybe your most preferred suppliers no longer have the part, but a secondary supplier does, or maybe the supplier asks you to check back again later for updated lead times.

Real-time API Integration

It's important to access real-time, account-level data via application program interfaces (APIs). These provide the ability to access stock availability, lead times, costs, and more by using your contract information. Accessing real-time data allows you to gain knowledge about the details that matter in a precise moment while keeping you up to date on any sudden changes.

Contact Off-line Suppliers

Another best practice: Stay seamlessly connected to your supplier representatives who don't have API capabilities. As you rely more on a broader supply base, managing this process through email will not be easy. Look for shared digital workspaces where you can manage communication between you and your suppliers so that both parties can stay organized and collaborate more seamlessly. This creates clearer and more efficient communication so you can focus on making the right decisions together.

Stage 2: Execute Faster

You've done the hard work of locating parts from a supplier, but by the time you send the purchase order, you learn the parts have been sold to someone else. You are now in the second stage of the supply chain disruption. It's not enough that you're scouring your supplier contacts for parts, because now everyone else is as well. You need to be first to place the order. That's why it is important to add speed, agility, and efficiency to your procurement process.



Chintan Sutaria

Proactively Manage Risk With Your Customer

A volatile supply chain market requires even more communication with your customers to manage expectations and convey risks. During the quoting and purchasing process, keep your customers informed by flagging any materials at risk from limited availability, price increases, or if you are having to resort to alternative sources to procure the necessary materials.

Push Notifications for Parts

Sometimes getting the parts is about timing your search to be right after the inventory gets posted. Instead of tediously pinging your supplier for updated stock and price information, use automated searching services to create a watchlist of parts that alerts you. You can get an email notification whenever it is in stock and be in control of how frequently you want to check for the parts' availability.

Automate Order Execution

Once you've found the parts you want, it is important to place the order quickly and efficiently before they get purchased by someone else. It is key to API-based ordering, or effi-

ciently updating your outstanding purchase orders. Place orders in real-time through APIs for instant order confirmation to secure your inventory.

Link Your Quoting, Sourcing and Purchasing Processes

Use automation from quoting to purchasing for your standard components to focus your time on strategy and exceptions rather than mundane transaction processing. In a time where you are already so busy, you should not waste time requoting everything again when it comes time to purchase. Instead, link your quoting and purchasing processes so that data is shared between the two and can be easily updated based on current market conditions.

Stage 3: Update Requirements

If the parts you need aren't available anywhere in the supply chain, no amount of searching and process efficiency will help. It's time to start looking at your purchasing requirements to see whether alternate parts will be acceptable. Having multiple sources for components on a BOM is a best practice during all supply chain climates, but it becomes crucial during advanced stage disruptions. Search for solutions to help you find and approve alternates so you can broaden your search criteria.

Component Databases

Several distributors offer suggestions for alternate parts, especially on passive components. These, plus other component databases such as IHS, Z2Data, and Silicon Expert, can be helpful at creating alternative sourcing options on your BOM. Integrating these data sources into your core quoting and purchasing processes through their API options can add significant efficiency.

Reference Your History

If you have solved a sourcing problem in the past, then reference it again today. By having

your quoting and purchasing activity properly organized in a database, you can look up alternate parts or vendors you have gone to previously.

CalcuQuote is compiling the next generation solution for managing AVLs, part number aliases, and component search through a new product called PartCQ. Through an innovation in crowd-sourced data management and a heavy investment in machine learning expertise, we can take rough component descriptions and find corresponding part numbers, suggest alternates, and provide a confidence rating on whether two parts belong together.

Stage 4: Collaborate

This stage of supply chain disruption is the most taxing in terms of affecting manufacturing. At this stage, there is a deeper choke point in the supply chain that is having widespread impact across entire segments of components. Using alternate parts isn't always helpful because the demand has outpaced the supply for too long. At this point, it is time to collaborate as an industry to solve the root causes and create a more resilient supply chain for the future.

Peer-to-peer Component Trading Community

There are millions of dollars' worth of inventory with no active demand from within the warehouses of OEM and EMS companies right now. Many of those parts will never find a use again and will eventually be discarded. But some of those parts are on the shortage list of a buyer who is diligently checking with their suppliers to find it.

With the price volatility of hard-to-find components, and with the help of IPC and various OEM/EMS industry leaders, we have developed a solution to help connect buyers of OEM/EMS companies directly with the OEM/EMS companies who have the inventory sitting on their shelves.

Over the course of a few months, hundreds of executives attended roundtable discussions

to deliberate and determine a fair way to run a community trading platform. Today, these companies collectively trade parts through a virtual stockroom combining the inventory of 60-plus OEM/EMS companies with more than 150,000 unique part numbers.

Collaborative Problem Solving

As one example, during the first year of the recent pandemic, we launched the virtual AccelerateEMS conference. With more than 350 attendees over two days, we saw overwhelming enthusiasm for what they learned and the connections they made. It is now a recurring event.

We plan to host our third industry conference, Aug. 30-31, in-person for the first time. We expect to see attendance from distributors, buyers, technologists, leaders, and visionaries. We are seeking to convene the best people in the industry, with the goal to learn and discuss these problems through roundtables, panels, and presentations. **SMT007**

References

1. calcuquote.com/happy-april-fools-day.

Chintan Sutaria is founder and president of Calcuquote, a quoting and supply chain software business serving more than 200 electronics manufacturers in 25 countries.

ClearBuds: First Wireless Earbuds That Clear up Calls Using Deep Learning

As meetings shifted online during the COVID-19 lockdown, many people found that chattering roommates, garbage trucks and other loud sounds disrupted important conversations.

This experience inspired three University of Washington researchers, who were roommates during the pandemic, to develop better earbuds. To enhance the speaker's voice and reduce background noise, "ClearBuds" use a novel microphone system and one of the first machine-learning systems to operate in real time and run on a smartphone.

ClearBuds use a dual microphone array. Microphones in each earbud create two synchronized audio streams that provide information and allow us to spatially separate sounds coming from different directions with higher resolution. Second, the

lightweight neural network further enhances the speaker's voice.

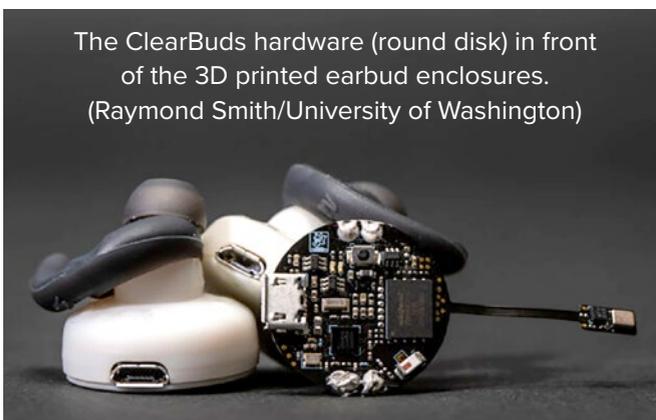
While most commercial earbuds also have microphones on each earbud, only one earbud is actively sending audio to a phone at a time. With ClearBuds, each earbud sends a stream of audio to the phone. The researchers designed Bluetooth networking protocols to allow these streams to be synchronized within 70 microseconds of each other.

The team's neural network algorithm runs on the phone to process the audio streams. First it suppresses any non-voice sounds. And then it isolates and enhances any noise that's coming in at the same time from both earbuds — the speaker's voice.

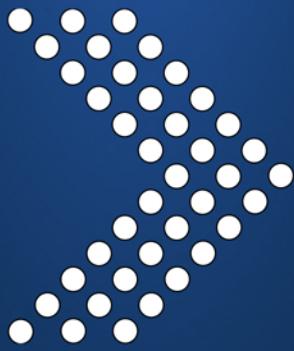
"Because the speaker's voice is close by and approximately equidistant from the two earbuds, the neural network can be trained to focus on just their speech and eliminate background sounds, including other voices," said co-lead author Ishan Chatterjee, a doctoral student in the Allen School. "This method is quite similar to how your own ears work. They use the time difference between sounds coming to your left and right ears to determine from which direction a sound came from."

When the researchers compared ClearBuds with Apple AirPods Pro, ClearBuds performed better, achieving a higher signal-to-distortion ratio across all tests.

(Source: University of Washington)



The ClearBuds hardware (round disk) in front of the 3D printed earbud enclosures.
(Raymond Smith/University of Washington)



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Supplier Highlights



Mycronic Evaluates Listing Axxon ▶

The Board of Mycronic AB has decided to investigate the possibility of listing Axxon, the core of the High-Volume division, on the STAR market of the Shanghai stock exchange and floating a minority stake. If feasible, the listing could take place during 2024.

Successful Swiss Technology Days of Hilpert electronics AG at Rehm Thermal Systems

Under the motto “Cutting-edge technologies for electronics manufacturing,” the Technology Days event on 6–7 July 2022 brought customers and interested parties from Switzerland to Rehm Thermal Systems in Blaubeuren, Germany.

Southwest Systems Technology Now Offers X-ray Inspection from VJ Electronix

Southwest Systems Technology, Inc., a leading manufacturing resource, is pleased to announce that it now represents VJ Electronix, Inc. X-ray inspection systems in the states of Texas, Oklahoma, Arkansas, and Louisiana.

Thermaltronics Embraces Strict Quality Control for Superior Solder Robots

Thermaltronics USA, Inc. is pleased to announce that its solder robots go through extensive quality control procedures to maintain the company’s position as the most awarded, accurate, and versatile solder robot on the market.

Lean Digital Thread: The Secure Digital Thread ▶

Securing intellectual property has become a priority for manufacturers, and recent reports from the U.S. and EU governments highlight the risks and direction for securing the supply chain. Let’s look at some of these recent publications and how they affect manufacturers.

Altus Looks Back at 10 Years of 3D SPI Innovation ▶

3D solder paste inspection (SPI) systems have been a game-changer in reliable electronics, ensuring that complex PCBAs are fail-safe. A trailblazer for this is Koh Young.

Electrolube’s Polyurethane Resin a Success for Tier 1 Automotive Supplier ▶

MacDermid Alpha Electronics Solutions is pleased to announce a successful collaboration between its electro-chemicals brand, Electrolube, and a Tier 1 automotive supplier.

Dymax Announces New Partnership with Quantum Systems ▶

Dymax, a leading manufacturer of rapid curing materials and equipment, proudly welcomes its newest sales partner, Quantum Systems, to its growing list of business partnerships.



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Printed Circuit Boards: Past the **Lobby** and Onto the **Floor**



Feature Interview by the I-Connect007 Editorial Team

Editor's note: This interview was conducted on July 6, 2022. At the time of our discussion with U.S. Rep. Blake Moore (R-Utah), House Resolution 7677 (HR 7677) had been introduced to Congress, comprised of an investment program and a tax credit for purchasers of printed circuit boards. In our interview, we discussed details about both key sections. On July 7, an amendment to HR 7677 was published, in which the tax credit portion of the bill had been removed. This interview has been edited to remove the tax credit-specific sections of the conversation.

There has not been a time in recent memory when the U.S. legislative body is putting as much focus on the microelectronics indus-

tries. One bill, the CHIPS Act, was signed into law last year. A new bill introduced this year seeks to allocate funding for printed circuit board fabrication. In this exclusive interview, our team spoke with Travis Kelly, CEO of Isola Group and president of the Printed Circuit Board Association, and U.S. Rep. Blake Moore (R-Utah), who has co-sponsored the bill now before the House. Travis and Blake both express optimism about onshoring domestic production, but the realities of the legislative calendar may pose some risks.

If you would like your voice to be heard, reach out to your U.S. legislators, or visit one of the associations mentioned in this interview: PCBAA, IPC, or USPAE. Each is lobbying on your behalf.



20
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PRE-REFLOW AOI REDUCES COSTS, INCREASES YIELD, AND MAXIMIZES QUALITY

Koh Young's AI engines help manufacturers analyze and optimize the process by managing data from connected SPI, pre-reflow AOI, and post-reflow AOI systems. Integrate multipoint inspection with Koh Young's SPI, pre-reflow AOI, and post-reflow AOI to optimize the assembly process while increasing quality, reducing defects, and minimizing costs.



The multipoint measurement and process data collected from SPI, pre-reflow AOI, and post-reflow AOI systems, combined with data from printers, mounters, and reflow ovens will allow manufactures to deliver an AI-powered, zero defect, self-healing line. Indeed, the quality of data is more important than the quantity of data to create effective and reliable solutions with high value proposition.

Yet, it is the combination of reliable data, along with a statistically relevant quantity of data, is what delivers next level of relatable results. When manufacturers integrate multipoint inspection like SPI, pre-reflow AOI, and post-reflow AOI, they can optimize the assembly process to increase quality, reduce defects, and minimize costs. These inspection solutions are laying the foundation for a smart factory, while revolutionizing process optimization.

Nolan Johnson: Thank you, Travis and Rep. Moore, for joining this conversation regarding the Supporting American Printed Circuit Boards (SAPCB) Act of 2022. Our readership is the electronics manufacturing sector that designs, manufactures, and assembles those printed circuit boards, so this legislation is near and dear to their hearts and wallets. We're delighted to have you here. Would you provide some background on the genesis of this proposed legislation?

Travis Kelly: As you know, the printed circuit board industry in the United States has gone from roughly 2,000 companies down to 145, which is very draconian in terms of the overall resiliency of that domestic supply base. We are constantly looking at the different levels of competition within the industry; ultimately, we need to level the playing field. In some cases, the U.S. printed circuit board fabricators and assemblers are actually competing against countries, not companies. This means competing against foreign subsidies in terms of some of the competition that arises. We want to level the playing field so that the U.S. domestic industry, as it relates to microelectronics, is not only resilient and sustainable but also secure. HR 7677, supporting American-made PCBs, is important to the overall health of the domestic industry.

Rep. Blake Moore: As I work throughout my district, I haven't seen anything more consistent. In my role, I'll interact with leaders from car dealerships to manufacturing operations. I was just at a meeting this morning where the topic was the dire need for chips. They told me they're having to pay more than what they had built their cost models on, and they are desperately in need of product. I've never seen something so ubiquitous across our economy that needs this big family of semiconductor capability. We need to shore up our supply chain; it's tied directly to national security and my distrust of Chinese-made products. I believe



Rep. Blake Moore

legislation like this will help onshore production and will address the supply chain issues regarding national security.

Passing this legislation will show industries that we know they're working hard but it's virtually impossible to do the job that they need to do at scale. I'm in contact with a company right now that manufactures sensors for weather-related issues and builds predictive models for numerous government agencies. They can't do their job because they can't even get access to this material. This is where we can step in and help. We shape the legislation, as Travis mentioned.

Johnson: Is it fair to say that the primary objective of this legislation is to both level the playing field and increase availability in the supply chain?

Moore: For me, the primary objective is about what's important long term. We know we have ceded so much of our manufacturing capability to adversarial nations. Looking at the big picture means pulling that back and using



Travis Kelly

those opportunities of scale to build back that network in the U.S. better. I want to bolster domestic printed circuit board production, while strengthening supply chains. We must complement semiconductor incentives by encouraging domestic PCB manufacturing and addressing the acute need to reduce supply chain disruptions.

Let's make sure to bolster our capability, our workforce, and the network. While our first foray into this topic was defense related, we know it naturally broadens out to more commercial use. Defense is a good place to start because we know we cannot trust some adversarial nations. Let's build from there and use increased defense production to scale up. Ten years down the road, we will be up and running, and have a lot more capability than we had before. We will need to have the workforce to take on that need. Utah, for example, has a really strong manufacturing capability.

Workforce issues are tough, but we have the capability. The best thing for our economy is to have a strong manufacturing base with a

diverse workforce and production-based capability because it gets you through the economic downturns. You're not just wholly reliant on a consumer-based economy. It's important to think long term.

Kelly: Rep. Moore is spot on. The question does need to be bifurcated between short-term and long-term goals. HR 7677 will provide that initial investment in the domestic industry. There's roughly \$3 billion earmarked for an expansion and modernization of facilities and equipment as well as workforce development. That's the adrenaline that the microelectronics ecosystem needs as it relates to printed circuit boards. If you look at overall defense spend, you're really looking at roughly 3% of the overall market, which is not sufficient to create a sustainable domestic industry.

We need to look at the different critical end-uses. If we all agree that defense is a critical end-use infrastructure—like 5G, 6G, medical, commercial, aerospace, or banking—to support that we need a trusted and resilient supply. Then you have an aggregated demand of roughly 26% of the global market that I think would be sustainable. We're not myopic; we know we need to be protected both economically, and to Blake's point, for national security. That's where we need to get our voice around this, and that's why HR 7677 supporting American-made PCBs is so important.

Barry Matties: Do you see the number of shops increasing in the long term as well? What projections are you making?

Kelly: I get that question a lot: What is the right number? I will often respond by saying that 4% global market share being manufactured in the U.S. is definitely not the right number and 100% being manufactured in the U.S. is also not the right number. Similarly, you might see consolidation with several companies, so does 145 become 120? Maybe. Do you see new companies starting? I don't think so. I

think we'll see consolidation efforts and some investment in expanding current PCB fabricator and assembler footprints—similar to what Isola Group did. We invested \$40 million into Arizona to expand our footprint and automate our facilities. I expect to see very similar activity elsewhere in the United States. I don't see too many new entrants coming in.

Moore: This goes back to the adage, "Success breeds success." With the tumult that exists in the South China Sea, moving forward I strongly feel this is an area where we can grow and start to pull production back to the United States and partner countries. We've done it well in the past. I love the push and pull concept there. You see where the incentives are. What can we do to incentivize that and get more capability back here?

Matties: Will we see more captive facilities? Will this incentive drive captive OEMs to set up their own PCB fabrication?

Kelly: Both Barry and I know there are some OEMs that are doing the vertical acquisitions, even though it's greenfield, they say it's vertical acquisition and doing the captive approach. Many OEMs are concerned about the resiliency of the supply chain. Once again, COVID taught many lessons on numerous fronts and one happens to be that the global supply chain, although it can be effective, can wreak havoc if you over-index, especially at the end use. I think you'll see a nice hybrid approach: some captive, some consolidation. You may even see some, I'll say Asian, competitors start building brick and mortar in the U.S. Typically, economies will evolve when they're forced into innovation and into creating new strategies to go to market.

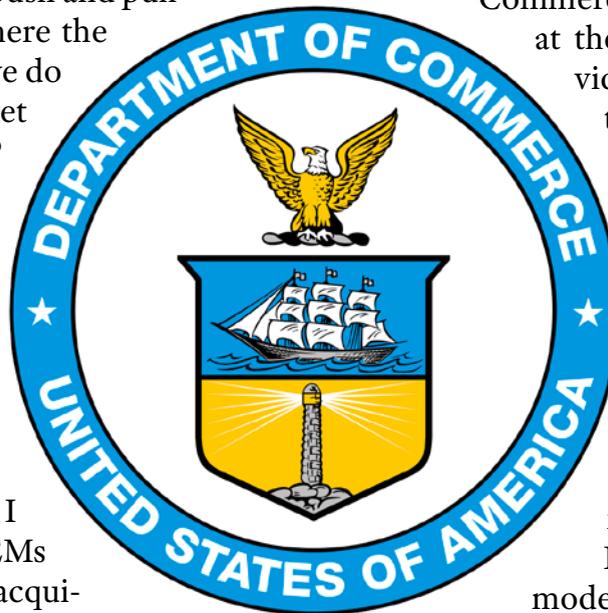
Johnson: Travis, we've already discussed a potential consolidation, but also new capabilities and capacity build-out in existing companies. We touched on whether new companies might start up to fill into this space, and we've just mentioned captive sites. We've already identified four different ways the industry might create more resiliency in printed circuit board fabrication. How does HR 7677 enable these approaches? How do we expect to see the funding used?

Kelly: We will focus on the \$3 billion investment from the government. From an investment standpoint, the U.S. Department of Commerce is always going to look at the companies that are providing that best-in-class technology, that can provide the great workforce opportunities, especially in underserved areas of the country, and that will be successful from a competitive global economic standpoint. There will be certain criteria relative to how that money gets spent.

It will be spent on modernization, expansion, and workforce development to scale up.

We need to have enough brick and mortar, the right workforce, and the R&D to stay on top of that technology curve to ensure the supply is both trusted and resilient. That's why this bill is so important for the domestic industry, because that \$3 billion original investment is the catalyst behind beefing up the industry, ensuring that the infrastructure and workforce development exist, and it's a really nice adrenaline shot to do what we say we can do.

Johnson: How do HR 7677 and the CHIPS Act work in sync? How does that happen?



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Moore: They complement each other. This PCB-focused effort is similar to the effort to reassure manufacturing for semiconductors. They're both trying to accomplish a similar objective and the general product family is similar. This is about a DoD call for domestic investment and it provides for the proper incentives necessary to meet this growing challenge. I'm working on it as a conferee with both the House and the Senate China bills. Not everybody is even comfortable with the Senate's USICA legislation, but then House Speaker Nancy Pelosi complicated the process by adding a lot of her unrelated priorities into the COMPETES Act. It extended the China legislation far beyond where people were comfortable supporting it.

Now in trying to reconcile those two, we know we need to get the CHIPS Act going, and it is broadly supported. The hope is that even if the wider China legislation simmers and fizzles out throughout this tumultuous campaign season, there's a potential the CHIPS Act could

I'm not sure that printed circuit boards have ever made their way to an active discussion on the floor of Congress, and how the two bills align. They're mutually exclusive. One was introduced with the CHIPS Act. This one, HR 7677, was introduced a couple months ago. I like these discussions because it's beginning to resonate, meaning it's not just semiconductors and it's not just printed circuit boards. It is a very complex microelectronics ecosystem where the chip is the brain, and the PCB is the body. Neither one can work without the other. Printed circuit boards are more than just boards. There's all the componentry as well. One doesn't work without the other.

For the first time in a long time, legislators see that this needs to be a holistic approach. The discussion is much broader than one or the other. To fix the root cause of problems you can't just go after the symptoms. That's why this legislation is so important.

If you really want to have a microelectronics ecosystem that is trusted, resilient, and sus-

get pulled out and passed separately, but it's the main negotiating piece motivating the entire conference process for many Republicans. I can't stand this process. I don't think it's the right approach for the American people, the manufacturers, and the people working and paying their taxes who are frustrated that our government can't come up with reasonable solutions. I want to be a reasonable voice, and I've come in on bipartisan legislation, in particular this PCB legislation. We must move the ball forward and not get hung up on politicizing the process of passing key legislation.

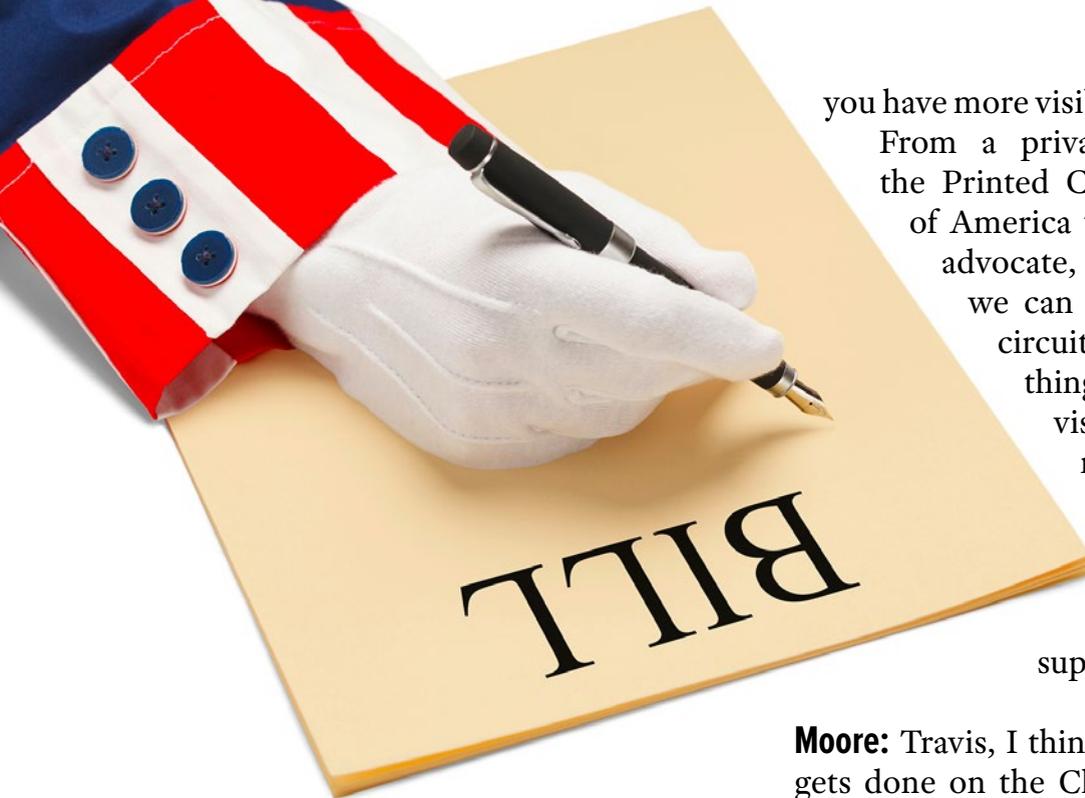
Kelly: I want to thank Reps. Moore and (Anna) Eshoo, D-Calif., for co-sponsoring this bill.

tainable, then you must look at all the different aspects and activities that it takes to ensure that supply chain is resilient. It's a lot more than just semiconductors. That's why we always say chips don't float; they must be embedded into a board to function. This is how I see the conversations aligning with the CHIPS Act and HR 7677.

Johnson: As we're recording this interview, it's the July 4 congressional break. Congressman Moore, where is HR 7677 in the process?

Moore: It has been introduced and it's on the front end of the process. We are closely watching what's going on with the China legisla-





you have more visibility into that than we do. From a private industry standpoint, the Printed Circuit Board Association of America will continue to educate, advocate, and legislate as much as we can on behalf of the printed circuit board industry. The best thing we can do is to get more visibility and make people more conversant on what the issues are. We must keep driving home the idea that we need a trusted and resilient supply chain.

tion. To give you a sense of where things are right now, there are three more weeks in July and then you have the August recess period. We meet for three weeks in September, then we recess in October. It's not the schedule I would choose, but that's the way an election year works.

I hate to be the bearer of bad news, but it's going to take quite a bit in that short timeframe before the election season comes to get anything done outside of what's already in the pipeline. You might see something late breaking as we approach the end of the year, but if the House flips, Democrats are going to offload all the appropriations responsibilities back onto the Republican side.

In the meantime, last year's NDAA (National Defense Authorization Act) succeeded in including language on printed circuit boards and that was enacted into law. So, we have seen more traction on the NDAA, but this particular bill, HR 7677, is still on the front end.

Kelly: Blake, that's a consistent message that we're hearing from everyone: With midterm election distractions, it's a long putt to think this bill gets approved this year. But obviously

Moore: Travis, I think the lead-in can be what gets done on the China legislation. That can give us a sense for the appetite that exists, given that CHIPS and SAPCB are similar and working in concert. There's at least an indicator that will tell us what might come of this.

Matties: Travis, what can the fabricators do to help support and move this along?

Kelly: PCBAA, as well as our colleagues IPC and USPAE, are sending a letter to the representatives of Congress signed by CEOs of domestic operations. As part of PCBAA, I have joined Will Marsh (VP, TTM Technologies) on Capitol Hill numerous times, meeting with Rep. Moore and other representatives, trying to get co-sponsors and further sponsors.

The key is to continue advocating for the microelectronics domestic industry. It's important and a needed resource that we provide. Rep. Moore said it right: It's national and economic security. We need to continue to drive those points home.

Johnson: Closing thoughts and remarks?

Kelly: From the Printed Circuit Board Association of America and all its members, we very much appreciate the work that Blake Moore

and Anna Eshoo have put into this bill. It's fantastic that the printed circuit board industry is getting visibility on the importance it plays in microelectronics. Thank you very much, Blake, and thank you, Anna, for co-sponsoring.

Moore: I want to thank our respective teams for all their effort. Will Marsh has been a valuable resource working with my chief of staff, legislative team, and my defense team.

This situation affects everybody. It is ubiquitous, and something that we never really grappled with before last year. We all know what circuit boards are, but I never got into the weeds until this role in Congress. Now I see how this touches every industry. When you can look closely at the national security side, it's worth putting in the time and effort.

Shoring up our national security supply chains is what our job in Congress is designed to do. The number of jobs and manufacturing plants just in Utah's 1st Congressional District is overwhelming. We must also ensure we have strong supply of rare earth and critical minerals, and we need to keep costs in check. In addition, we have amazing people running the companies that are relying on PCBs, and they're trying to provide government contracts, defense work, and just general commercial applicability. When something like this touches so many facets of our lives, we must find some reasonable solutions. I am very confident that the work that we've done is that right direction.

Matties: Thank you for putting so much energy into this. Congressman Moore, when you became aware of the situation, how surprised were you that we were so vulnerable?

Moore: It's my first term in Congress and I'm excited to talk about how I am trying to build a productive way forward, because it becomes such a blaring issue. I was very surprised to see how close this is to every industry. For example, as general consumers, we

all buy cars. It's a typical purchase that has occurred seamlessly for decades in our nation. Now we have vehicles waiting on the lot for technology components that we know how to build, but we are just facing a major disruption. That's very concerning. The pandemic highlighted some areas of our national economic armor that are vulnerable, so I was thrilled to put some elbow grease behind this.

Matties: Thank you for bringing it up to a high level of priority. Travis, thanks to you and the PCBAA for being such a strong voice for the PCB industry. Your results are already evident.

Kelly: Great. Thank you very much. **SMT007**

FOR YOUR INFORMATION

CHIPS for America Act: The Creating Helpful Incentives to Produce Semiconductors for America Act incentivizes investment in the U.S. semiconductor industry. While it was passed in January 2021, a funding package has not been approved by Congress.

HR 7677: Introduced in House, the Supporting American Printed Circuit Boards Act of 2022 is intended to provide incentives for the domestic production of printed circuit boards, and for other purposes.

USICA: United States Innovation and Competition Act of 2021 addresses U.S. technology and communications, foreign relations and national security, domestic manufacturing, education, trade, and other matters. The text of this bill substituted the text of the America COMPETES Act of 2022. The amended bill was passed by the Senate and sent back to the House.

Utah's 1st Congressional District: Serves the northern area of Utah, including the cities of Ogden, Logan, Park City, Layton, Clearfield, and the northern half of the Great Salt Lake. It does not include a portion of Salt Lake County.

Supply Pain Points

85%

of engineers expect longer lead times over the next 18 months

Source: AVNET Research

73%

say shortages present a "very significant design challenge"

Source: AVNET.com

64%

say parts availability is driving design

Source: AVNET Market Insights

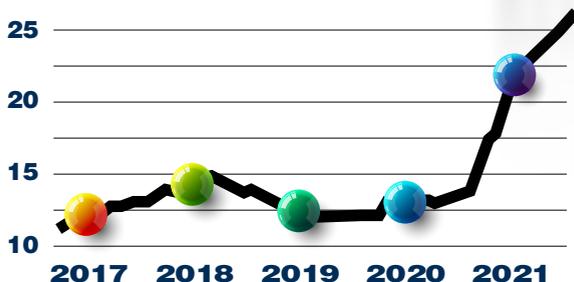
81%

expecting higher prices over the next 18 months

Source: AVNET.com



CHIP LEAD TIMES (WEEKS)

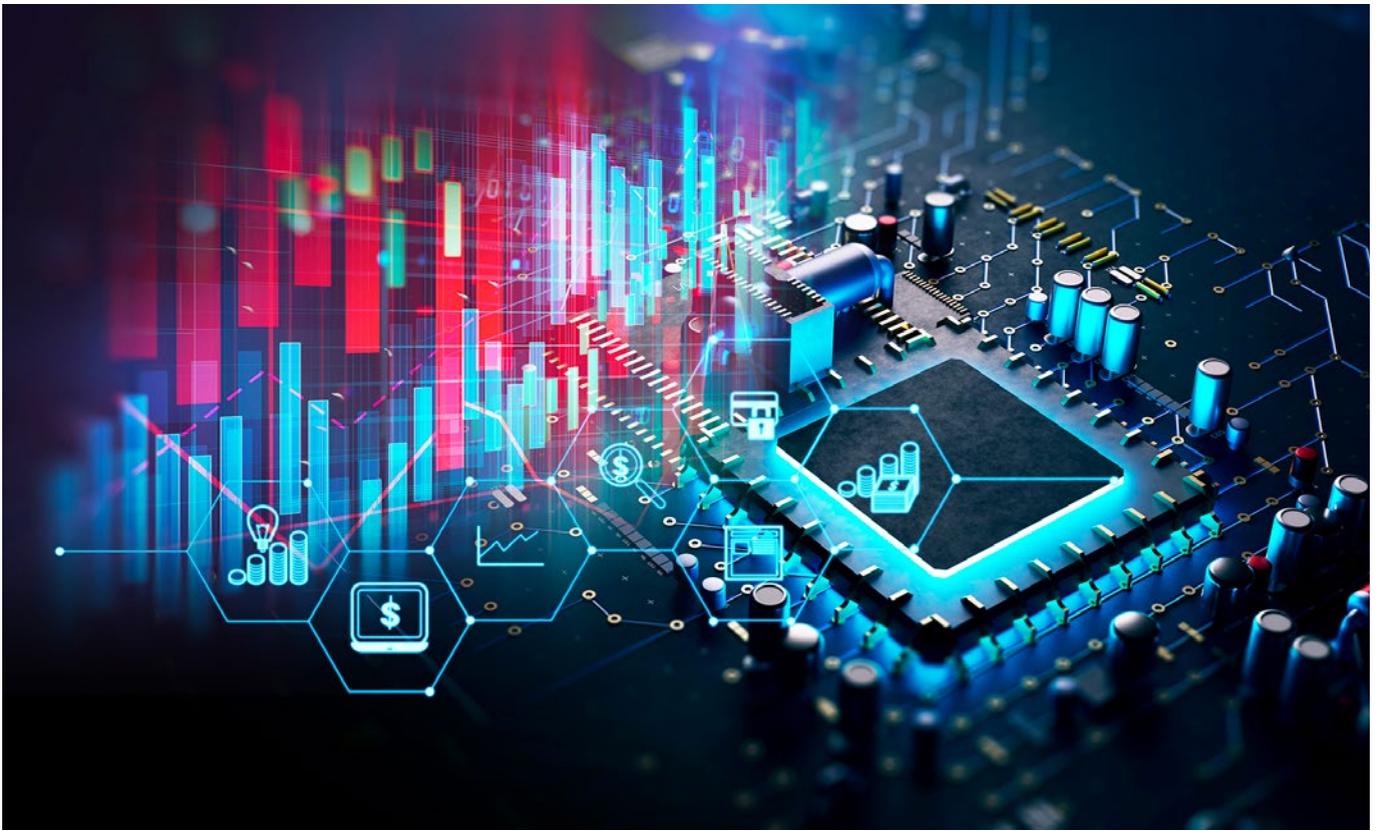


Source: Susquehanna Financial Group

COMPONENT LEAD TIMES (WEEKS)



Source: Sanmina



Thriving Through Greater EMS Collaboration

Feature Article by Christopher Peters

USPAE

The success of an organization often rests on the performance of its supply chains, especially the bonds between a chain's nodes. In the electronics industry, a company's relationship with its electronics manufacturing services (EMS) provider can be the deciding factor in its success.

EMS firms or contract manufacturers are the keystone of the industry. They make decisions on behalf of customers, have detailed insights into their extended electronics supply chains, and contribute significantly to the quality and performance of a customer's products. EMS companies are a crucial node in the electronics supply chain and just one example of how an organization's relationship with its trading partners can impact success.

When the Chips Are Down

Events of the past two years have clearly demonstrated the value of strong trading relationships. When materials become constrained, as in the recent microchip shortage or any of the pandemic-driven supply chain snafus, the companies that have those materials have a choice to make. Which customers will be put at the front of the line, and which will be placed at the rear?

Too often, company executives assume that since they are a large buyer, they automatically will be prioritized when supplies are constrained. Research has shown that this is not always the case, and that assumption can leave a company in a weakened position.

One such study is the work of Dr. Steven Melnyk, professor of operations and supply chain



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management at Michigan State University. His work on “earned preferential treatment”¹ showed that “buyers receive perks and benefits not earned by large volume purchases or by paying on time, but rather by being a good customer.”

In the case of EMS companies, being perceived as a good customer may come from sharing accurate demand forecasts, greater collaboration on production scheduling, involvement in the development of innovations and more. The key is having an ongoing dialog with trading partners to understand what is important to them and how both companies can better work together. There are plenty of examples where an EMS company has bent over backward to help customers that weren’t necessarily their largest one.

The key is having an ongoing dialog with trading partners to understand what is important to them and how both companies can better work together.

Seeing the Forest and the Trees

As the keystone of the electronics supply chain, EMS companies have significant industry and supply chain insights that their upstream customers quite often do not. In most cases, a large customer like the Department of Defense (DoD) will buy from a defense prime contractor, which buys from a third-tier supplier that then buys from an EMS company.

When the buyer (at whatever tier) turns over the bill of materials (BOM), it often identifies several authorized suppliers of the various components, ranging from printed circuit

boards (PCB) to passive and active electronic components. The decision on which of those authorized suppliers will be used is up to the EMS company, and that information is often not shared with the customer. In many cases, there is not a list of authorized suppliers, and the EMS company has even greater discretion on where the components are purchased.

Consequently, the one company that has the greatest insights into what is going into each product is the EMS company. Now, consider that these EMS companies are getting quotes and buying high volumes of components from providers all around the world. That results in EMS companies gathering a considerable amount of industry insights, like lead time and pricing, that again are often not shared with upstream customers. In this case, EMS companies have the greatest ability to see the entire picture in ways that many other electronics supply chain participants cannot.

You Won’t Find What You Don’t Seek

Being the keystone of the supply chain places a significant burden on EMS companies, and it also presents upstream customers with considerable risks. What if the EMS company doesn’t have the tools and relationships in place to properly manage its supply chain? Could its suppliers be at risk from financial issues, child labor law violations, conflict minerals use, and so on? How well does the EMS firm communicate with its customers about these supplier issues when they do arise?

There is also the question of trustworthiness. Customers must trust that EMS companies fully comply with requirements like export control and counterfeit detection. Aside from an initial site inspection, many customers do not regularly visit suppliers to validate compliance with requirements or seek out risks.

This problem is exacerbated in volatile times like those being experienced now. Shortages of everything from chips to capacitors to connectors increases the level of counterfeiting in the industry. As Matt Turpin, senior advisor

to the U.S. Partnership for Assured Electronics (USPAE) has noted, this problem is exacerbated since “this unregulated market has many non-transparent and unqualified players.” Prevailing conditions can only cause the rate of counterfeits to increase.

Any risks resulting from these and other issues ripple all the way downstream to the end user. When that end user is the warfighter, these concerns become particularly troubling when they cease being a risk and become an actual event.

Shrewd Tools to Tame the Risks

One answer to all these issues is to build strong relationships with EMS companies. Learn what it means to be a good customer for each to be well-positioned in tough times. Collaborate more closely with suppliers on all things related to supply chains, from demand forecasts to gaining greater visibility into their suppliers. The more open a buyer and supplier are with each other, the less likely those risks will come to fruition.

Stronger relationships also open new opportunities to create mutual value. When coupling the incredible insights and data that EMS companies have with a customer’s view into the future of demand, new possibilities may arise. Whether that be from reducing risks or increasing the success of new product introductions, merging insights that are currently siloed in buyers and suppliers can yield great results.

Finally, strengthen EMS selection criteria. Look for certifications like IPC-1791 that address issues ranging from counterfeit detection to supply chain risk management. Visit with EMS partners more frequently to establish a stronger dialog while performing spot checks that ensure requirements are being met.

Thriving vs. Surviving

The defense electronics industry is full of volatility, uncertainty, complexity, and ambi-

guity, which is often referred to as VUCA. The DoD has significant challenges in providing accurate demand forecasts for reasons ranging from siloed operations to limitations of funding and the federal procurement process. On the supply side, issues from world conflicts to material and capacity shortages make it difficult to meet today’s needs, much less the anticipated increase in demand.

On the supply side, issues from world conflicts to material and capacity shortages make it difficult to meet today’s needs, much less the anticipated increase in demand.

Greater collaboration throughout the supply chain is essential if companies are to succeed in a VUCA environment. As keystones in this process, EMS companies have the data, insights, and connections that can help its trading partners not just survive, but thrive. **SMT007**

References

1. “The lure of ‘earned preferential treatment,’” by Steven A. Melnyk, *SupplyChain Management Review*, March 1, 2021.



Christopher Peters is executive director of the U.S. Partnership for Assured Electronics. His work has been documented in several books and publications that include *The Wall Street Journal*, *Businessweek*, and

Supply Chain Management Review.



The CMMC 2.0 Countdown: Will You Be Ready When the **Clock Hits Zero?**

Article by Divyash Patel

MX2 TECHNOLOGY

If you influence IT decisions at your workplace, you need to hear this. If you make the decisions, you need to listen, not just hear: Unless you start acting on CMMC compliance now, you are putting yourself at a disadvantage—one that will take much more time to correct than you might expect.

Think of me as a spokesperson for the industry I represent: we are concerned about you. From what I've heard and seen over the last few months, too many of you are listening to suppliers, upstream and downstream partners, or other business owners on how seriously to take CMMC. As a result, far too much wishful thinking is guiding decision-making. So, listen to the experts.

The DoD says we can expect CMMC 2.0's final rules in March 2023. Given the delays, rollbacks, and revisions that have characterized the program's rollout to this point, I'd be very surprised if they miss this deadline. Sixty days after the rules come out, CMMC certification will be a non-negotiable requirement for manufacturers in any part of the DoD's supply chain.

Sixty days is not enough time to prepare.

I recently spoke with the IT director of a company I know well. This individual is very much aware that CMMC is coming, and that DoD business represents a fairly significant portion of the company's revenue. He also knows that, to get compliant in time, his company needs to

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start working on it now. The owner of the company also knows this, and is a very smart, very capable person, but the decision came down that the company is putting compliance efforts on the back burner.

I was dismayed but not entirely surprised to learn the reason for the delay. The owner had reached out to other suppliers and manufacturers to hear their CMMC plans and most of them were doing nothing. I heard similar kinds of reasoning at a recent CEO forum—from my rough estimate, fewer than 10% of them were taking active steps toward compliance.

The owner had reached out to other suppliers and manufacturers to hear their CMMC plans and most of them were doing nothing.

It seems there's a feeling out there that if most small suppliers don't comply, it will somehow force the DoD into waiving the requirements or kicking the deadline farther down the calendar.

This is nonsense.

Granted, there have been mixed signals regarding CMMC and small to medium contractors, but here's the thing to ask: In the three years or so since the program has been in development, have the threats of cyberattacks or the effectiveness of phishing scams decreased? No, they have not; across the board, cyberattacks have done nothing but increase, especially targeting small businesses.

Someone needs to tell you this: The wait-and-see approach is a very bad strategy for small businesses, even in the unlikely event of further delay from the government. It only takes one or two of the giant prime contrac-

tors to make a government deadline irrelevant, and I know of certain large primes who have put CMMC regulations into their contracts already. Do you really believe the prime contractors you support or large manufacturers you supply want to risk their own multi-million-dollar contracts by working with vulnerable suppliers? I don't.

For those of you thinking that coming into compliance with CMMC's Level One requirements is something you can do quickly, please think again. I've been part of compliance efforts for several manufacturers, and it is not a fast process, even when you run an already tight ship.

One of my clients received a notification from their client, a DoD prime contractor. In it, they were given six months from the date of the notification to self-attest to CMMC Level One compliance or they would be disqualified from bidding on any further opportunities.

CMMC Level One has six domains (high-level categories) each of which is further broken down into several capabilities and practices. On their face, they sound straightforward enough and some of them are. For example: Limit physical access to systems and data to authorized users (I'm paraphrasing). But in practice, determining which users currently have access to what, and who should actually be authorized to access what, can take a good deal of time and effort.

This particular client was AS 9100 certified, and certain the Level One requirements were already in place when the notification came—access control was in good shape, for example. But that is not the case for most businesses we see. Simply put, access control requires you to define and limit who has access to what on your networks. Simply giving everyone access to everything is not a compliant answer—shared drives and open networks are significant reasons CMMC exists in the first place. For your networks to be secure, user access must be traceable and specifically defined. That means no more shared passwords. That means only

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people in operations should be able to access operations data; sales folks should have access only to sales specific folders and files; and the same for each of your departments, functional areas, or lines of business. Then within each of those, access to data needs to be defined by the individual's job description.

Despite my client's level of preparedness, the entire process of bringing them into compliance took nearly the full six months. As I explain why, ask yourself if your organization might face similar challenges. Part of that time was used in setting up a compliant physical environment for their servers, which required changing both the room's location and retrofitting fire suppression and HVAC. But the refit of the server environment wasn't the most time-consuming piece. It was defining, developing, and training folks on the new IT policies and procedures, including a security and disaster recovery plan.

Despite my client's level of preparedness, the entire process of bringing them into compliance took nearly the full six months.

These things do not happen overnight, and because each company is different, off-the-shelf plans won't work. Your plans must be customized to your technology environment and the people and machines that connect to it.

Customize Your Plan

Like other manufacturers, this company had a diverse technology environment—one that had grown in fits and starts over time. This is perfectly natural; companies usually add peo-

ple, equipment, and technology based on actual or projected demand and opportunities as they arise, sometimes over the course of decades. But as a result, no one in this company had a complete knowledge of their full IT environment, literally everything that connected to its network, every user's every device, every bit of production equipment, every software program—even the smart refrigerator and vending machines in the breakroom. Of course, we needed to perform a vulnerability scan of the entire network and anything that connected to it over time. It's not enough to examine a specific day, we must look at the network over a good chunk of time to get a real sense of what's happening.

Some of you will be in the same position; you will find that you are already following certain practices pretty well, but without a gap analysis your remediation efforts are like shooting arrows in the dark. You can't begin, let alone pace, a reasonable remediation program until you know what you need to remediate.

Further, you must allow for production downtime for certain tasks, and for the fact that other tasks will have to be done off hours, by someone who knows what they are doing. All these will affect your timeline.

Now think about your company. Even if you have an in-house IT person, this work will require three to six months of an FTE's effort. Who will be stepping in to backfill your IT person's day-to-day responsibilities?

Find an Expert

Level One compliance relies on an annual self-attestation, and this attestation must be signed by the owner, CEO, or another C-level executive. Here's my prediction: Some small business owners will try to do this on their own, and will check boxes, believing they are doing things properly according to CMMC. Sooner or later, however, a customer, a vendor, or a prime with IT security experts who know these requirements inside and out will come along and say, "Show me."

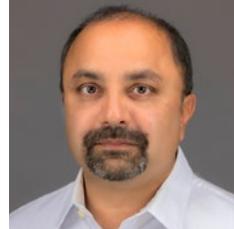
The best thing you can do now is find an expert you trust to put together a gap analysis and develop your policies, procedures, and system security plans. This will give you a reasonable idea of what compliance will take in terms of time and materials. All in, compliance should cost a fraction of a full-time IT resource. Compared to the cost of missing out on contract opportunities, it's a drop in the bucket.

Fortunately, this will be a one-time cost. Once you have the IT environment secured, and policies and procedures developed, staying compliant will simply be a matter of maintaining the network and following protocols.

I'm sure most of you would much rather focus on sales, sourcing, production, and shipping—your bottom-line concerns. But if you

do or plan to do work for the DoD, then compliance is a top-line concern, and without a sufficient top-line, the bottom-line will unfortunately take care of itself.

Here's one more prediction: Other departments and agencies of the federal government will quickly adopt similar cybersecurity requirements. If you read this thinking you might get a pass because you aren't in the DoD supply chain, I wouldn't count on it. **SMT007**



Divyash Patel is president of [MX2 Technology](#).

U.S. Departments of Labor, Commerce Announce 120-Day Cybersecurity Apprenticeship Sprint to Promote Registered Apprenticeships

At a National Cyber Workforce and Education Summit at the White House, Secretary of Labor Marty Walsh and Secretary of Commerce Gina Raimondo announced the 120-Day Cybersecurity Apprenticeship Sprint, an effort to support numerous industries' use of Registered Apprenticeships to develop and train a skilled and diverse cybersecurity workforce.

The 120-Day Cybersecurity Apprenticeship Sprint supports a commitment to expand Registered Apprenticeships to meet industry's need for talent and to connect underserved communities to good jobs. Improving the nation's cybersecurity apparatus is critical to the nation's economic and national security.

The partnership between the departments of Labor, Commerce, other federal agencies and the



White House Office of the National Cyber Director seeks to recruit employers, industry associations, labor unions, educational providers, community-based organizations and others to establish Registered Apprenticeship programs or to join existing programs to ensure the nation's economic sectors have greater numbers of qualified cybersecurity workers. The sprint will continue until National Apprenticeship Week, Nov. 14-20, 2022.

There are currently 714 registered apprenticeship programs and 42,260 apprentices in cybersecurity-related occupations. Since Jan. 20, 2021, 199 new programs have been created—a 28% increase during the Biden-Harris administration. The 120-Day Cybersecurity Apprenticeship Sprint will build upon this progress and focus on creating new pathways for workers in cybersecurity or a related field through partnerships with K-12, higher education, workforce partners and training programs. Introducing more employers to the potential of cybersecurity Registered Apprenticeships is essential to fill the nearly 700,000 open cybersecurity jobs, which span all industries.

(Source: U.S. Department of Commerce)

Teaching About Solder Paste

Maggie Benson's Journey

by Dr. Ronald C. Lasky, INDIUM CORPORATION

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

Maggie Benson and her fiancé John were relaxing at the grill at the Woodstock Country Club with their mentor, Ivy University's Professor Patty Coleman, and her husband Rob. As usual, Maggie and John were bested at golf by Patty and Rob.

"Maggie, John, thanks for giving us a tour of the vastly improved Ivy-Benson Electronics yesterday," Patty began. "The change seems miraculous."

"I agree," Rob chimed in. "The improved facilities and the change in the workers are

impressive. Especially the workers—they seemed so enthusiastic and committed."

"Well, the improvement in the facilities is something easy to understand," Patty said. "You invested a lot of money and sweat equity to bring the facilities up to date. But what caused the change in the workers?"

"We couldn't understand it either," John answered. "Our training program and paying for college courses are partly responsible, but we were missing something."

"Then it became obvious that part of the magic was one young couple," Maggie added.

Maggie and John then proceeded to tell the story of Andy and Sue. They explained that Andy and Sue's newfound passion for learning and self-improvement was contagious.

"What was really interesting is that both of



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them were constantly asking questions of their co-workers to understand all the aspects of electronic assembly,” Maggie elaborated. “This trait became contagious, as the other workers wanted to learn more, too.”

“One of the chaps, who was a little rough around the edges and a sloppy dresser, came into work one day sporting a complete make-over. He was well groomed and dressed in smart business casual attire,” John said. “I complimented him, and he told me that seeing Andy so ‘with it and enthusiastic’ encouraged him to make a change.”

Meanwhile, at their favorite pizza shop, Sue and Andy were working on their homework and preparing to give their second class at Ivy-Benson.

“How is ‘Miss Can’t Speak in Front of a Group’ doing?” Andy teased.

“Thanks for helping me in the first class,” Sue said. “Toward the end, I actually felt comfortable speaking to the group. It helped that you lectured, and I just answered questions.”

“Well, at the end you were speaking more than I was,” he responded. “I think I could explain the derivation of the area ratio formulas, but you did it much better than I could.”

“This has been a big breakthrough for me,” Sue said, with a little shakiness in her voice.

“Anyway, are you ready for tonight’s math class?” Sue asked.

“Yikes, trigonometry,” he said, jokingly. “Though, I have gotten sine, cosine, and tangent memorized with the mnemonic: Oscar had a heap of apples¹.”

Off they went to their math class and, after class, ended up in their favorite ice cream parlor to discuss the next SMT lesson they were teaching.

“In three days we teach the very basics of how solder paste is made and how it functions,” Sue began, with Andy responding, “I found it fascinating.”

“I think it’s neat that the solder powder can be made by taking liquid solder and splashing it on a fan blade,” Sue commented.

Solder Powder Screening

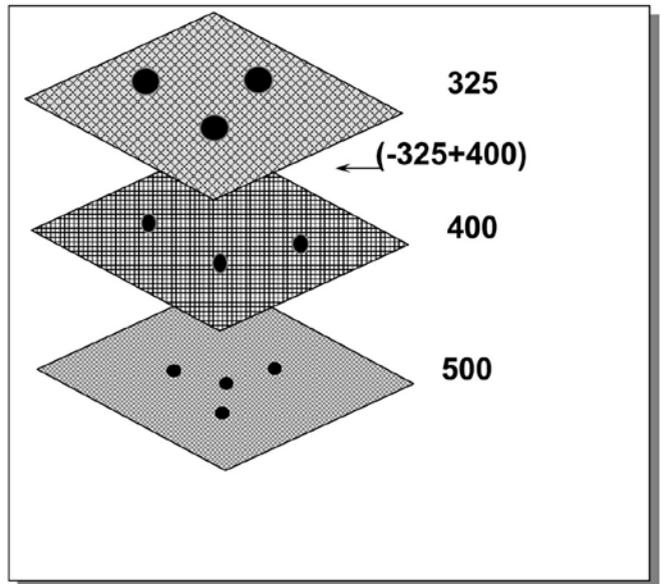


Figure 1: Solder powder is sieved by using screens of differing fineness. The numbers are the number of openings per inch. A Type 4 solder powder uses a coarse screen of 400 and a fine screen of 635. The powder on the 635 screen is the Type 4 powder.

“Yeah, then they put the powder through screens to get the desired particle size distribution,” he added (Figure 1).

“What I never appreciated was that solder paste is a multifaceted material. What everyone refers to as flux is really a complex mixture of materials that not only enables effective soldering but must have the right viscosity for printing and tack to hold the components,” she said.

“Another interesting property that a solder paste must have is good response-to-pause²,” Andy said.

“That’s one thing I haven’t heard of,” she replied.

“Well, when you stop the line and the stencil printer is not printing, some solder pastes stiffen and the first print after starting up is not useable. So, that board has to be wiped clean and reprinted. Chuck Tower said that Ivy-Benson had used a paste that had this problem, and it caused a lot of downtime. The paste was very cheap but ended up causing the com-

pany to lose money because of the downtime. We switched to a paste that did not have this issue and even though it was a little more expensive, the new paste saved us thousands of dollars,” Andy said.

“Another thing that I learned was that the fluxing action of solder paste goes beyond removing oxides from the PWB pads,” Sue said. “The flux must also be an oxygen barrier to protect the solder particles during reflow.” She then showed a PowerPoint slide that depicted all the functions of a solder paste flux (Figure 2).

“Wow, the flux in the solder paste is really quite complex—it has to perform so many functions,” Andy said. “It is easy to see why Chuck calls it a highly-engineered material.”

They continued to prepare their slides for the upcoming workshop. As they headed out for a brief moonlit stroll, Andy commented, “The next class is on component placement and line balancing. For line balancing, I’m going to have to lean on you heavily for this one.”

Will Andy be able to teach line balancing without heavily leaning on Sue? Stay tuned to find out. **SMT007**

FLUX TYPE

Paste Flux Composition

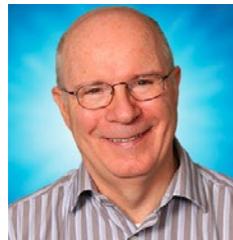
- **Activators** - *cleaning agent during reflow*
 - Dissolve oxides off the metal surfaces & promote wetting
- **Resins** - *synthetic rosin*
 - Tacky and viscous
 - acts as an oxygen barrier
- **Rheological Additives** - *viscosity regulators*
 - Create the thixotropic properties of solder paste
- **Solvents** - *dissolve chemicals*
 - Dissolves *activators, gelling agents, & resins* to create a homogeneous (uniform) paste flux

Bottom Line Impact

Figure 2: The composition and many functions of a solder paste flux are shown.

References

1. Trigonometry mnemonics, Wikipedia.com.
2. “Response to Pause: A Critical Solder Paste Parameter,” by Ronald C. Lasky, Indium Corporation.



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



SMT007
Get smarter here.



Wiwynn Kickstarts Phase II Server Plant in Johor, Malaysia

Wiwynn Corporation, a Taiwan-based innovative cloud IT infrastructure provider for hyperscale data centres, officially commenced its Phase II development on a server PCBA plant for cloud data centers.

The Big Picture: The Virtual Via Drum

A key to the success of the Roman empire was its extended roadway system. Designed by planners called mensors, and executed by Roman legions, they were transnational, connecting the then-known world across culture and region. Knowing the amount of wealth they carried, the roads were frequented by bandits and criminals. Today's internet is the modern version of the Via Publicae.



FedDev Ontario Invests Over \$7M for FTG Green Operations

Aerospace is a pillar of the economy and of innovation in Canada. It is one of the most research-intensive and export-focused manufacturing industries, employing thousands of highly qualified people in every region across the country.

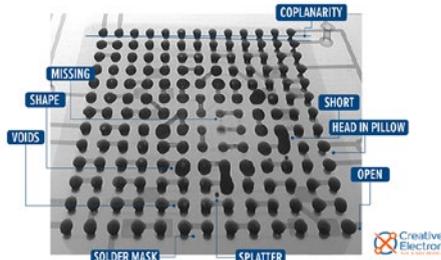
Clean Energy and Critical Minerals: The Dichotomy and Divergence

There has long been a battle between environmental groups and the mining industry, the former pushing for clean energy and net zero carbon initiatives while the latter is buried deeper and deeper under overly burdensome permitting processes and relentless lawsuits that halt exploration, construction, and clean production of critical minerals.



X-Rayted Files: My Favorite BGA Assembly Ever

In the early 1980s, Motorola and IBM introduced a novel package that allowed a high number of input and outputs with a large pitch in a small area, thus providing large savings in board real-estate. The ball grid array (BGA) was born.



Enics Merges with GPV to Create a European Electronics Giant

Two European-based EMS providers, Enics and GPV, are merging. The transaction values the combined business at more than 500M€. The merger will create Europe's second largest EMS company with more than 7,500 employees and operations worldwide.

Celestica Named One of Canada's Best 50 Corporate Citizens 2022



Celestica Inc., a leader in design, manufacturing, and supply chain solutions for the world's most innovative companies, announced that it has been included among

Canada's best corporate citizens in 2022 by Corporate Knights, an organization dedicated to encouraging responsible business practices.

CMMC 2.0: Are You Ready?

Nolan Johnson discusses with Ryan Bonner of DEFCERT exactly where EMS companies should aim for CMMC certification and how to go about it. Organiza-

tions, he says, "need to avoid false dichotomies where they assume that either CMMC is a go or it's not happening at all."



Assemblers Play the 'Revise or Wait' Game With Designers



Nolan Johnson recently spoke with Duane Benson at Milwaukee Electronics and Screaming Circuits. Duane was pointing out a trend in moving designs i

nto production, which he termed "revise or wait." This excerpt provides a preview of our exploration of similar topics involving supply chain issues, lead times, and more.

Maggie Benson's Journey: Learning the Basics

In this fictional series, Ivy Benson employees Andy and Sue continue to test each other on the basics of surface mount technology as they prepare for certification.



For the latest news and information, visit [SMT007.com](https://www.smt007.com)

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GOOD FOR THE INDUSTRY



Career Opportunities



Field Sales Engineer, North America

Location: New Hartford, NY

JOB SUMMARY:

The Field Sales Engineer, North America, is responsible for serving as Indium Corporation's lead sales contact and customer advocate to maintain existing sales and to drive new qualifications and sales of Indium Corporation products and services through effective account management and coordination of efforts throughout Indium Corporation's Metals, Compounds, Solar and Reclaim (MCSR) organization.

REQUIREMENTS:

- Associate's degree in a business or technical discipline
- Minimum 2 years related sales or technical field experience
- Technical aptitude
- Personable individual, with excellent oral and written communication skills
- Strong organizational skills
- Able to travel upon short notice
- Proficient in Word, Excel, PowerPoint

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Electrical Engineer/PCB/CAD Design, BOM/Component & Quality Support

Flexible Circuit Technologies (FCT) is a premier global provider of flex, rigid flex, flex heaters, EMS assembly and product box builds.

Responsibilities:

- Learn the properties, applications, advantages/disadvantages of flex circuits
- Learn the intricacies of flex circuit layout best practices
- Learn IPC guidelines: flex circuits/assemblies
- Create flexible printed circuit board designs/files to meet customer requirements
- Review customer prints and Gerber files to ensure they meet manufacturing and IPC requirements
- Review mechanical designs, circuit requirements, assembly requirements, BOM/component needs/and help to identify alternates, if needed
- Prepare and document changes to customer prints/files.
- Work with application engineers, customers, and manufacturing engineers to finalize and optimize designs for manufacturing
- Work with quality manager to learn quality systems, requirements, and support manager with assistance

Qualifications:

- Electrical Engineering Degree with 2+ years of CAD/PCB design experience
- IPC CID or CID+ certification or desire to obtain
- Knowledge of flexible PCB materials, properties, or willingness to learn
- Experience with CAD software: Altium, or other
- Knowledge of IPC standards for PCB industry, or willingness to learn
- Microsoft Office products

FCT offers competitive salary, bonus program, benefits package, and an outstanding long-term opportunity. Location: Minneapolis, Minn., area.

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Career Opportunities



Technical Support Applications Engineer

Full-Time — Duluth, GA

Koh Young Technology, founded in 2002 in Seoul, South Korea, is the world leader in 3D measurement-based inspection technology for electronics manufacturing. Located in Duluth, GA, Koh Young America has been serving its partners since 2010 and expanding team with an Applications Engineer to provide helpdesk support by delivering guidance on operation, maintenance, and programming remotely or on-site.

Responsibilities

- Provide timely, complete helpdesk support for Koh Young users
- Train users on proper operation, maintenance, programming, and best practices
- Recommend and oversee operational, process, or other performance improvements
- Effectively troubleshoot and resolve machine, system, and process issues

Skills and Qualifications

- Bachelor's in a technical discipline, relevant Associate's, or equivalent vocational or military training
- Knowledge of electronics manufacturing, robotics, PCB assembly, and/or AI; 2-4 years of experience
- SPI/AOI programming, operation, and maintenance experience, preferred
- Domestic and international travel (valid U.S. or Canadian Passport, required)
- Able to work effectively and independently with minimal supervision
- Ability to readily understand and interpret detailed documents, drawing, and specifications

Benefits

- Health/Dental/Vision/Life Insurance with no employee premium (including dependent coverage)
- 401K retirement plan
- Generous PTO and paid holidays

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European Product Manager Taiyo Inks, Germany

We are looking for a European product manager to serve as the primary point of contact for product technical sales activities specifically for Taiyo Inks in Europe.

Duties include:

- Business development & sales growth in Europe
- Subject matter expert for Taiyo ink solutions
- Frequent travel to targeted strategic customers/OEMs in Europe
- Technical support to customers to solve application issues
- Liaising with operational and supply chain teams to support customer service

Skills and abilities required:

- Extensive sales, product management, product application experience
- European citizenship (or authorization to work in Europe/Germany)
- Fluency in English language (spoken & written)
- Good written & verbal communications skills
- Printed circuit board industry experience an advantage
- Ability to work well both independently and as part of a team
- Good user knowledge of common Microsoft Office programs
- Full driving license essential

What's on offer:

- Salary & sales commission--competitive and commensurate with experience
- Pension and health insurance following satisfactory probation
- Company car or car allowance

This is a fantastic opportunity to become part of a successful brand and leading team with excellent benefits. Please forward your resume to jobs@ventec-europe.com.

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Career Opportunities



Director of Operations State College, PA

Chemcut Corp., a world leader in wet processing equipment for the manufacture of printed circuit boards and chemical etching of various metals, is seeking a Director of Operations.

Objectives of the Role:

- Collaborate with the CEO in setting and driving organizational vision, operational strategy, and hiring needs.
- Oversee manufacturing operations and employee productivity, building a highly inclusive culture ensuring team members thrive and organizational outcomes are met.
- Directly oversee manufacturing operations, production planning, purchasing, maintenance & customer service (product support) and partner with the CEO and controller on sales management to budget for sufficient investment capital to achieve growth targets.
- Aggressively manage capital investment and expenses to ensure the company achieves investor targets relative to growth and profitability.

Qualifications:

- Bachelor's degree in mechanical, electrical, or related fields
- 5+ years' experience in leadership positions
- Leadership skills, with steadfast resolve and personal integrity
- Understanding of advanced business planning and regulatory issues
- A solid grasp of data analysis and performance metrics
- Ability to diagnose problems quickly and have foresight into potential issues

Preferred Qualifications:

- Master's degree in business or related field
- International business experience

To apply, please submit a cover letter and resume to hr@chemcut.net

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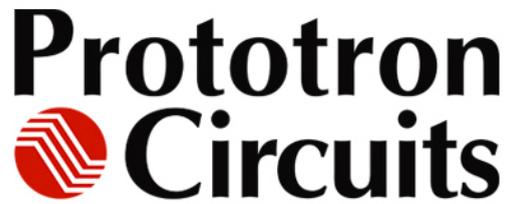
Are You Our Next Superstar?!

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 to 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.

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Career Opportunities



Sales Representatives

Prototron Circuits, a market-leading, quick-turn PCB manufacturer located in Tucson, AZ, is looking for sales representatives for the New England and Northern California territories. With 35+ years of experience, our PCB manufacturing capabilities reach far beyond that of your typical fabricator.

Reasons you should work with Prototron:

- Solid reputation for on-time delivery (98+% on-time)
- Capacity for growth
- Excellent quality
- Production quality quick-turn services in as little as 24 hours
- 5-day standard lead time
- RF/microwave and special materials
- AS9100D
- MIL-PRF- 31032
- ITAR
- Global sourcing option (Taiwan)
- Engineering consultation, impedance modeling
- Completely customer focused team

Interested? Please contact Russ Adams
at (206) 351-0281
or russa@prototron.com.

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R&D Scientist III Orange, CT

Job Description: The scientist will be a leader in technology for plating chemistry development, electrolytes, and additives. The position is hands-on, where the ideal candidate will enjoy creating and testing new aqueous plating processes and materials to meet the most demanding semiconductor applications related to Wafer-Level Packaging and Damascene. The qualified candidate will work as part of the R&D team while interacting with scientists, product management, and application engineers to commercialize new products for the advanced electronic solution business.

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Technical Marketing Specialist Waterbury, CT

This position provides information from the product team to the marketing communications team. It is a multifunctional role that requires some experience within electronics manufacturing supply chain or knowledge of how electronic devices are manufactured, specifically PCBs, semiconductors, and the chemical processes utilized therein. The primary function of this role is to help in the generation of product marketing collateral, but also includes assisting in tradeshow content development, advertising, and launches.

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Career Opportunities



Regional Manager Midwest Region

General Summary: Manages sales of the company's products and services, Electronics and Industrial, within the States of IL, IN & MI. Reports directly to Americas Manager. Collaborates with the Americas Manager to ensure consistent, profitable growth in sales revenues through positive planning, deployment and management of sales reps. Identifies objectives, strategies and action plans to improve short- and long-term sales and earnings for all product lines.

DETAILS OF FUNCTION:

- Develops and maintains strategic partner relationships
- Manages and develops sales reps:
 - Reviews progress of sales performance
 - Provides quarterly results assessments of sales reps' performance
 - Works with sales reps to identify and contact decision-makers
 - Setting growth targets for sales reps
 - Educates sales reps by conducting programs/seminars in the needed areas of knowledge
- Collects customer feedback and market research (products and competitors)
- Coordinates with other company departments to provide superior customer service

QUALIFICATIONS:

- 5-7+ years of related experience in the manufacturing sector or equivalent combination of formal education and experience
- Excellent oral and written communication skills
- Business-to-business sales experience a plus
- Good working knowledge of Microsoft Office Suite and common smart phone apps
- Valid driver's license
- 75-80% regional travel required

To apply, please submit a COVER LETTER and RESUME to: Fernando Rueda, Americas Manager

fernando_rueda@kyzen.com

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Field Service Engineer Location: West Coast, Midwest

Pluritec North America, Ltd., an innovative leader in drilling, routing, and automated inspection in the printed circuit board industry, is seeking a full-time field service engineer.

This individual will support service for North America in printed circuit board drill/routing and x-ray inspection equipment.

Duties included: Installation, training, maintenance, and repair. Must be able to troubleshoot electrical and mechanical issues in the field as well as calibrate products, perform modifications and retrofits. Diagnose effectively with customer via telephone support. Assist in optimization of machine operations.

A technical degree is preferred, along with strong verbal and written communication skills. Read and interpret schematics, collect data, write technical reports.

Valid driver's license is required, as well as a passport, and major credit card for travel.

Must be able to travel extensively.

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Career Opportunities



American Standard Circuits

Creative Innovations In Flex, Digital & Microwave Circuits

Wet Process Engineer

ASC, the largest independent PCB manufacturer in the Midwest, is looking to expand our manufacturing controls and capabilities within our Process Engineering department. The person selected will be responsible for the process design, setup, operating parameters, and maintenance of three key areas—imaging, plating, etching—within the facility. This is an engineering function. No management of personnel required.

Essential Responsibilities

Qualified candidates must be able to organize their own functions to match the goals of the company.

Responsible for:

- panel preparation, dry film lamination, exposure, development and the processes, equipment setup and maintenance programs
- automated (PAL line) electrolytic copper plating process and the equipment setup and maintenance programs
- both the cupric (acid) etching and the ammoniacal (alkaline) etching processes and the equipment setups and maintenance programs

Ability to:

- perform basic lab analysis and troubleshooting as required
- use measurement and analytical equipment as necessary
- work alongside managers, department supervisors and operators to cooperatively resolve issues
- effectively problem-solve
- manage multiple projects concurrently
- read and speak English
- communicate effectively/interface at every level of the organization

Organizational Relationships

Reports to the Technical Director.

Qualifications

Degree in Engineering (BChE or I.E. preferred). Equivalent work experience considered. High school diploma required. Literate and functional with most common business software systems MS Office, Excel, Word, PowerPoint are required. Microsoft Access and basics of statistics and SPC a plus.

Physical Demands

Exertion of up to 50 lbs. of force occasionally may be required. Good manual dexterity for the use of common office equipment and hand tools.

- Ability to stand for long periods.

Work Environment

This position is in a manufacturing setting with exposure to noise, dirt, and chemicals.

Click on 'apply now' button below to send in your application.

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Career Opportunities



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

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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

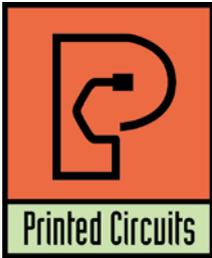
- A love of teaching and enthusiasm to help others learn
- Background in electronics manufacturing
- Soldering and/or electronics/cable assembly experience
- IPC certification a plus, but will certify the right candidate

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



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 3rd 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

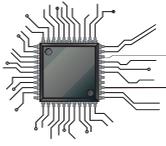
- Load and unload electroplating equipment
- Fasten circuit boards to racks and cathode bars
- Immerse work pieces in series of cleaning, plating and rinsing tanks, following timed cycles manually or using hoists
- Carry work pieces between departments through electroplating processes
- Set temperature 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

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Career Opportunities



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 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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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.

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

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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.

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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. 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



BLACKFOX

Premier Training & Certification

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.

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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 CAM tooling software, Orbotech GenFlex®.

Physical Demands

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

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

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

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

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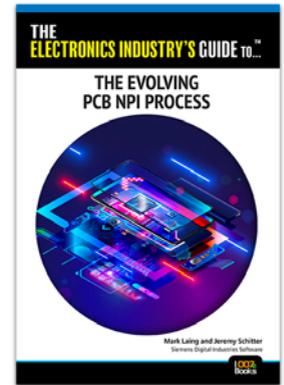
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by Mark Laing and Jeremy Schitter, Siemens Digital Industries Software
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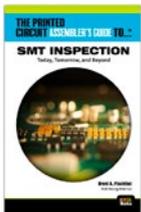
The Printed Circuit Assembler's Guide to...



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