

JUNE 2022

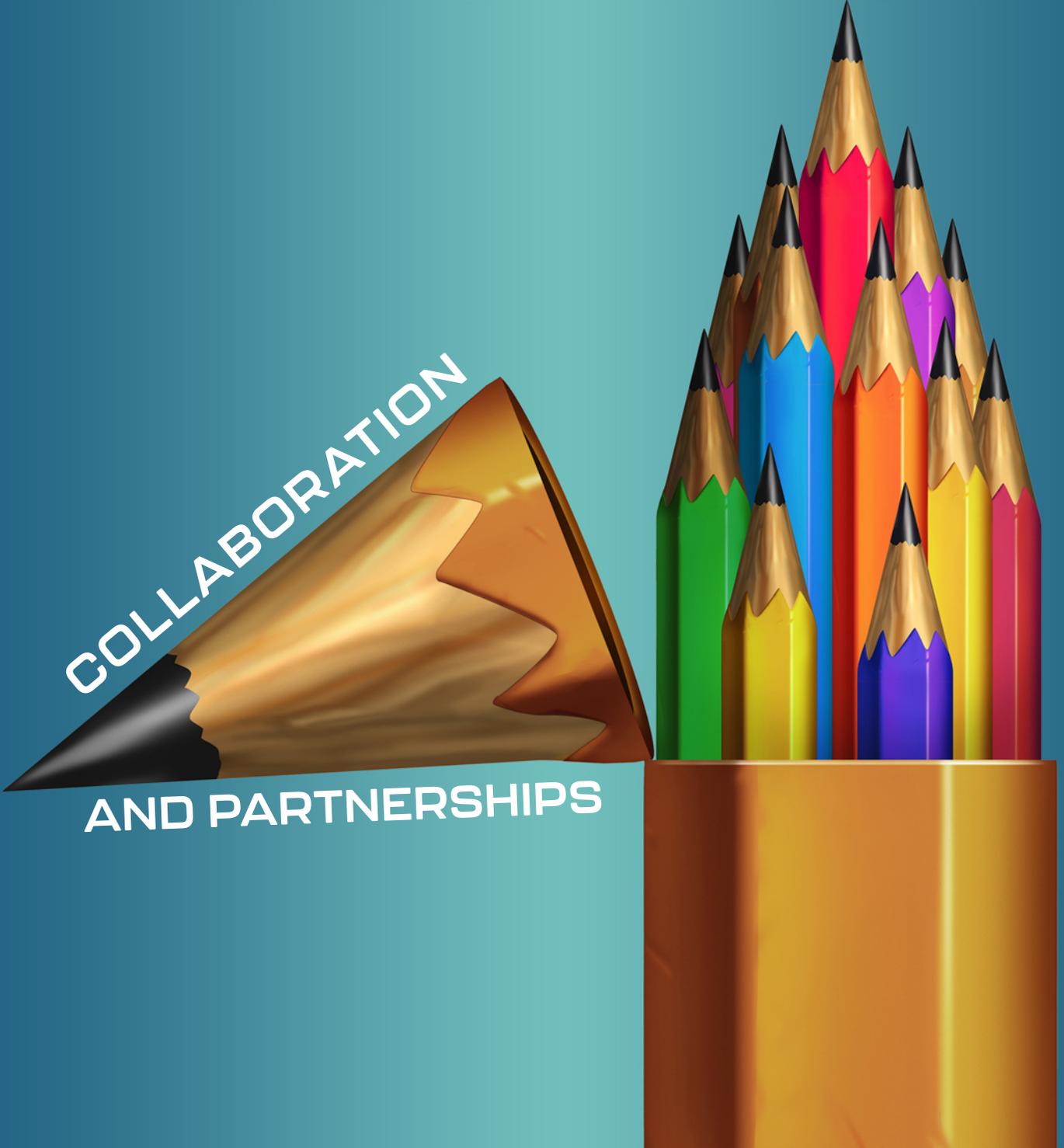
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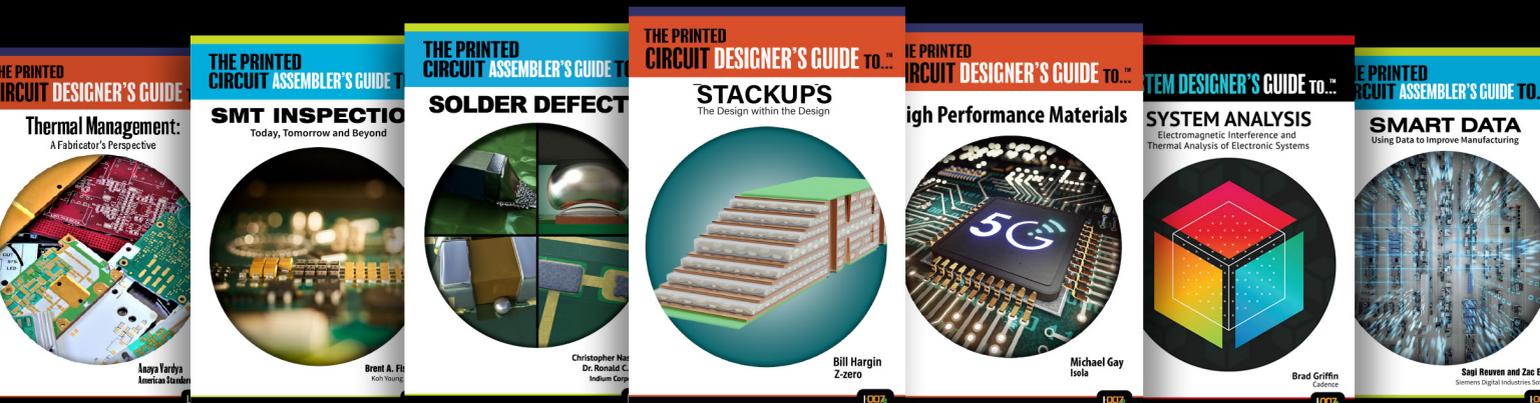
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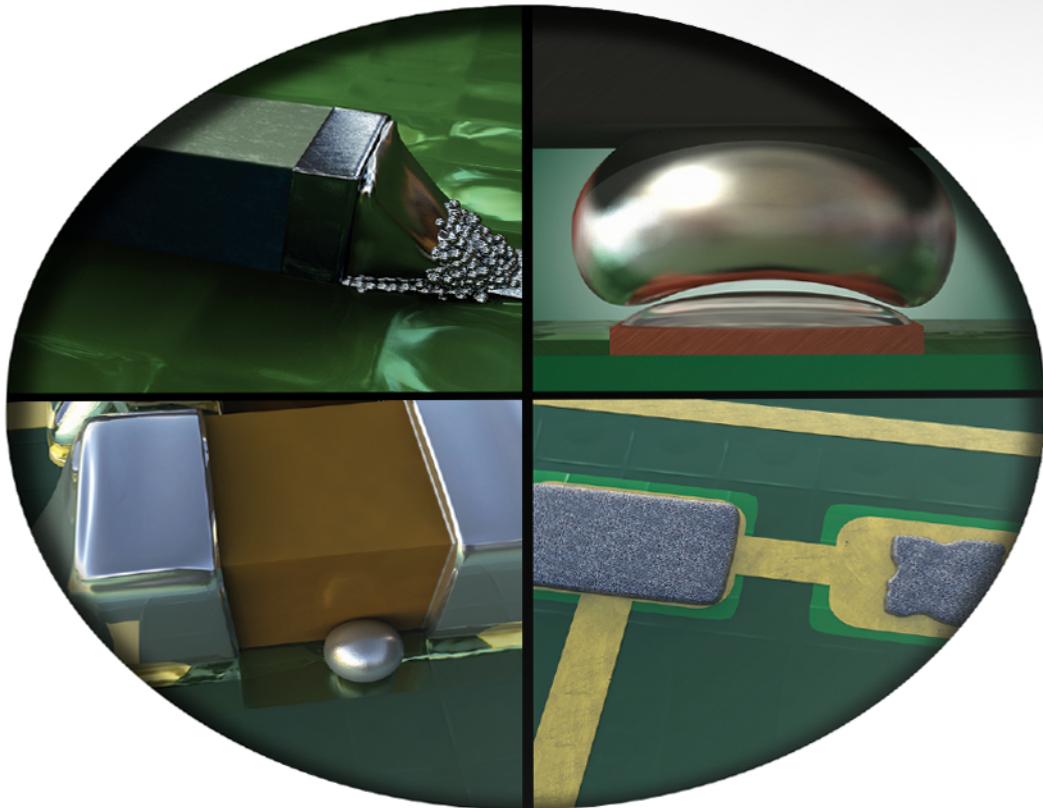
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The Point of Collaboration

While there's a place for competition in this current market, collaboration is even more effective as a growth strategy. But when and how? Whether your goal is to expand your capabilities without investing in a new facility, or encourage customer loyalty through purchasing convenience, collaboration and partnership should play a pivotal role in achieving those goals.



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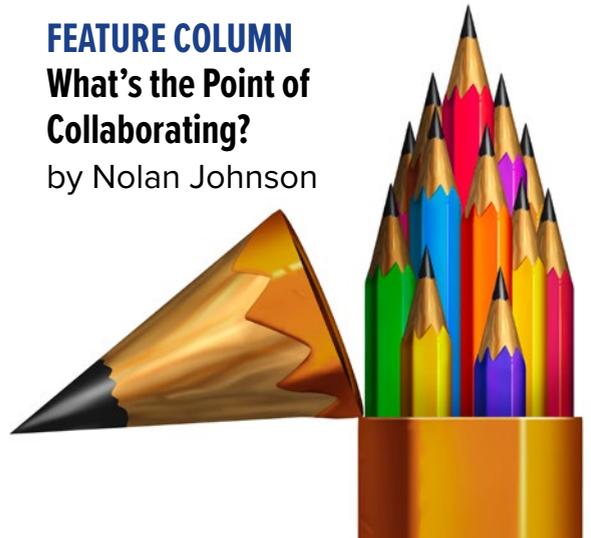


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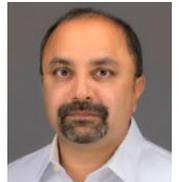


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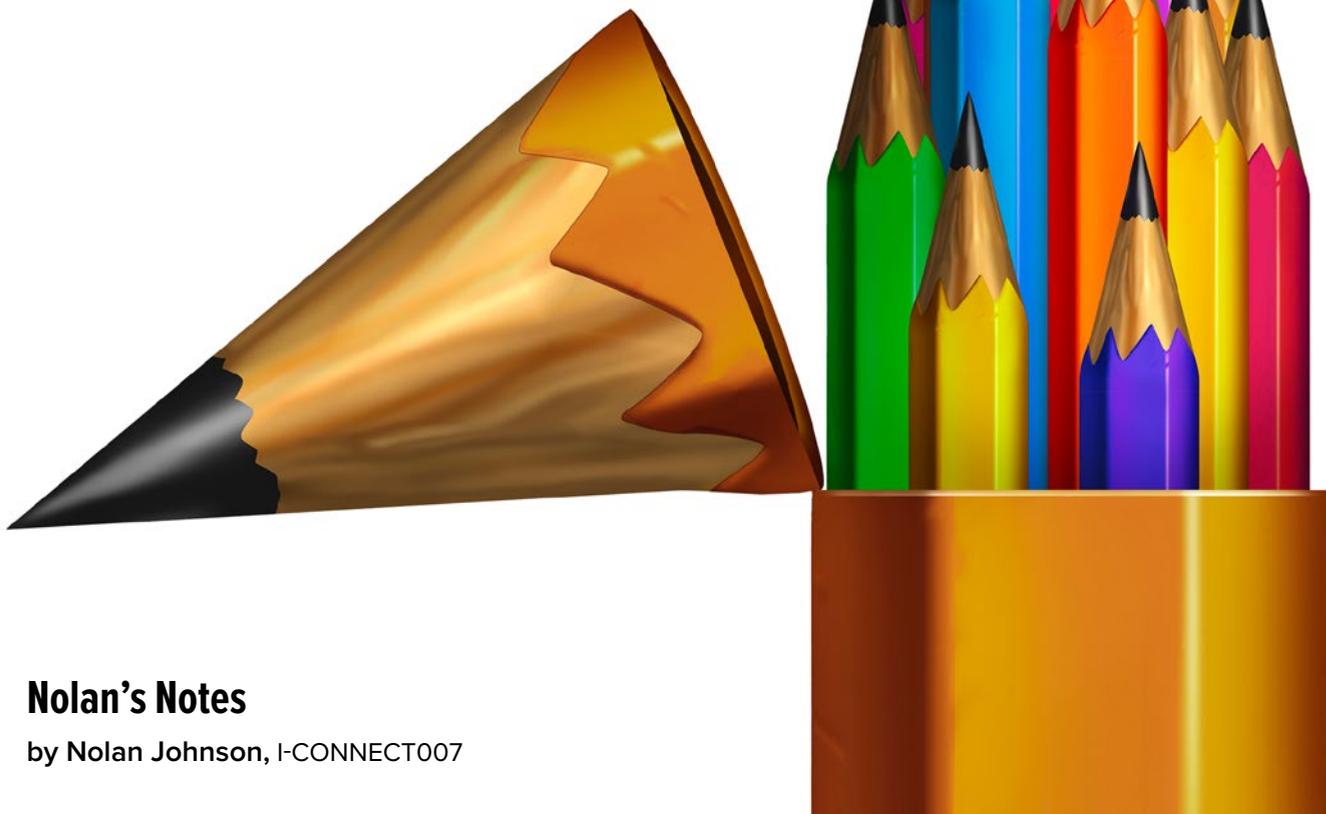
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What's the **Point** of Collaborating?



Nolan's Notes

by Nolan Johnson, I-CONNECT007

When I was a kid, we had a recluse who lived just down the street from us. I'm talking the movie stereotype of a recluse. You had to be up past your bedtime to catch him coming or going; he never ventured out during regular people hours. All the curtains were closed all the time, the lawn had long since reverted to a field of native species. Every Thanksgiving, just as we were ready to serve it up to the family, my mom would make up a plate ahead of everyone else. She'd dish up a healthy serving of everything, with plenty of gravy and two dinner rolls, and wrap it up with tin foil. Then, with-

out a word, she'd hand it to me. While everyone started passing the feast around the table, I'd pop down the street, and knock on the recluse's door, carefully set the plate down on the stoop, knock again, and step back 10 feet. Only then would he open the door—just a crack—and say, "Thank you!" I'd wish him a happy Thanksgiving and sprint home to catch up with our meal. I'd be sliding into my seat before the food was done being passed around. The next morning, mom's plate would be resting on the recluse's stoop, cleaned, and waiting for pick-up. That's the kind of giving I'm talking about.

Still, things could go too far, give too much away. When it did, talk turned to spiteful rhinectomies.

That seems to have been a persistent thinking pattern in business over the past few years. In a marketplace with compressed margins, lots of competitors, and customers demanding tight schedules and challenging builds, the idea has been to keep all the business to yourself. After all, you worked hard for that sale.

But that was then; this is now. Demand for electronics continues to be high; customer requirements can be challenging to our skill set. When we can do a fair portion of the work, but not all of it, instead of turning the job away, many are turning to collaboration. This idea drove the design of our cover this month. The main result can often be built up from numerous other constituent parts. Our product portfolio, like the largest pencil, may be a mini supply chain in and of itself—if we’re collaborating effectively, that is.

When we first started planning this issue, we used the word “partnership” in our working title. Partnership certainly is one way to collaborate. Creating close working relationships with manufacturing specialists who can extend your capabilities for your customers is one obvious way to collaborate. But there are others.

Collaboration can also look like proactive communication with customers as well as vendors, as showcased by our interview with Dan Beaulieu and representatives from fabricators and a material supplier. The conversation focuses on an entire assembly project and high-level collaboration ideas.

Columnist Emmalee Gagnon makes the point that collaboration can be an internal resource management exercise as well. Collaboration can also take the form of corporate responsibility, as ICAPE’s Lea Maurel suggests. She writes, “A 2015 Nielsen survey showed that more than 50% of consumers are willing to pay more for a product or service

if the company prioritizes sustainability. It’s a real indicator that consumers are asking more of companies. Companies should not just exist to make a profit but should give back to society and have a positive impact.”

That process of customers asking more of their vendors is an open invitation to collaborate with customers to grow into their needs, as well as an opportunity to develop partnerships.

Of course, those same customers tend to link environmental safety to sustainability. Hazardous chemicals and conflict-free mineral sources, therefore, play into corporate responsibility as well. In this issue, we step even further up the supply chain to get a take on the mineral/mining dichotomy. It’s worthwhile to remember that what we specify in our designs propagates as a demand all the way back to the mines digging up the ore to make the metals we consume. We provide an overview on the market dynamics from Noelle Lovern, as well as a compelling interview with mining CEO Shaun Dykes. In an industry like ours, where 90-day forecasts are often considered “strategic,” it’s mind-bending to consider that mining companies forecast out 20 years or more, and that our industry demands are a small part of their overall forecasting. Read our interview with Dykes to learn more about the how and why.

As always, our magazines are the culmination of collaboration with you, our readers. We strive to help advance the conversations we’re having within our industry. Your feedback and your suggestions for meaningful topics help advance the conversation as well. We love hearing from you. **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](#).



Partnership and Collaboration

Feature Interview by the I-Connect007
Editorial Staff

Dan Beaulieu and Nolan Johnson recently had a conversation with Christopher Kalmus of Aurora Circuits and Brigitte Lawrence of Brigiflex. Joining them was Jeff Brandman of Aismalibar North America. The group discussed the value of partnerships, noting how it has helped them win and keep business. They also describe a recent project for an OEM manufacturer in the automotive industry that served as a case study for this discussion.

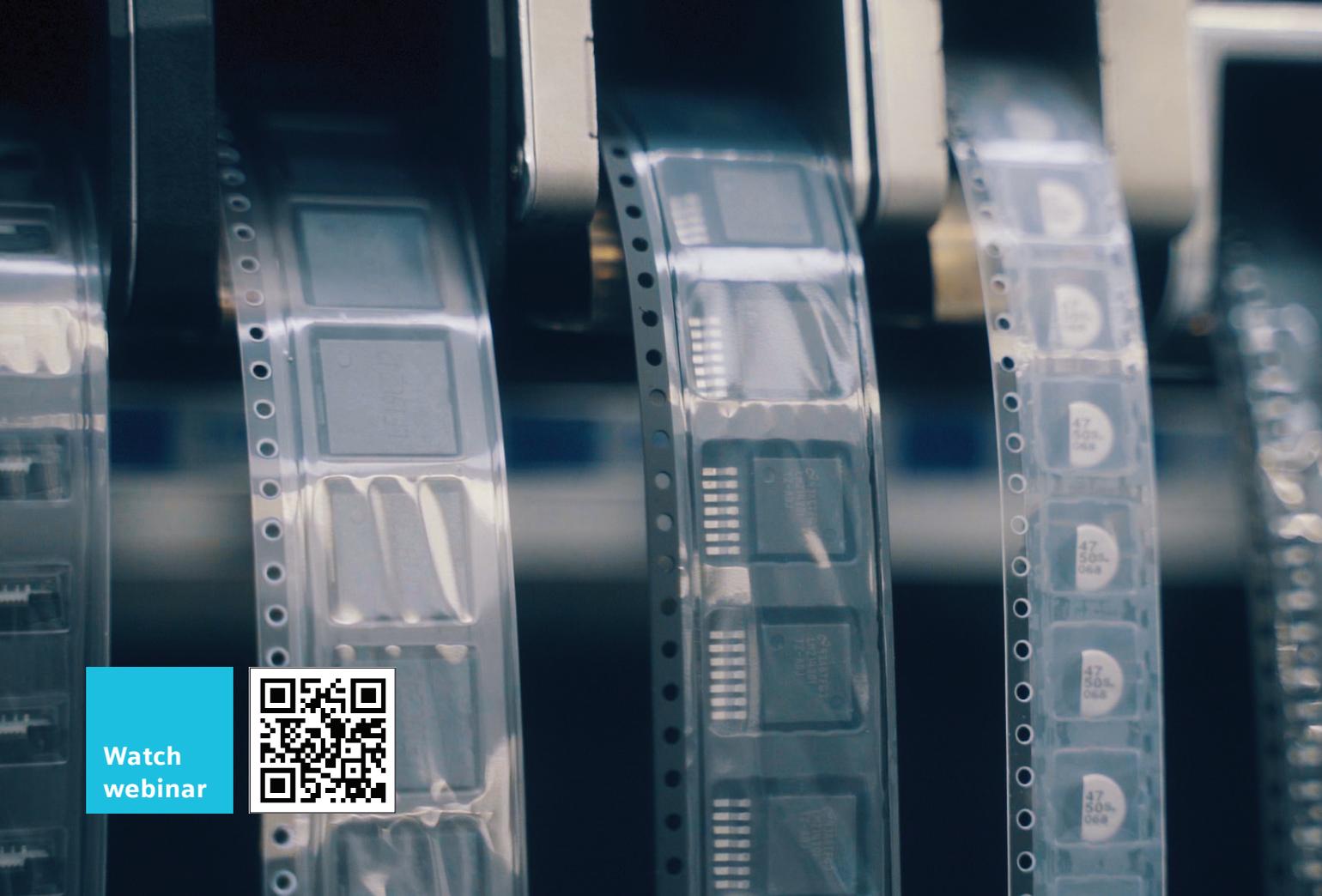
Nolan Johnson: What does partnership mean in your working relationship?

Christopher Kalmus: It means working together, trying to solve a problem that's of value to all of us.

Brigitte Lawrence: When a customer comes to us, needs something produced, and we don't have everything at our fingertips, we can work together with others to help the customer. We can work together to accomplish it in the time-frame, money frame, and everything else to get it out to the assembler or our customer.

Johnson: Is this a tactical or a strategic kind of relationship?

Lawrence: Neither. It's a friendship. In this type of situation, we're not competing. We are working together underneath an umbrella to keep everything friendly and noncompetitive. We each have our own niche, we know where it's at, and we don't cross each other.

A close-up photograph of a printed circuit board (PCB) manufacturing process. Several vertical strips of material are being processed, with various components and patterns visible on them. The lighting is blue and industrial.

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Johnson: So, by having complementary areas of specialty, you can work together, making those component pieces larger than the individual parts?

Lawrence: It's larger than the industry when we put it together.

Dan Beaulieu: The way I see it, you have some operations that Chris can't do, and he has some that you can't do.

Kalmus: That's right Dan. These are unusual times. We're dealing with an industry that's basically been devastated over the last two decades. You go back three decades, and North America produced maybe 50–60% of all the circuit boards in the world. It was a highly resilient industry; it could take some body blows and still be okay. I've seen a lot of different estimates that we now produce probably less than 4% of the world's production, while China currently is probably producing more than 50%.

Beaulieu: Some sources say over 80%.

Kalmus: Our industry is so stretched that it's not even possible for everybody to have everything that they want, to do everything that they want. Partnerships, from materials to final assembly, help fill the void.



Christopher Kalmus

Lawrence: We must work together. We must trust each other. We must use each other's machinery. Sometimes we are not allowed to collaborate, but we do it when we can. We do what we can to keep things here and work together as a team, keeping things here in the States. It's not just building the product. It's keeping the machinery running and keeping our factories running.

It's what it takes to build the product.

Kalmus: Circuit board innovations have always relied on people who have ideas, who know how to do things, and can extrapolate to other ways of doing things. To me, that's probably the bigger part of our partnership. Brigitte and Chuck (Lawrence) are two unique people in the printed circuit board world, with their knowledge and what they're capable of doing. We've always been innovative, going all the way back to Kalmus and Associates in the 1950s and 1960s.

Lawrence: Brigittflex used to be Pentaplex, and we go as far back as he does. We've made millions and millions of parts, and now we're building materials.

People contact us and say, "We can't find material." They inform us that material lead time is 46 weeks for a specific Dk, or they need

a board at two mils, or under a half a mil, or two inches thick with components inside of it. They ask if we can manufacture and make it. Between what Chris can do and what we can do, we get that to our customer in under two weeks. This is a partnership that leverages that knowledge. We've made material using all



our machinery together, so it's not just making boards anymore. It's all the new chemistries.

Johnson: Did I hear that right? You're also making your own material?

Lawrence: Yes, when we have to. The customer gets to approve it, and it gets tested.

Johnson: That does create some unique capabilities within your partnership for the two of you. I'd like to get a sense of the partnership process. Is this a situation where either of you might come up with a sales opportunity which needs something that you can collaborate on, and then you share the sales lead? How do you handle those relationships?

Kalmus: There are things that I'd love to be able to do, but can't, and vice versa. We tend to focus more on volume. Personally, I'm more interested in the human aspects of partnering. I find that I can innovate much better and think of things much better when I have somebody to talk it over with.

Beaulieu: Jeff, what can you share from a supplier-to-customer point of view? Aismalibar is a rep firm, a distributor, and a helper to the industry in North America.

Jeff Brandman: Partnerships are critical and I'm a big believer in them. Many key technical advancements in our industry are the result of partnerships, whether it's fabricators working together or OEMs, fabricators, and suppliers all working on joint partnerships.

For example, we worked in partnership to develop a pedestal design for a major automo-



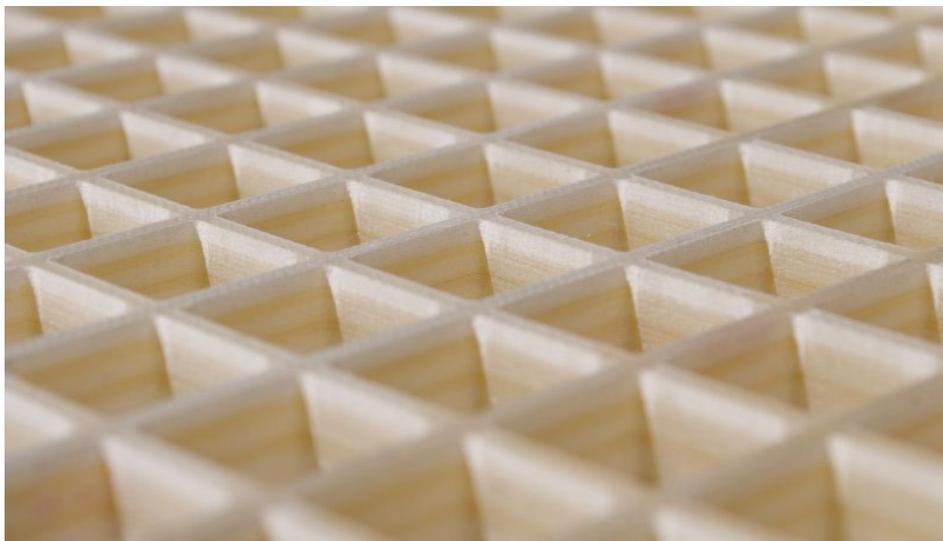
Jeff Brandman

tive company that ended up being a headlight, with the PCB manufactured at Aurora Circuits, the laminate manufactured in Barcelona, Spain, the PCB is assembled in Michigan, and the headlight housing assembled in the United States. This was a special project that typically would have gone to China, but the gatekeepers of the decision-making on this program saw the value in working

with North American manufacturing. It only could have happened when all the companies came together and worked hard at developing the technology of the PCBs for this program, as well as the supply chain, which is really critical. The material that we're working on for this program is copper-backed material, and the freight costs of either flying that in from offshore or even bringing it in by ocean was so expensive that it really created an advantage to manufacture that part in North America.

Johnson: Was this a project that was driven mostly by the OEM and their requirements? Is that what brought the partnership together?

Brandman: What happens with these automotive programs initially is that the prototype phase often happens in North America. When that's the case, much of that development hap-



pens here. But when it goes to production, then it starts getting quoted everywhere. In this case, it was quoted in Asia, but quoted in North America too.

Much of the technology is driven by designs that are happening here. And as a result, we bring together the key technology leaders for the PCB part of the assembly. In that realm, working together is how the partnership delivers. I would say it's almost an organic process on how it comes together, not necessarily where every piece has been strategically analyzed and brought together. Between relationships and core strengths, organically, these partnerships are developed.

Johnson: Obviously the prototyping work was done here in the United States. I just want to clarify that, for this project, the production work was also in North America?

Brandman: Absolutely.

Johnson: Was the partnership formed just for this project? Was this the first time that all these companies together worked in partnership, or was this a pre-existing relationship?

Brandman: This was a new relationship between all the key stakeholders in the partnership.



Dan Beaulieu

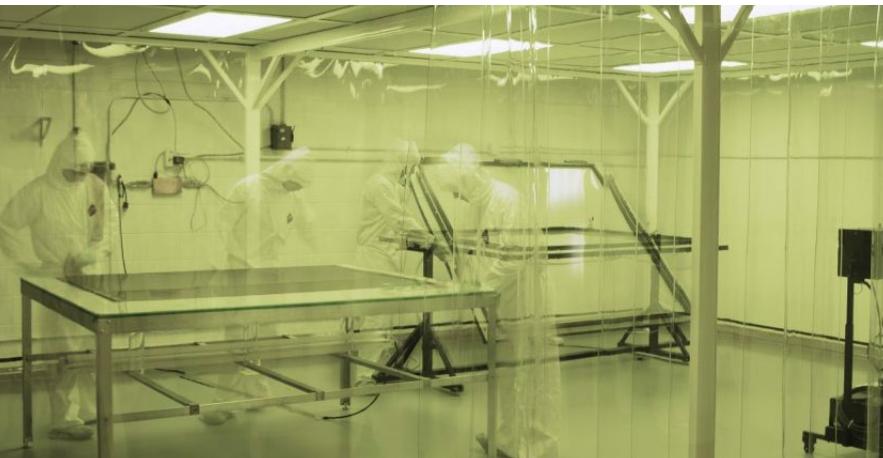
Johnson: I think this is a great little case study then. For such an opportunity, which also happened to be reshoring, to come together in partnership and work together to win a very large order that benefitted multiple companies. There is value in coming back to the U.S. How much of that is monetary? How much of that is supply chain resilience? Jeff, can

you give us a sense for what this partnership created, and why it was important enough to the end customer to stay in the U.S.?

Brandman: Sure. Aurora Circuits developed a PCB with cutting-edge technology for headlights, and I think they created a very competitive, robust product that their customer was able to appreciate, compared to other prototypes from other fabricators. But at the end of the day, some other fabricators could also do a good job making that PCB in China, but I think Aurora was able to do it competitively in the U.S. This sort of collaboration between OEM and manufacturers needs to be the everyday occurrence.

With this program of collaboration between Aurora Circuits and Aismalibar, we opened the door for more large-scale automotive production in the U.S. I know it's also happening with other fabricators. The innovative, smart, competitive PCB shops in the U.S., however, need to continue to push this message. And I strongly believe that we will be able to create more onshoring possibilities.

Beaulieu: The two companies we're talking about are unique, and obviously they don't want to market themselves, but I will. Chris's company makes unique boards. They can do boards that are over 20-ounce copper. That's a big deal. Most companies stop at four ounces. Brigitte



can build a rigid board approaching the size of a ping pong table. I don't know who else can do that. These unique capabilities are why these are small, family-owned shops have so much value to the overall industry.

Johnson: Jeff, what do you see from your perspective as the future of partnerships?



All images courtesy of Brigitflex.

Brandman: It seems like partnerships will be more critical going forward. As technology develops, it's really hard for one company to own all the newest technologies. For things to move forward in our market, key partnerships where we're sharing technologies, capabilities, and our niche will be critical to our combined success.

Johnson: Just as Chris and Brigitte were talking about at the start of our conversation?

Brandman: Yes.

Kalmus: The key partnership is between a customer and a supplier over the entire manufacturing chain.

Lawrence: Yes.

Kalmus: It's been rare to find companies that will do that. Although in the past couple of years, it's becoming more common

Brandman: That's a good point. It's just like in my relationship with many of my customers, from a vendor-supplier-customer perspective. I find that, when fabricators and assemblers bring the laminate supplier like myself into their customer, into that conversation, where we can have a high-level technology conversation about the laminate and about the PCB and about the design, the rate in which my customers win those jobs is quite high. When they

show the added value, and that they have a strong team behind their product from all their different suppliers, it goes a long way.

Lawrence: What I've noticed is a little bit different. I can have a very, very good relationship with my engineers, those who are designing the boards. Then I turn them over to the materials suppliers because they frankly don't believe the lead times. I have no problem with the chemistries, but when it comes to the base materials, well, I'm late on two orders because the material hasn't been in, and I'm lucky if I will get it in six months.

Johnson: That's the glamor of the printed circuit board industry, right there. Thanks, everybody. I appreciate it.

Beaulieu: Thank you, Nolan. Appreciate it. Thank you, guys.

Brandman: Thanks for having me. Really appreciate it.

Kalmus: Thank you.

Beaulieu: See you, Brigitte. See you, Chris. SMT007

Brigitte Lawrence—Owner/Operator, Brigitflex.

Christopher Kalmus—President, Aurora Circuits.

Jeff Brandman—President, Aismalibar North America.

Dan Beaulieu—D.B. Management Group.

Social Responsibility and **Ethics** in Manufacturing



Article by **Lea Maurel**

ICAPE GROUP

Customers, partners, and employees are increasingly moving toward companies that care about people and the environment and are no longer just about their economic profitability. Corporate social responsibility (CSR) has thus become essential, even in the manufacturing sector. CSR defines an organization's approach to sustainable development by considering the environmental, social, economic, and ethical issues of its activities.

What Does Corporate Social Responsibility Mean?

Corporate social responsibility (CSR) is the voluntary integration by companies of social and environmental concerns into their busi-

ness activities and their relations with stakeholders. In other words, CSR is the contribution of companies to the challenges of sustainable development.

A company that practices CSR will therefore seek to have a positive impact on society while being economically viable.

ISO 26000, an international standard, defines the scope of CSR around seven central themes:

- Governance of the organization
- Human rights
- Working relationships and conditions
- The environment
- Fair practices
- Consumer issues
- Communities and local development

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Does CSR Matter in Business?

Increases employee motivation

Employee engagement is now an extremely important issue for companies. Employee engagement is often synonymous with productivity, quality of life at work, reduced turnover, etc. For a company, having engaged employees is a fundamental strategic objective.

However, today the concept of employee engagement is increasingly complex. In a progressively more fluid work environment (with telecommuting, co-working, digital, etc.), employee engagement is becoming less physical, and more “moral.” From now on, to engage its employees, it is the values of the company that play the most, its ability to mobilize on social issues, and to capitalize on this mobilization. In any case, this is what recent studies reveal.

For a company, having engaged employees is a fundamental strategic objective.

“Research shows that about one in four employees is not only thinking about changing their jobs in the following months, but also changing them to pursue a job that’s more meaningful than their current one.”¹

A company with a strong CSR significantly increases its chances of attracting and especially retaining high-caliber employees. Many young graduates or workers are looking for jobs where they could have an impact. Because employees seek meaningful careers, a company with a successful CSR program can attract the best talent available.

Keeps customers engaged and maintains a positive brand image

It is not enough to commit to CSR; you must make it known.

CSR commitments are indeed crucial to retaining customers and consumers. According to the 2019 Edelman Earned Brand study², communication around brand values is now more effective than product communication. In fact, 34% of consumers say they would consider a purchase following messages from a brand based on its values, compared to 28% following messages about the product.

Communicating its CSR commitments to its prospects and customers is a lever for acquisition and loyalty. This can directly help boost sales.

Indeed, it has become very complicated for a company to stand out in a hyper-competitive corporate world. CSR has become a real way for companies to gain consumers, as well as develop a platform to market and attract the attention of their target audience.

Social responsibility can allow a company to be seen as a positive force. Indeed, the projects a business undertakes can help raise awareness for important causes but also keep your business top of mind.

CSR is an incredible development tool for brand image. Building trust with the target audience is crucial for a brand to thrive and retain customers. Having a real commitment to a CSR strategy can help build a good reputation in the market.

A 2015 Nielsen survey³ showed that more than 50% of consumers are willing to pay more for a product or service if the company prioritizes sustainability. It’s a real indicator that consumers are asking more of companies. Companies should not just exist to make a profit but should give back to society and have a positive impact.

An engagement for a sustainable future

Faced with environmental and climate challenges, the notion of corporate social responsibility is the common thread by reducing the environmental impact of the company, in the context of its business activities, administrations, governance, and choice of partnerships. Environmental responsibility involves reducing waste and sorting it, repairing and main-

taining equipment, using modes of transport with low CO₂ emissions, reorganizing processes with a view to preserving resources, and reducing the carbon impact.

CSR and Manufacturing

The manufacturing industry has a strong impact on the environment contributing to pollution and social cost. Consequently, CSR is a means for reducing the negative effects linked to manufacturing activities, but also of increasing long-term performance and the confidence of stakeholders.

The demand for circuit boards and technical parts used in hundreds of millions of everyday products comes at a significant environmental cost, as well as a social and human cost. Some solutions have been put in place to overcome this and others are in development.

Greener materials and practices

Environmental impact has long been a challenge for the PCB industry. Many companies and factories are strong proponents of sustainable manufacturing. PCB manufacturers have the option of using new environmentally friendly processes and materials such as 3D printing, additive processes, high precision screening, and new pastes for conductive and dielectric applications, etc. It is now possible to use green solvents to help make the manufacturing process safer, more efficient, and more sustainable.

The Restriction of Hazardous Substances Directive

RoHS certification, adopted by the European Union in 2003 and extended in 2011, prohibits the use of toxic substances in circuit boards and has achieved global compliance from importers, distributors, and manufacturers. Toxic materials prohibited by RoHS include:

- Lead
- Mercury
- Cadmium

- Hexavalent chromium
- Polybrominated biphenyls
- Polybrominated diphenyl ethers
- Four classes of phthalates

In addition to eliminating these chemicals from PCB manufacturing processes, RoHS compliance also covers any plating or finishing applied to electronic products and creates documentation of compliance and non-compliance.

While the original RoHS also applies to things surrounding the boards—components, subassemblies, and wiring—RoHS 2 covers all electrical/electronic equipment, cables, and components. RoHS 3 lists additional phthalates as hazardous. Compliance with the RoHS directives leads to the application of a CE mark on the products.

Factories around the world are implementing ways to conserve energy and reduce environmental impact. For example, some factories are or have installed geothermal energy systems. This geothermal heat pump system should reduce the cost but, above all, the energy consumption.

The certification of environmental management systems, ISO 14000, helps organizations demonstrate their ongoing commitment to environmental performance. This certification demonstrates the adequate implementation of an environmental management system in accordance with the requirements of the standard, meeting the requirements of customers, and stakeholders and reducing water and energy consumption.

The impact of carbon dioxide on the environment has spurred the development of voluntary global standards for measuring and reporting carbon footprint products. This includes the amount of greenhouse gas emissions, calculated as carbon dioxide (CO₂) equivalent, accumulated over the full life cycle of a product, from the production of raw materials to manufacturing, delivery, use of the product in the home, and ultimate disposal or recycling.

In addition to ISO 14001, which is one of the most recognized global standards for environmental management systems, the International Organization for Standardization has worked for a long time on many standards that relate to climate change.

- ISO 14064: Parts 1 and 2 provide requirements and guidelines for the quantification, monitoring, and reporting of greenhouse gas emissions activities. Part 3 defines requirements and provides guidance for those responsible for validating and verifying greenhouse gas claims.
- ISO 14065: Standard provides guidelines for organizations that perform greenhouse gas validation or verification.
- ISO 14066: Standard specifies the competence requirements for greenhouse gas validation and verification teams.
- ISO/TS 14067: A technical specification that provides guidelines for quantifying and reporting a product's carbon footprint, based on ISO 14040 and ISO 14044 (international standards for cycle analysis of life).
- ISO/TR 14069: A technical report that provides guidelines for quantifying and reporting an organization's direct and indirect greenhouse gas emissions.

Conflict minerals

Conflict minerals refer to raw materials or minerals that come from a particular part of the world where a conflict is occurring and affects the extraction and trade of those materials.

These conflict minerals are tin, tantalum, tungsten (the “3 Ts”), and gold. They are mined in eastern Congo and are found in all consumer electronics, as well as products in the jewelry, automotive, aerospace, medical equipment, and many other industries.

A landmark conflict minerals law was passed in 2010 by the U.S. Congress and requires U.S.-

listed companies to determine whether their products contain one or more of the four minerals—tin, tantalum, tungsten, and gold—originating from Congo, or one of its nine neighboring countries.

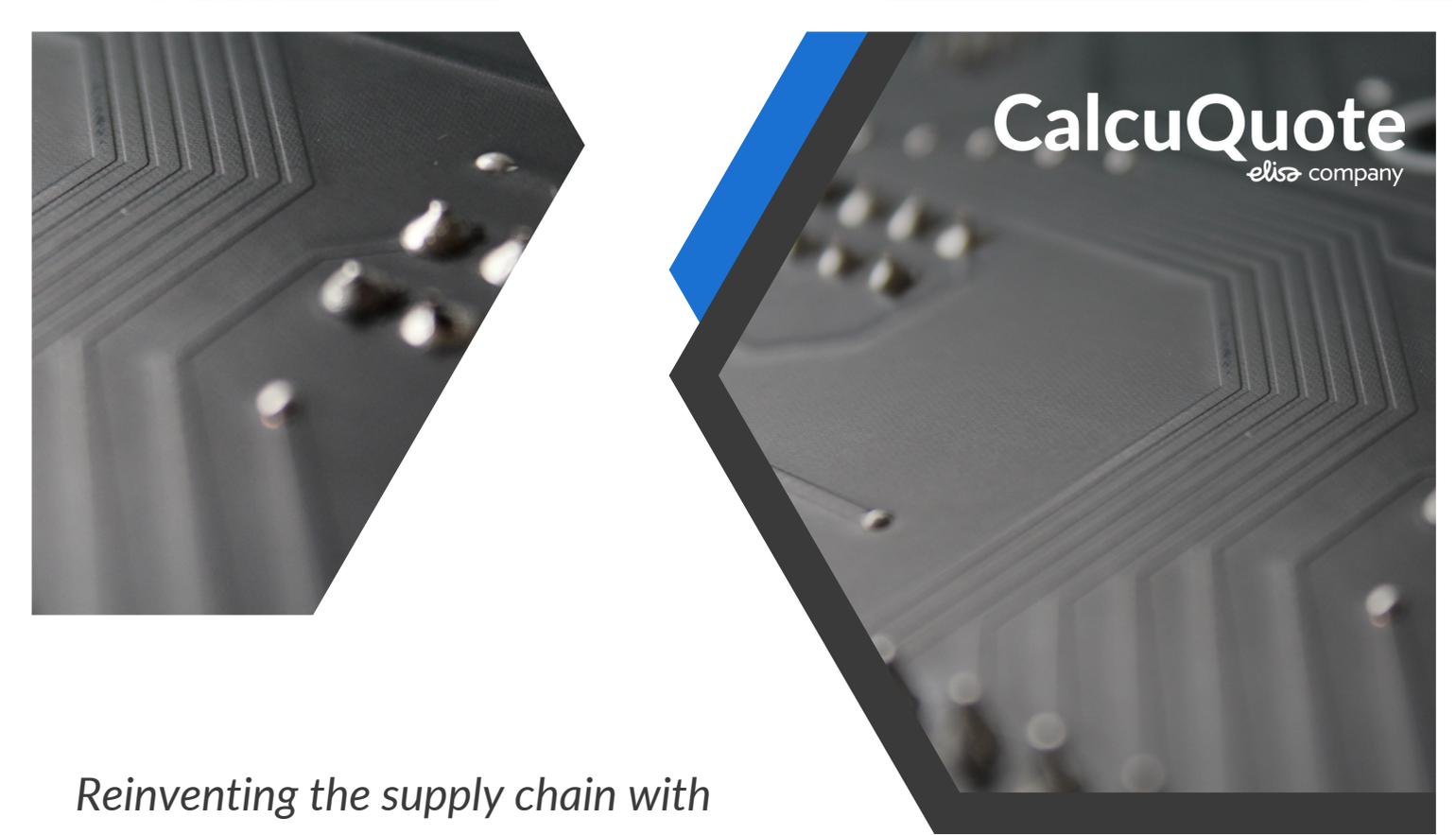
Section 1502 of the U.S. Dodd Frank Act, known as the “Conflict Minerals Provision,” is the first piece of legislation aimed at severing ties between the lucrative mineral trade in eastern Congo and violent armed groups. It requires publicly traded companies in the United States that believe they are sourcing from the region to carry out checks on their supply chains (known as due diligence), to determine whether their mineral purchases have benefited abusive armed groups. Companies must then report publicly on the actions they have taken to the U.S. regulator, the Securities and Exchange Commission (SEC).

Labor ethics

The ISO 45001 certification is primarily aimed at managing the health and safety of employees in the workplace. Implemented in March 2018 in the face of workplace accidents, it replaced the OHSAS 18001 standard in December 2021. This certificate is not yet commonly implemented in the PCB industry. But some major PCB manufacturers have already started implementing it, demonstrating their commitment to their employees and to responsible manufacturing.

Social Accountability 8000 or SA8000 is an international certification standard that encourages organizations to develop, maintain, and apply socially acceptable practices in the workplace.

Many factories have already integrated the SA8000 into their organization and strategy. It is, among other things, the guarantee that there is no child labor, forced labor, the assurance of respect for health and safety, working hours in accordance with international standards, or rules against discrimination.



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How Can a Company Be Socially Responsible?

CSR governance: One of the main starting points of a real CSR strategy within a company is to define a CSR governance. Without real CSR governance, with a manager who reports directly to the CEO or the head committee, nothing can be put in place in a sustainable way. Establishing internally a certain level of quality through certifications such as ISO (9001, 14001, 26000, etc.) or SA (8000), but also choosing to work only with partners who have done the same, is proof of a desire to achieve sustainable governance.

Carry out a CSR analysis/diagnosis. Reviews of CSR initiatives within the company must be implemented on an ongoing basis to ensure perennial monitoring of the CSR strategy and actions.

Identify the CSR risks. Identify the main CSR risks that a company may face such as non-respect for the environment, human rights, social conditions, or the presence of corruption in certain sectors or countries.

Identify stakeholders and recognize issues that affect them. The stakeholders are the shareholders, employees, customers, and suppliers, but also the business relationship with the local and national state institutions and standards. It is crucial to carry out an analysis of trends, business opportunities, and risks at the local and group level through certain tools such as a SWOT analysis.

Define the right approach to respond to CSR risks while considering the expectations of stakeholders. The CSR approach must be authentic and in line with the company's vision and values.

Set SMART objectives. Define and measure SMART (specific, measurable, acceptable, realistic, and timebound) key performance indicators to make sure that the CSR strategy has a positive impact on the operations.

Strongly involve employees in defining the strategy to strengthen internal support.

Good communication is a must. Everyone at the company needs to understand the CSR strategy. We should constantly be asking for feedback from the employees and communicating on the results and the impact.

What We Do at ICAPE Group

Governance organization

We have a CSR department and manager directly attached to the CEO. Within the group, there is a CSR committee overseeing the deployment of the CSR approach and reporting to the board of directors.

Equity in hiring

There are, among the 600 employees of the group, 33 nationalities that enrich the culture and the expertise of ICAPE GROUP (in 2021). One of the crucial points of the group's CSR strategy is to put everything in place so that discrimination in hiring does not exist within the group.

Dedicated sustainability audits of our partner factories in China

We have a team of trained CSR auditors based in our service offices in China (in the Guangdong and Jiangxi provinces). We are in the process of organizing and carrying out sustainable development audits of our partner factories based on the ISO 26000 framework standard. Close monitoring of action plans has been put in place.

Empowering women

More than 50% of the staff are women. Gender parity on the Board of Directors is ensured and respected.

EV stations

A gradual transition to a fleet of hybrid and electric vehicles is underway. We will gradually equip all our offices with EV charging stations; there are currently some in our French and German offices.

Nonprofit organization—ICAPE Planète Bleue

ICAPE Group participated in the creation of the ICAPE Planète Bleue Foundation, which aims to support environmental, educational, and social projects. For example, the financial support given to a French humanitarian convoy for Ukraine.

Ethics charter

ICAPE Group deployed an ethics charter in 2007. This ethics charter is an obligation and is present in each supplier contract. A special ethics charter has also been put in place for employees.

Greenhouse gas emission calculation in progress

A Scope 1, 2, and 3 carbon footprint measurement is in progress to reduce and monitor our GHG emissions.

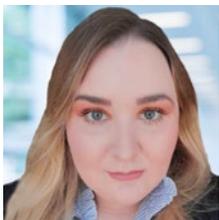
Transportation and supply chain

Actions have been implemented to reduce the carbon impact of logistics: consolidation strategy; call-off order, VMI, promotion of maritime transport in quotations; the objective of developing rail transport. We approach supply chain with an eye on sustainability and eco-friendly shipping practices: our goals are to optimize onsite resources, planning, execution, and to eliminate unnecessary trips. **SMT007**

Visit ICAPE Group online.

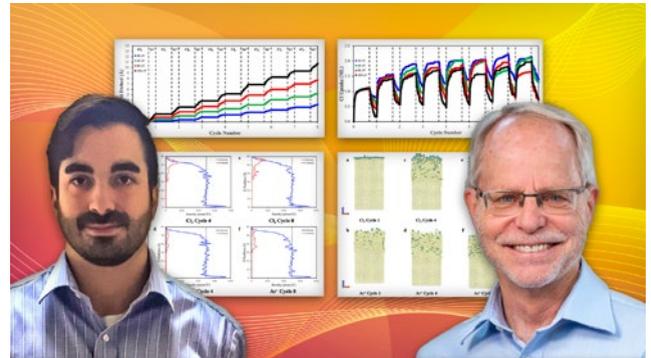
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Lea Maurel is the Americas marketing manager at ICAPE Group.

PPPL Findings Could Lead to More Powerful Microchips, Supercomputers



Physicist Joseph Vella, left, and David Graves with figures from their paper.

The information age created over nearly 60 years has given the world the internet, smart phones, and lightning-fast computers. Making this possible has been the doubling of the number of transistors that can be packed onto a computer chip roughly every two years, giving rise to billions of atomic-scale transistors that now fit on a fingernail-sized chip. Such “atomic scale” lengths are so tiny that individual atoms can be seen and counted in them.

With this doubling now rapidly approaching a physical limit, the U.S. Department of Energy’s (DOE) Princeton Plasma Physics Laboratory (PPPL) has joined industry efforts to extend the process and develop new ways to produce ever-more capable, efficient, and cost-effective chips. Laboratory scientists have now accurately predicted through modeling a key step in atomic-scale chip fabrication in the first PPPL study under a Cooperative Research and Development Agreement (CRADA) with Lam Research Corp., a worldwide supplier of chip-making equipment.

The PPPL scientists modeled what is called “atomic layer etching” (ALE), an increasingly critical fabrication step that aims to remove single atomic layers from a surface at a time. This process can be used to etch complex three-dimensional structures with critical dimensions that are thousands of times thinner than a human hair into a film on a silicon wafer.

(Source: Princeton Plasma Physics Laboratory)



Molybdenite

Mining for Metals Requires a Long View

Interview by Nolan Johnson

I-CONNECT007

Nolan talks with Shaun Dykes, a 50-year expert in the mining industry, who gives a concise primer on mining development, and the amount of time and effort required to develop and supply the mineral resources we depend upon for the manufacture of printed circuit boards. There are many factors that play into when and where a mine is developed—and what can prevent a mine from ever producing minerals.

Nolan Johnson: Shaun, what is your specific role and your background?

Shaun Dykes: I'm the president and CEO at American CuMO Mining Corp., and an engi-

neer and geologist by background. I've been in the business for almost 50 years. I've been all over the world, looking at and working on deposits in different regimes, governments, and bureaucracies from Canada, U.S., and Australia. I spent time in Russia and South America as well.

Johnson: Minerals and their role in the supply chain for finished metals has a great impact on our readers. They rely on the copper, tin, lead, and all the metals that go onto those fiberglass boards. In addition, there's solder and the minerals involved in those formulations. Copper, of course, plays a central role; that seems to be a metal at the core of the dynamics going on.



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Shaun Dykes

What are some of the global supply and demand trends in your industry and how might that be affecting us in electronics manufacturing?

Dykes: Metals, especially now with all the new technologies, are appearing everywhere—your circuitry, desalination plants, batteries, even your drinking water. Every single metal is in strong demand. The supply is getting shorter and shorter, and as mines become older, the grades are dropping and that reduces the amount of metal available. It now takes about five times longer to permit a mine than it used to because of the new regulations and rules you must go through.

Even then, some mines just can't go into production because they're either too costly or the opposition is too strong, and you can't get the permits to proceed. Right now, the supply is far less than the demand. Of course, that demand is increasing on a steady basis, year in, year out. That's why you're seeing the increase in metal prices.

Johnson: It sounds to me like any sort of domestic mining is under even stricter regulation, even while the demand is going up.

Dykes: Definitely. What we go through in the mining industry—some of it's good, while some is red tape and just absolute garbage. But other parts are good for the environment to make sure that the old days of mining, where you just rape and pillage with no care for what was going on, is long gone. Now, when we look at developing new mines, one of the first things we look at is the environment—rare and endangered species, trees, and more, before we even start spending the hundreds of millions of dollars it takes to develop a mine.

Johnson: Hundreds of millions of dollars to develop a mine? In our space, to build a computer chip factory, a semiconductor factory, is hundreds of millions of dollars and four or five years before it's producing. Is it comparable with a mine? If you decide to go forward, how quickly can you get a mine up and running?

Dykes: Well, it depends. From first boots on the ground, you've got to drill it and explore; for the larger scale mines, like the ones that supply your metals, it's averaging close to 20 years.

Johnson: Twenty years to get a mine started?

Dykes: From when you've discovered and outlined it, and let's say you've got all your resources and a bankable feasibility study, it's probably two to four years to construct it. Your construction costs can range from a couple hundred million dollars for the small mines up to several billion dollars for the large scale. A large-scale copper mine today will cost \$2 billion to \$3 billion, maybe even more. We've been working on a mine in Idaho since 2004. We still have about two years to go on the economic analysis part and then it will be three or four years to build it. The cost to build it is anywhere from \$1 billion to \$3 billion.

Johnson: So that particular example runs about 23 to 24 years.

Dykes: Yes, and that's for smaller mines. The smaller-scale gold mines that you see all over the place don't take as long. You can do them in four to six years, but not the larger main metal supply mines that supply your copper, silver, and aluminum; even your nickel, cobalt, all these metals.

Johnson: So, especially for copper or those sorts of metals, you're going to look for large scale mines because the demand is that high. It's huge and only makes sense to help feed the supply—a couple billion dollars over 20 years to get that up and running. How quickly can you get an ROI on that sort of investment?

Dykes: Much of the high-grade deposits in the Western world, like here in the U.S. and Canada, have basically all been discovered and mined out; new deposits being found are lower grades. If you're looking in exotic places like Africa or Russia, there are higher grade deposits. You also have to try to get the mine financed, and I'd say you're looking for a two- to five-year return on payback of the initial investment. Some of them go out as far as seven and 10 years, depending on the size. But a good one is usually two to five years return on the initial capital expenditure.

Johnson: Of course, it varies as well from mine to mine. But what's the typical expectation for how long a mine will stay active?

Dykes: It varies, but the minimum is 10 years, while most of them stay active anywhere from 15 to 25 years. Going back to the first example, we have spent about \$50 million to get to where we are today and still have probably another \$60 to \$100 million to get to that production decision.

Johnson: You've given us an idea of the math and timeline for developing a mine domesti-

cally and the thresholds you need to be profitable and move forward. You just mentioned that a lot of the very high-grade deposits have been mined out, so how do you find a new site?

Dykes: It's mostly done by going through the historic literature, which is tremendous. In fact, the mining industry gathers large amounts of data, probably more than any other industry, or you have prospectors that will bring you properties to examine. There are several hundred thousand properties in the U.S. alone that are currently being looked at. I would say probably 2–5% are lucky to become a mine. The best way to describe it is that you go through a lot of deadwood to find a gem.

We've worked on many projects and keep in mind things like profitability, tons, and grade. You're trying to make it work. Quite often, you'll drill holes, the expected results don't come back, and you walk away. Ten years later, somebody comes back, the prices have changed, and suddenly it becomes economic. You just never know. There are a lot of low-grade deposits that are not economical even at today's metal prices.

It's continually changing. These days, when you go to a property, you're probably the third or fourth group working on that property as you develop the model of what it looks like. Of course, with geologists and engineers, no two can agree on the same thing, so it's continuously changing over time. We might go back to a property we looked at 25 years ago under new conditions. There could be new technology or new recovery methods, metal prices, or the demand has changed. Right now, for example, copper is at \$4.50 per pound. Deposits we looked at in the 1970s when copper was 60 cents or 65 cents that were not economical, are economical today.

Johnson: Obviously, mining happens all around the globe. Can we compare what's going on globally vs. domestically when it comes to mining minerals?



metal. As far as we're concerned, we either mine it or grow it. Those are the only choices. Mining is a major player, and a big change is the markets. They've tried to regulate the markets, but there are these ongoing derivatives and stockpiling, which, of course, control the short-term pricing.

But in mining, you can't use short term pricing. You have to guesstimate the long-term price, in five- or 10-year chunks. I'm not interested in the price of copper today; I'm interested in the next five years and then in the next 10 years, because we must figure that out to do economic calculations.

Johnson: In our business culture where Wall Street only cares about the next 90 days, to be thinking 20 years out just to get it running, and then a minimum of 10 years of production, is a long time.

Dykes: Exactly. That's one difference in philosophy between the Western and Asian worlds. The Western world can't see past next week, and everything is controlled by these two- to three-year government plans. The Chinese, for example, and other Asian countries lay out 20-, 30-, 40-, even 50-year plans, so these small changes don't affect their plan.

Johnson: With all the metals now used in electronics, whether it's molybdenum, lithium, copper, aluminum, etc., what are the most challenging of the metals to supply from the mining perspective?

Dykes: No surprise here: the rarer they are, the more challenging. I wouldn't call copper a rare metal. There's quite a bit of copper still in the ground at lower grades around the planet, but it is more remote. It will cost you more to mine, but the price takes care of that.

When the demand goes up—because of the long timeframe to start a mine—it may take four or five years for the mines to catch up, and you end up with supply and demand matching up. In

Dykes: The big change in the market in the last five to 10 years is resource nationalism where countries are now establishing rules to produce the finished goods rather than ship out the raw material. They've realized they can build the products and then sell you the finished product. That's one big change in the market. China's approach is different than what's been done historically over the past 400 or 500 years. Normally, you mine your own material first, then you go mine someone else's. China produces its own, but it's also buying up everybody's else's deposits, because they've got the money to do it; they go in and purchase all these.

We have two or three offers on our deposits from the Chinese wanting to control the metals in order to control the market and maintain it. If you control 70% or more of the market, you can manipulate the prices so that you can flood the market at times and gather up all the deposits. Once you have control, you can throttle off the supply to raise the price.

The other thing, of course, is these derivative markets. What happens is at certain times you can look at the market and realize there's been more copper sold than exists. That creates these artificially high prices. If a lot of these markets were called, the price would skyrocket because there's just not enough, so you get this contributing to the supply/demand curve.

The bottom line is the world still needs the



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the meantime, the price goes up, and long term, it comes back down as new mines come on.

When you get into things like germanium, and the rest of your rare earths, these are all required by the industry—not in great quantities, but there’s still a requirement. For example, F35 jet fighters can’t fly without some of these metals. On the U.S. and Canada’s list of critical minerals, you’ll find all the minerals that are difficult to find. Basically, the more difficult it is to find, the longer it takes you to develop the mine.

Johnson: We’re talking 20 years to develop a mine for copper. What does that mean for mining something like germanium?

Dykes: What takes you 20 years is when you’re starting from scratch. This means you’ve got to get your drills in there and drill it all out because you never know how much success you will have in developing it. Every deposit is different. What’s fun about geology and engineering is there are no two deposits that are alike, and you have to start from scratch in every one of them. And it’s not common to get these metals all in one place. You must go to different areas of the world to find some of these metals and in the right type of deposits.

There may be deposits we found 30 years ago, but now because germanium is \$9,000 a kilogram, it suddenly becomes economical. There are one or two mines in the U.S. that have been sitting there for 40 years, and suddenly, we say, “Hey, we need rare earth.” You can then develop them fairly quickly because a lot of the work has been done previously. Once geologists find a deposit, you’ve got three choices: walk away, put it on the shelf, or start developing it.

Johnson: Shaun, your industry forecasts out 20 years. Did the mining industry see this spike coming in the demand for electronics?

Dykes: I would say some did. That’d be about 5% of those making forecasts. Work tends to

slow down during the low-price environments and increase during the high prices, which is backward from the way it should be done. Investors tend to finance things when the price is high and going up.

So, you raise the money to do the work while in a high price environment. By the time you get to production, the price has dropped. A perfect example was in 2008. The molybdenum price was high at \$40 a pound; a mine was fully funded, and even started ordering the equipment for the mill. Everything was economic and looked really good. They did all the work producing the bankable feasibility study, which took them four years to do. By the time they completed the feasibility study, the moly price had come down to \$10. The mine wasn’t economic any longer. It’s 14 years later and the mine is still not in production.

The mining industry must work the other way. You really have to be able to do all the initial work during the low-price environments and then build your mine when the high price environment comes about so you can get your payback fairly quickly.

Unfortunately, the financing doesn’t work that way, except for the 5% of the financiers who can see that and say, “This is going to be economic sometime. Let’s fund the work now and be ready for the next high price.”

Johnson: Do those cycles have some regularity to them?

Dykes: There are so many factors that control these cycles. I wouldn’t say they’re regular, but it’s normally five to seven years. In the time I’ve been around, we’ve been through about five or six cycles. They’re all over the place with it. Again, it all depends on what happens. The cycles will likely get slightly longer because, to reduce the metal prices, you have to increase the supply. Over time, the supply side is not as fast to deliver the increase because the high-grade deposits are not there, longer timing, and everything else, so it stretches them out a little bit.

The EV Critical Battery Materials Boom

WHERE DOES THE LITHIUM ORE COME FROM?



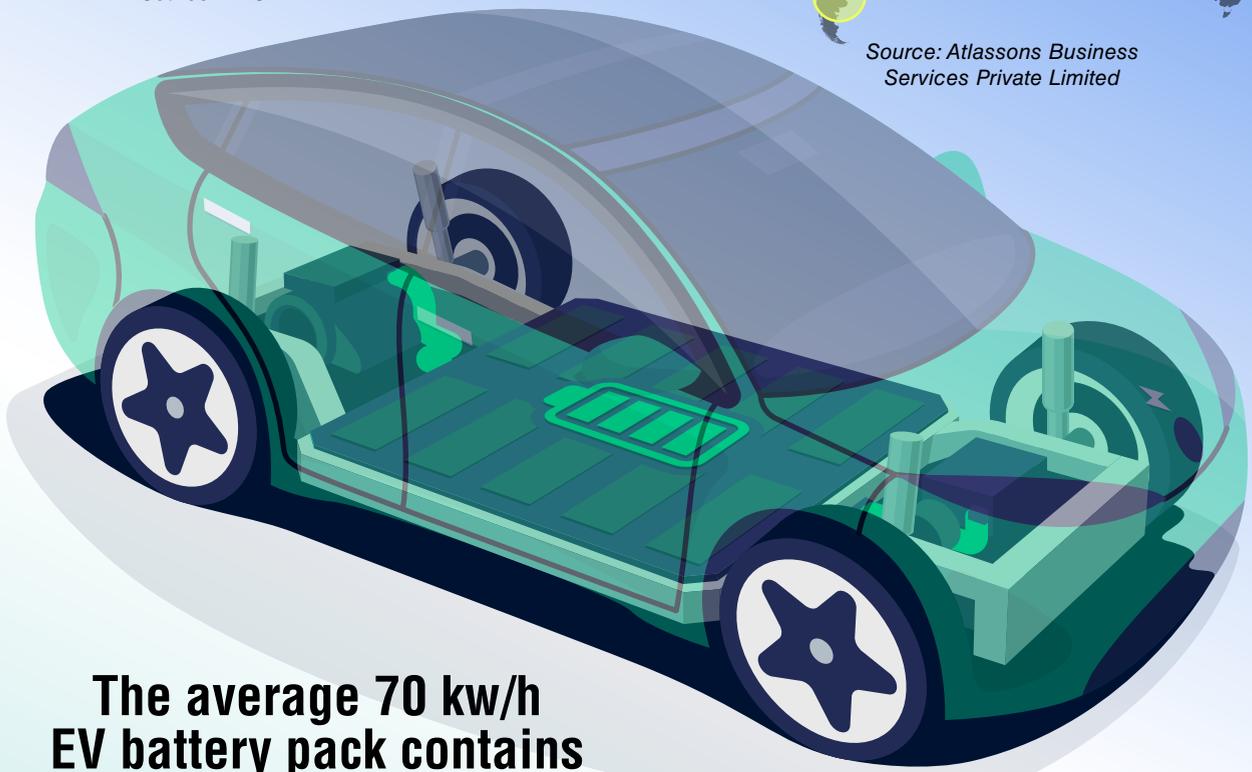
Source: Atlassons Business Services Private Limited



10000%

Expected growth in demand for minerals needed to make EV batteries by 2050

Source: PBS



The average 70 kw/h EV battery pack contains



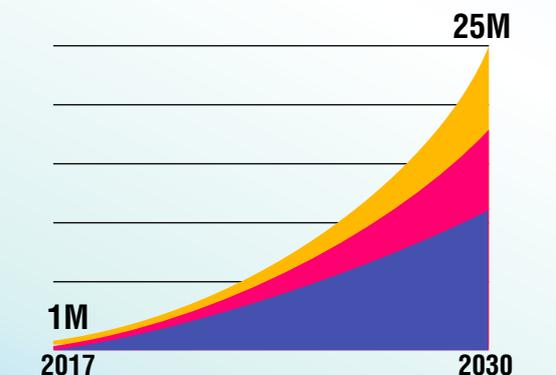
77 lbs.

31 lbs.

18 lbs.

Source: Energy X

AS EV SALES INCREASE, MORE LITHIUM WILL BE NEEDED



United States China All other countries

Source: Bloomberg, NEF, Marklines

But the problem occurs when the slightest thing, like the Ukrainian war, spooks the investors who we depend on. If I can't raise money to do the work, I must put everything on hold until we can. Short term thinking does have a major effect on the ability to do the work, which is driven by the ability to raise the funds to explore and develop these mining projects.

Johnson: It's clear that we are not going to mine our way out of this supply problem.

Dykes: No, not at the moment, and not with this new green technology and the amount of, let's call it, green metals. Everybody wants this new green energy, but where are we going to get the metals to do it?

Johnson: As you look ahead in electronics manufacturing, what should we expect the minerals market to look like?

Dykes: Going forward, the demand will remain strong for these metals. For at least four or five years, my opinion is the metal price will stay high. We'll see more increases over \$5 (per pound) copper before we see below \$4 (per pound), unless something significant happens. It's just not there. They must pay higher prices for the copper used to manufacture things. Of course, that will be translated into higher prices for products. As deposits come online, certain metals may not increase as much. But overall, the cost is going up.

Of course, other costs are increasing, such as the cost of mining and hiring people to do the work. That translates into inflation, and higher cost of goods. As well, you have China trying to control the market, wanting to control the manufacturing, and controlling the release of metals. That will all contribute to the Western world needing more metals. The U.S. especially will need to develop its domestic supply sooner or later.



Germanium

The outside world wants to sell the finished products, and many are starting to. I'm seeing it in South America, Indonesia, and other places where these metals can be mined. They require a local manufacturing plant there if you want the raw materials. So, that will cut off the manufacturing industry in places like Canada and the U.S., which, of course, affects jobs.

Yet we have the raw materials still here in the West. We're just hung up on all this permitting, bureaucracy, and delays to our various projects. But we'll see some of that give way as people start to realize what's happening. We'll eventually come back to reason instead of these polarized views.

The mining industry has changed over the past 50 years. We can mine, do it properly, and do it in the right way. But those factions protesting mining operations continue to slow down the process, which doubles or triples the time it takes to put a mine in production and therefore delays the supply of the metal. In the meantime, the price goes up. When the price goes up, the other groups, which are not affected by the delays, can move their metals inventory on the market.

Johnson: This has been an amazing conversation. Thank you.

Dykes: My pleasure. SMT007

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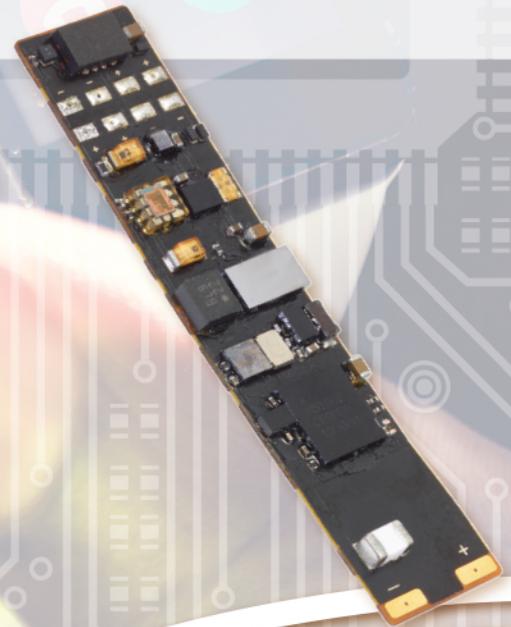
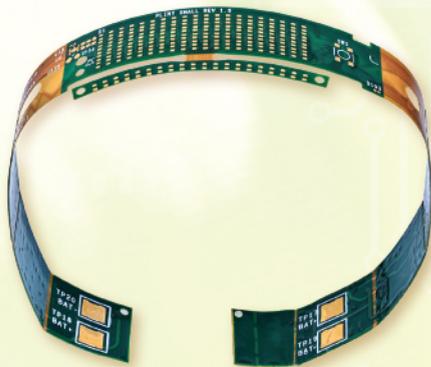
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Clean Energy and Critical Minerals: The **Dichotomy** and **Divergence**

Article by Noelle Lovern

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

Supply Chain Issues—No Surprise USGS

In 2018, the U.S. government signaled a strong priority to address looming supply chain issues by studying the availability and supply of mined materials and reporting it out in the critical minerals list. At its origin the list published by the U.S. Geological Society (USGS)

included 35 minerals considered to play a significant role in infrastructure, national security, renewable energy development, and the economy. Until the recent 2022 update of the list, the U.S. was importing at least 50% of 31 critical minerals from foreign sources—an issue that is arguably one of the greatest threats to the U.S. economy and defense.

The urgency to resolve the supply chain issues has been exacerbated by disruptions related to COVID-19 and now the Russian invasion of Ukraine and associated sanctions. Current supply chain threats have urged USGS to add 15 commodities to the 2022 Critical Minerals List. To further address the matter, the Biden Administration issued Executive Order 14017 in February 2022 to secure critical supply chains.

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Nearly every technology and much of manufactured goods require mined elements. It is often said, “If you don’t grow it, you must mine it.” Now more than ever, mined materials are in higher demand. Clean energy initiatives are supported by technologies that demand more and more strategic and critical minerals.

Reconciling the Supply and Demand

Low-carbon technologies are projected to increase the need for critical minerals up to 1000% by 2050. From electric vehicles (EVs) to solar photovoltaic (PV) industries, every clean technology requires strategic minerals for production and distribution, but most of all in storage (batteries). Batteries have existed since the late 1800s and currently have many advanced formulations, including one of the most popular modern energy storage products: lithium-ion batteries, or LIBs. These are high-capacity long-life batteries commonly used for small scale applications. With proper modifications they offer the most promise to eventually power large-scale applications.

Minerals Critical to Energy Storage

The amount of electrical storage for EV batteries ranges from 70 kWh to 200 kWh. Keep in mind that one 70 kWh EV battery requires 30 pounds of battery-quality nickel, 10 pounds of cobalt, and 140 pounds of lithium. Development, testing, and production of battery technology requires hefty amounts of these three minerals, two of which the U.S. does not produce, nor possess, a national supply or reserve.

Critical Move to Production

While the U.S. has dropped low on the charts in production of strategic minerals, countries including Canada and Australia, each of which maintain equally stringent environmental permitting laws, are producing and exporting seven of the top critical minerals (cobalt, gallium, beryllium, graphite, tellurium, lithium, platinum elements, and others). Australia

and Canada have balanced the importance of domestically supplied strategic minerals with tightly structured oversight and a regulated statutory two-year environmental permitting process.

While regulatory oversight in these countries outpaces U.S. processes, expanded partnerships with Australia and Canada, such as the Critical Minerals Mapping Initiative, try to bolster and maintain a diversified supply of critical minerals among the three countries.

The relationship with our three countries notwithstanding, mining investors are still often deterred from funding projects in the U.S. due to unreasonably long lead times to obtain approval or rejection for permitting a proposed project. This has put U.S. mining on the ropes at a time when the clean energy industry needs mineral development most. Both industries—low-carbon technology and mining—have a vested interest in finding solutions that match their needs, but will they find the common ground to collaborate and drive innovation closer toward carbon net-zero?

A Closer Look at Critical Minerals

Understanding the strategic minerals necessary for a robust and sustainable energy efficient technology industry is important for achieving a stable, productive future for our economy and national security. Here is snapshot of three of the most critical minerals to clean energy.

Cobalt

Access to critical minerals that are instrumental in battery technology entails navigating environmental issues and political landscapes. One of the most precarious of these, the Democratic Republic of Congo (DRC), is home to 50% of the global supply of cobalt.

Cobalt, the most expensive and the rarest mineral critical to battery development, is often referred to as the “blood diamond of batteries” based on practices that endanger the child workforces in the mines. Human rights

activists are pushing the technology industry and battery makers to move away from cobalt to other battery formulations.

Nickel

Currently, nickel is mostly used to produce stainless steel products. However, as the demand for clean technologies grows, so will the need for nickel. These new technologies require better quality nickel than is now in production. Shifting production from lower quality to battery quality nickel is a wholesale change which includes identifying sources for the much rarer nickel sulphides and modifying processing.

Lithium

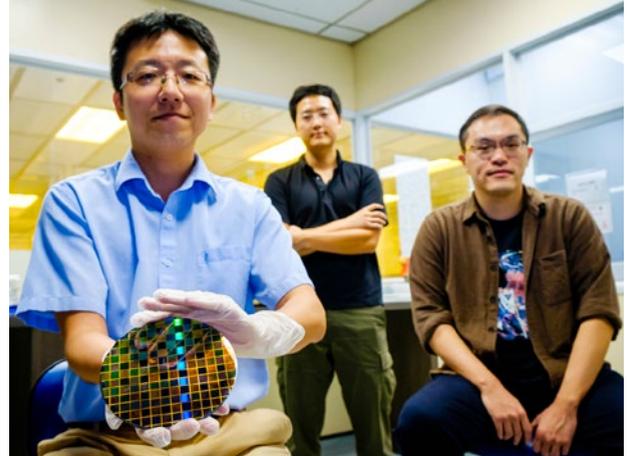
The supply of lithium is considered pivotal to global electrification, however, as demand for electric vehicles increases, the long-term supply of this mineral is questionable. As the demand for EVs increases, strategic and critical mineral supplies will struggle to keep pace. With an estimated 30-95 million tons of lithium on the earth, better design and recycling is required to slow the depletion, however, researchers project that supplies will be depleted by around 2100.

The equipment used to generate clean energy and the ever-increasing demand for improved storage capacity is highly dependent on mined materials, especially critical minerals. Proponents of clean energy technologies and the mining industry cannot remain in their historic deadlock if net zero carbon is to become a reality. This interdependency requires common ground and urges both sides to map pathways to improved policies and streamlined permitting of pro-environment mining operations. **SMT007**



Noelle Lovern is a public relations consultant for the mining industry.

New Technique Opens Door to Cheaper Semiconductors, Higher Chip Yield



Scientists from the NTU Singapore and the Korea Institute of Machinery & Materials (KIMM) have developed a technique to create a highly uniform and scalable semiconductor wafer, paving the way to higher chip yield and more cost-efficient semiconductors.

Semiconductor chips commonly found in smart phones and computers are difficult and complex to make, requiring highly advanced machines and special environments to manufacture.

Their fabrication is typically done on silicon wafers and then diced into the small chips that are used in devices. However, the process is imperfect and not all chips from the same wafer work or operate as desired. These defective chips are discarded, lowering semiconductor yield while increasing production cost.

Nanotransfer-based printing—a process that uses a polymer mould to print metal onto a substrate through pressure, or “stamping”—has gained traction in recent years as a promising technology for its simplicity, relative cost-effectiveness, and high throughput.

However, the technique uses a chemical adhesive layer, which causes negative effects, such as surface defects and performance degradation when printed at scale, as well as human health hazards. For these reasons, mass adoption of the technology and consequent chip application in devices has been limited.

(Source: Nanyang Technological University)



Supplier Highlights



SMT Perspectives and Prospects: Critical Materials—A Compelling Case, Part 2 ▶

When I wrote Part 1 on this topic in January, the global geopolitical landscape could be characterized as “status quo”—testy, challenging, yet absent of “war” in any region of the world. Now with Russia’s invasion of Ukraine, the title of the article may warrant: “Critical Materials—A Precariously Escalated Compelling Case.”

Maggie Benson’s Journey: Report and Verify ▶

In this chapter, Maggie and John meet with her grandfather, who sold the company to Maggie, to talk about how it’s going.

The Manifest: Optimize Throughput for High-Mix, Low-Volume Manufacturing ▶

For manufacturers who have high-mix, low-volume production, there are certain pieces of equipment that can help you optimize your throughput potential.

Mycronic Releases Interim Report January-March 2022 ▶

Mycronic has announced its interim report for first quarter of 2022 (January-March). Net sales declined 12% to SEK 1,135 (1,291) million. Based on constant exchange rates, net sales decreased 19%.

Danutek: Technology Day Brings the Electronics Community Together ▶

Danutek, a distributor and service provider in the SMT manufacturing industry, brought together leading global companies for a Tech-

nology Day in Serbia and Bulgaria, where attendees learned about the latest innovations within the electronics industry.

Aegis Software Announces New Updates to FactoryLogix Manufacturing Operations Platform ▶

Aegis Software, a global provider of Manufacturing Operations Management Software, announces new capabilities in their latest FactoryLogix 2022.1 and 2022.2 releases.

Koh Young Technology Celebrates 20 Years of Innovation ▶

Originating from a passionate team of ten engineers, Koh Young Technology has flourished into the industry leader of True 3D measurement-based inspection solutions.

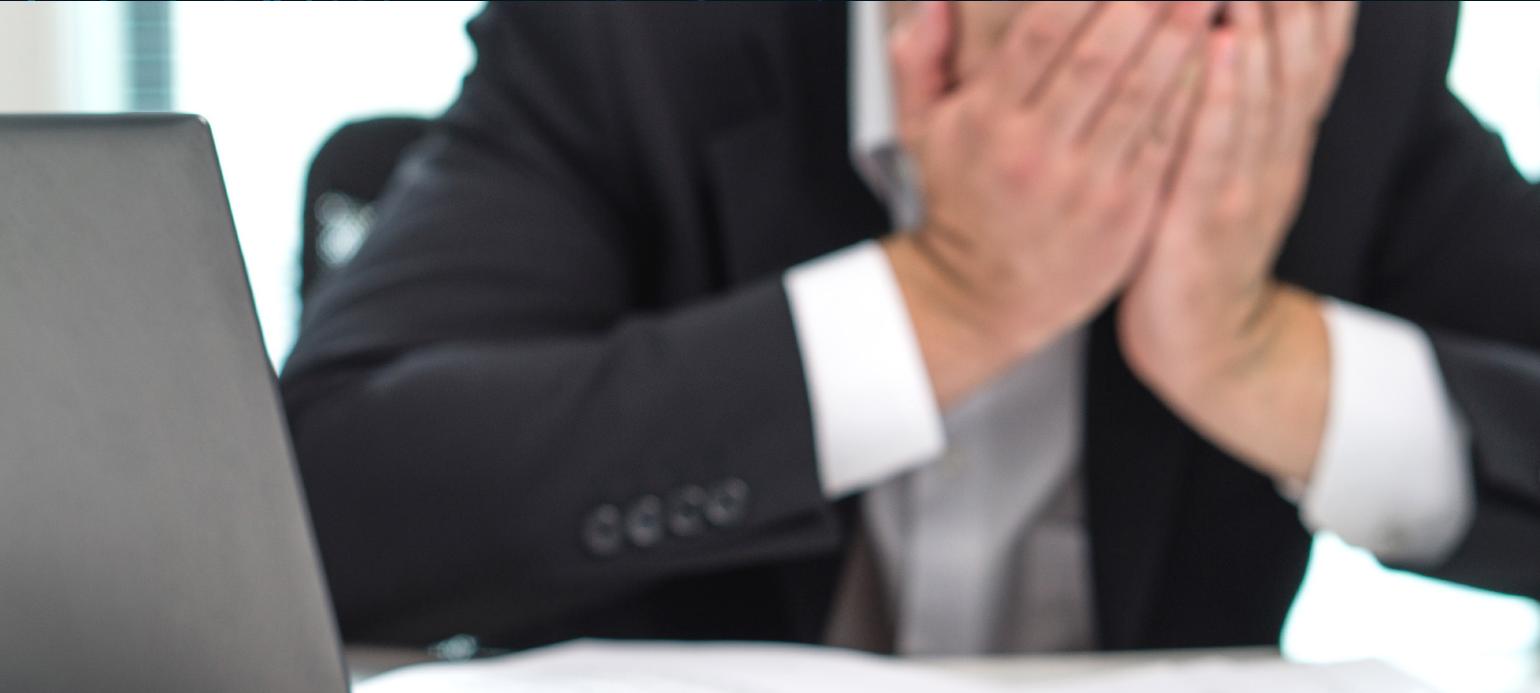
EY Names Dr. Subodh Kulkarni of CyberOptics as an Entrepreneur of the Year 2022 Heartland Award Finalist ▶

Ernst & Young LLP (EY US) announced that Dr. Subodh Kulkarni, president and CEO of CyberOptics Corporation, was named an Entrepreneur of the Year 2022 Heartland Award finalist. Entrepreneur of the Year is one of the preeminent competitive business awards for entrepreneurs and leaders of high-growth companies who think big to succeed.

TestEquity Proudly Announces Distribution Partnership with Kurtz Ersa ▶

TestEquity announced that it has become an official authorized distributor of Kurtz Ersa products.

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Resourceful Solutions During Nationwide Shortages

The Manifest

by Emmalee Gagnon, MANNCORP

As supply chain issues and chip shortages continue plaguing the world, companies are still struggling to get SMT components. A variety of solutions have risen to combat these struggles. The main methods being used are preservation of existing parts, reworking of PCBs, reclaiming of placed parts, and—if surface-mount technology isn't enough—turning to through-hole technology to fill the gaps.

Secure SMT Production With Counters, Dry Boxes, and Rework Machines

Preservation of existing parts, as well as reuse and reclamation of placed boards, are all critical elements of getting through the shortage. Keep precise count of components, keep them protected from moisture, and be ready to rework when necessary to retain the number of parts you have with the right equipment.

Here are the top three equipment categories for achieving these goals.

Preserve

- **Component counters:** Having accurate counts of your components ensures control over inventory, which means management is aware when specific parts are running low (so they can order ahead of time and prepare for wait times appropriately) and can catch shrinkage through misuse, theft, or waste of SMD parts.
- **Dry boxes:** It is crucial to keep components safe from moisture damage, especially in this time of short supply. Ensure the parts you have are usable by storing them safely in dry boxes and using baking dry boxes to restore affected moisture-sensitive devices.



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Rework and Reclaim

• Rework systems

1. Reworking boards in need of repair, or that need to perform a new function, helps to reduce the number of PCBs disposed of and the number needing to be ordered.
2. Reclaiming the placed parts (including SMDs, BGAs, QFPs, and LEDs) on existing boards limits the number of new parts that must be sourced. Previously placed parts can be cleaned of residual solder after salvage and then re-balled with either tin-lead solder, or lead-free solder to be reused on new boards.

Printed circuit boards often contain valuable and difficult-to-source electronic components. You can avoid letting any of these parts go to waste by having control over inventory, reworking existing parts and boards, and by keeping critical components safe from moisture. The result will be fewer parts needing to be sourced, combatting unnecessary drains on the already-parched system.

Replace the SMT Parts You Can't Get by Converting to THT Parts

In cases where preservation and reclamation of SMT parts are not enough to keep produc-

tion going, some manufacturers have begun converting to through-hole parts over surface mount technology as a short-term solution. Equipment suppliers are now seeing an uptick in orders of through-hole equipment, especially for lead-forming and soldering equipment. Here's why it may be a good idea to look back in time to look forward in manufacturing.

By repurposing existing parts to function as through-hole technology, manufacturers can combat the current crisis—not letting the part shortage halt production. The top pieces of equipment needed for this part conversion (which are being purchased at a rate not seen in over a decade) include:

- **Wave soldering machines:** With either single or dual waves, wave soldering machines permit automated lead-free or tin-lead processing of through-hole and surface-mount boards.
- **Selective soldering machines:** Selective soldering is a precise, low-price-point, benchtop alternative to hand soldering; in this time of labor shortage, selective soldering machines reduce the number of workers needed by doing the work of four to six people doing hand soldering.

Secure SMT Production



Component Counters



Rework Systems



Dry Boxes

Electronics products are becoming ubiquitous in many aspects of modern life, including smart devices, internet of everything, wearables and self-driving vehicles, as well as the more established (but still growing areas) of communications, entertainment, medical devices, lighting, automotive, avionics and computing. The growth is largely driven by the continued increase in density of integrated circuits, the applications that utilize the greater functionality, and by steadily decreasing power consumption and cost.

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John H. Lau, Ph.D.
Unimicron

Convert SMT Parts to Through-Hole



Wave Soldering



Selective Soldering



Lead Formers

- **Lead formers:** Axial and radial lead-forming machines are available to efficiently cut, bend, and form taped and loose components for through-hole assembly.

As many companies with in-house production (and those looking to start with their own product assembly) have been confronted by shortages of parts, through-hole (THT) production has emerged as a possible solution for many. Since the components necessary for THT are more readily available than those for SMT, reconfiguring can help manufacturers reduce wait times and increase output. If your company has been struggling to get the SMT parts necessary for production, it may be worth considering adding THT capability to your production.

Continuing Production Despite Shortages

In this time of short supply, American manufacturers have shown resiliency and ingenuity. Equipment suppliers are ready to meet the changing needs of the market by supplying the necessary tools. With the right equipment, manufacturers operating in-house equipment can continue production. By taking precautions to safeguard the components available, and by being able to have the flexibility to pivot from SMT to THT when necessary, small and medium manufacturers can survive despite adversity. **SMT007**

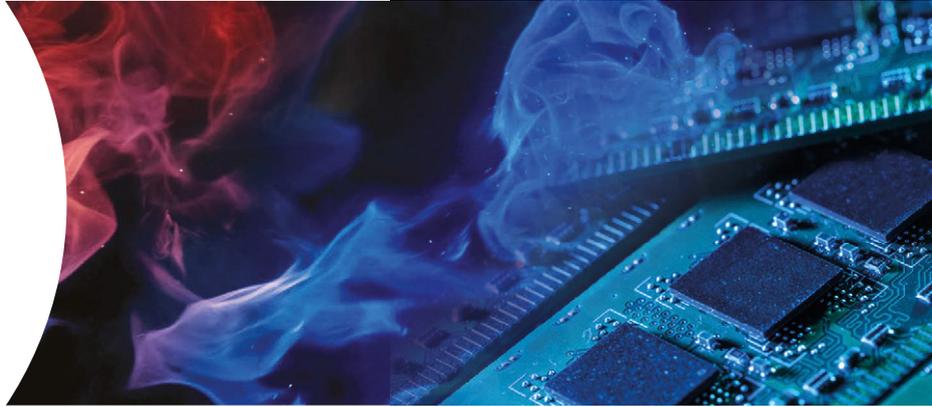


Emmalee Gagnon writes about SMT-related topics and customer stories for Manncorp. To read past columns or contact Gagnon, [click here](#).

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ein Electronics Industry News and Market Highlights



Dell Technologies World 2022: Liquid, Samsung, and Tanzanite Silicon Solutions Deliver CXL Orchestration with Composable Memory Demo ▶

Liquid, a company delivering data center compositability, announced they are collaborating with Samsung and Tanzanite Silicon Solutions to demonstrate composable memory via the Compute Express Link (CXL) 2.0 protocol at Dell Technologies World 2022.

DuPont Wins Four 2022 Edison Awards, Highlighting Innovative Technologies ▶

DuPont is proud to announce that four of its innovative, breakthrough technologies were recognized with the prestigious 2022 Edison Award.

Semiconductor R&D Spending to Rise 9% After Hitting Record in 2021 ▶

New update shows Intel continues to lead research and development ranking, the top 10 raised spending 18% last year, and 21 companies invested \$1 billion or more on R&D in 2021.

Dell Solar Community Hubs Bring Technology, Healthcare, Workforce Skills to Remote Communities ▶

Dell Technologies, in partnership with Computer Aid, Intel and Microsoft, announced its Solar Community Hubs strategy, marking an evolution in its established Solar Learning Labs program. Moving beyond technology access for education alone, the hubs improve access to technology, healthcare, and workforce skills for communities in remote areas around the world.

Sierra Wireless' Next Generation Radio Frequency Optimized 5G Module ▶

Sierra Wireless, an IoT solutions provider, announced the availability of its next generation 5G mobile broadband embedded modules, the Radio Frequency (RF) optimized EM92 Series.

IDC: Smartphone Shipments Declined 8.9% in Q1 as Global Demand Softens ▶

Worldwide smartphone shipments declined 8.9% year over year in the first quarter of 2022 (1Q22), according to preliminary data from the International Data Corporation (IDC) Worldwide Quarterly Mobile Phone Tracker.

Kyocera Integrates Walkie Talkie Application in Microsoft Teams ▶

Kyocera, a North American leader in rugged mobile solutions, has entered into an agreement with Microsoft to integrate the Walkie Talkie application in Microsoft Teams on ultra-rugged 5G Android smartphones.

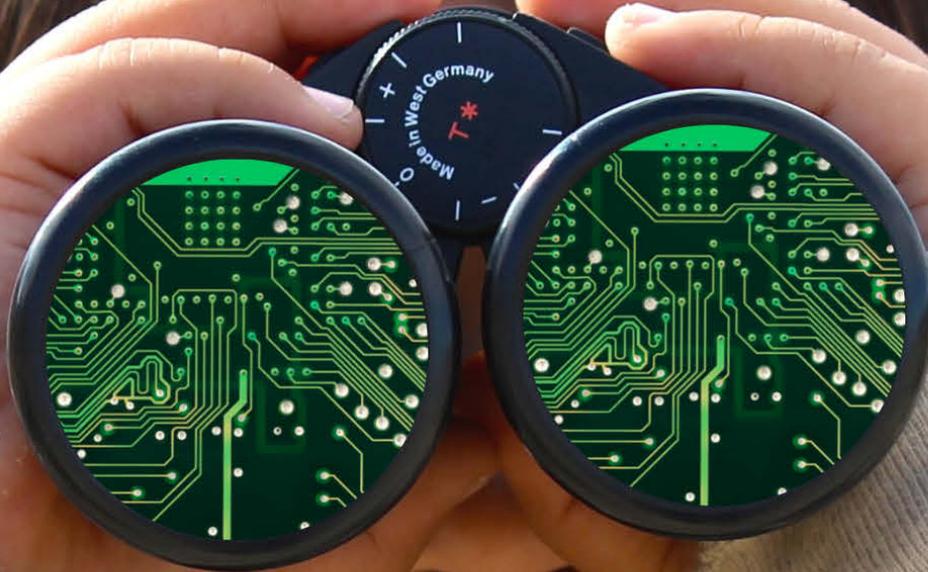
Airgain, Mobix Labs Collaborate to Develop Future-Proof 5G Technology ▶

Airgain, Inc and Mobix Labs Inc. announced an agreement for the development of strategic, future-proof 5G technology.

RADCOM Wins Multi-Year 5G Assurance Contract for a Mobile Network in Europe ▶

RADCOM Ltd. announced it has entered into a multi-year contract to provide its service assurance solution to enhance the end-to-end customer experience for a mobile operator in Europe.

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Anaya Vardya: An Advocate for Great Partnerships



Feature Article Compilation by the
I-Connect007 Editorial Team

We can't have a solid issue about partnership without including Anaya Vardya, CEO of American Standard Circuits, who feels strongly that it's time for electronics manufacturers



to come together in a spirit of unity and put aside some of their competitive differences to create a more robust industry. For the past six years, Anaya has written in his monthly column, Standard of Excellence, about the advantages of working together for a common goal. We reviewed every column and curated our own top 10. We know you'll agree with his sentiments. How have you seen this working in your factory?

1. Partnerships Made Us Stronger

January 2022

It's 2022, a brand-new year, things are going to be different, and we are going to change it up. We have now settled into the COVID life. Every time we think it's going away, it comes back. We have spent over 22 months with this evil monster, and it looks like there is more to come. But the good news is that we are getting used to it. We have learned how to do things effectively during these especially challenging times. Some of us have increased our marketing, others have found different ways to communicate with our customers, and many of us, much to our surprise, have found that our top numbers have been actually increasing over the past two years.

Free Checklist: Vulnerability Assessment

The Checklist helps CEOs understand what to expect from their Vulnerability Scan, so they can be prepared to better understand risk and make necessary changes. Topics include:

- ✓ The CEO's role before, during and after a Vulnerability Scan.
- ✓ Baseline cybersecurity tenets that CEOs need to be confident in.
- ✓ Questions CEOs should be asking to understand and justify the risk associated with each of the findings.
- ✓ How CEOs can communicate the results of a Vulnerability Scan.

THE COMPLETE SECURITY VULNERABILITY SCAN CHECKLIST

What is a Vulnerability?

- ✓ A design flaw or misconfiguration which makes a network (or a host in a network) susceptible to malicious attacks from local or remote users. (Risk varies from disclosing information to a total compromise of a network).

Where Does a Vulnerability Exist?

- ✓ Vulnerabilities exist in: Firewalls, Servers (Email, Application, File Transfer Protocol (FTP), etc.), or Operating Systems.

Vulnerability Scan Process

- 1 - **IDENTIFY** by running a scan
- 2 - **ANALYZE** by reviewing report results
- 3 - **RISK ASSESS** by reviewing severities by level
- 4 - **REMEDiate** by acting to resolve vulnerabilities

What is a Vulnerability?

- ✓ A design flaw or misconfiguration which

2. Partnership is a Team Effort

December 2021

The best way to develop and implement a true ongoing and productive partnership with your vendor-partners is to make it a full team effort. Each company's partnership team should have members from each of the company's departments. For example, the vendor's team should have someone from the shipping department coordinating with someone from your receiving department. The same with engineering, quality, and operations. This coordination should be at all levels from the top down.

3. From Adversaries to Collaborators—Let's Do This Together

April 2022

Because of the results of the pandemic, we are experiencing shortages like we have never faced in our lifetime. Therefore, it is more important than ever that we all work together—and I really do mean all of us. Those of us who fabricate PCBs must open our minds and doors to the idea of working together. Where for so many years we competed to the point of treating one another as adversaries, we now must come together to form a cohesive partnership.



4. Forging Partnerships Through Adversity and Problem Solving

October 2018

For the past few months, this column has discussed how to find and work with a great PCB vendor, and most importantly, how to form a strong, productive partnership. This month,



Anaya Vardya will address how adversity can forge a great partnership between you and your PCB vendor that will last for life.

5. Working Through Shortages

August 2021

As result of the pandemic, severe shortages—both real and created—from our offshore vendors is making it difficult for us to build and deliver products on time. Here are five tips for getting through this together.

6. Working for the Future—Partnering With PCB Vendors on Innovative Technology

September 2018

The true test of the vendor-customer relationship comes when you need innovative PCBs—boards that are not easily found in the common marketplace and are so technologically advanced that they require your designers and suppliers to work together to go where neither has gone before.



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pliers are no longer able to keep up with your PCB needs? Do your designers feel limited by your vendors' limited capabilities? Are you finding an issue locating alternate sources for PCBs due to the consolidation of the larger shops in our industry? If so, you are not alone.

10. From Partnership to Greatness

May 2022

“We choose to go to the moon in this decade. Not because it will be easy, but because it will be hard. And because that goal will serve to organize and measure the best of our energies and skills. Because the challenge is one we are willing to accept, one we are unwilling to postpone, and one we intend to win.” — *John F. Kennedy, Rice University, September 12, 1962.* That speech represents the onset of the greatest example of peacetime cooperative partnership this country has ever seen. It was a partnership based on positive achievement not only for our country but for all mankind. **SMT007**



7. Successful R&D With Your PCB Partner

March 2020

Now, more than ever, we have to rely on our PCB partners to help us with new product development. A great deal of trust and confidence in them is required to create and fulfill this type of partnership fruitfully. Anaya Vardya shares eight things that must be in place to have a successful R&D relationship with your PCB partner.

8. Dare to Share

May 2021

We often talk about the value of working closely with your vendors to the point of making them partners. This strategy makes sense. The closer you are to your vendors, the more you help them, the better vendors they will be, and most importantly the better partners they will be. Now let's take that idea to the next level, all the way to the point of a true partnership.

9. Making Your PCB Fabricator Your PCB Partner

June 2018

Are your PCB needs exceeding your vendor base's capabilities? Do you feel that your sup-

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2/3 of electronic industry companies have difficulty finding production workers.¹

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¹IPC. (2017). Findings on the Skills Gap in U.S. Electronics Manufacturing.

The Double-edged Sword of CMMC



Article by

Divyash Patel

MX2 TECHNOLOGY, INC.

For the past few years, those whose SMT provider organizations supply or contract with the U.S. Department of Defense (DoD) have been hearing about—or even gearing up for—implementation of the Cybersecurity Maturity Model Certification (CMMC) program. By this, I mean that you were gearing up for CMMC 1.0. Today, we have CMMC 2.0, and there are several changes in the new version that impact both the standards for compliance and how you certify that compliance—especially if you run a small business.

Small businesses are the backbone of the defense industrial base (DIB), just as they are for the entire economy. As both patriots and businesspeople, I'm sure most contractors serving the DoD support the goals of

the CMMC program: ensuring the security of sensitive data up and down the supply chain. I'm also certain that the CMMC 1.0 rules, which went into effect in November 2020, caused more than a little stress and anxiety for smaller contractors. Why? Because CMMC 1.0 required contractors to undergo an examination by a Certified Third-Party Assessment Organization (C3PAO) to become certified.

When it became clear that the burden CMMC 1.0 placed on small contractors was significant enough to potentially force some out of the DIB, the DoD hit pause on the CMMC program. In fact, the official in charge of the CMMC's implementation came out and said one of the main goals of revising the program was to decrease the cost burden on small

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Divyash Patel

businesses. As a result, the DoD scrapped CMMC 1.0 and announced CMMC 2.0 in November 2021. The full 2.0 framework is expected to be released sometime next year.

But don't make the mistake of thinking the government will kick the CMMC can down the road once again when 2023 rolls around. I fully expect CMMC 2.0 to come online when the rules are final.

At a high level, the two major changes that will likely affect you are the new tiers of security and the shift to annual self-attestation of compliance.

The original CMMC defined five levels of security. CMMC 2.0 has three:

1. Foundational
2. Advanced
3. Expert

For most of you, the newly collapsed levels won't change the practical compliance requirements. This is good news. Most contracts will fall into Level 1, so any work you have done to this point to achieve Level 1 compliance under CMMC 1.0 has not been wasted. The new framework relies on the same 17 baseline security controls¹ used in the prior version—more on those controls in a moment.

The key distinction between Level 1 and Level 2 under CMMC 2.0 has to do with the type of information you handle. Level 1 focuses on securing federal contract information (FCI), for which there are no national security concerns. The bar for Level 1 is not set very high—it is essentially developing and maintaining good baseline cybersecurity policies and procedures. In my view, this is something any company should do; it's just a good business practice.

Some of you might fall into one of two Level 2 categories. Level 2 applies if you handle controlled unclassified information (CUI), but it applies differently based on the sensitivity of the CUI involved.

The other major change is that Level 1 and certain Level 2 companies must self-attest to their compliance annually. There's little argument that self-attestation will be less expensive than C3PAO certification, but there was likely more to that decision than altruism on the part of the DoD. Information security sooner rather than later is the department's goal. Allowing for self-attestation should make it more likely that contractors will make compliance efforts well before the final 2.0 rules are set.

Self-attestation comes with another kind of cost, however: unknown risk. For example, what might happen if you self-attest and are later found to be non-compliant? As of this writing, the final rules for CMMC 2.0 haven't been issued. But even if there are no fines associated with falling out of compliance, the financial consequences might be greater than lost opportunity.

About a month before CMMC 2.0 was announced, the Department of Justice (DOJ) made an announcement of its own: a new Civil Cyber-Fraud Initiative which paves the way for civil actions against contractors who misrepresent their cybersecurity readiness. This initiative is based on the False Claims Act (FCA), which permits the government to prosecute organizations and individuals to recover 300% of their damages. FCA further allows them to

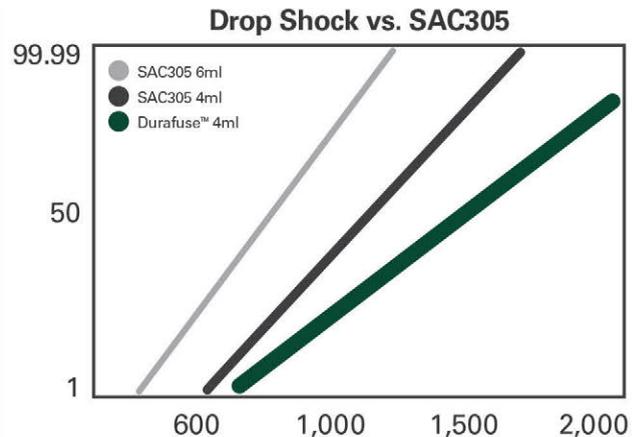
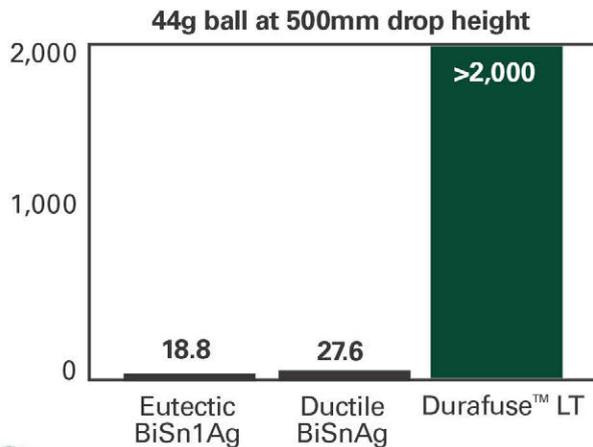
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share awarded money with whistleblowers. (Full disclosure, I am a cybersecurity expert, not an attorney, but I do know how to use Google and put two and two together. For instance, in fiscal 2020, the DOJ took in more than \$2 billion under the FCA.)

This raises some questions in my mind. Is it a coincidence that CMMC 2.0 now requires the annual affirmation be signed by a senior company official? How liable is that official? To what? What if you signed an affirmation based on an assessment your people made—without intent to defraud—and it is later deemed insufficiently detailed or rigorous? We just don't know at this point.

My intention here is not to scare you, but to warn you. I've worked with many, many business owners, and I can tell you that very few of them were deeply familiar enough with their cybersecurity practices and policies to find any gaps. But they will be the ones who sign their names to an attestation.

In practice, however, I think the vendor community will hold each other accountable for compliance before the government does. Likely, the government will get involved either after there has been a data breach or other cybersecurity problem, or after being contacted by a whistleblower. How will other vendors—especially downstream ones—ensure your compliance? I think it will become commonplace for them to present you with cybersecurity questionnaires and to expect you to be able to prove your answers.

Fortunately, the [17 controls that form the base of Level 1 compliance](#) are relatively straightforward. You'll find they are essentially setting standards. For example, here are the first four controls, taken directly from Federal Acquisition Regulation 52.204-21 Basic Safeguarding of Covered Contractor Information Systems.

(1) The Contractor shall apply the following basic safeguarding requirements and procedures to protect covered contractor information

systems. Requirements and procedures for basic safeguarding of covered contractor information systems shall include, at a minimum, the following security controls:

(i) Limit information system access to authorized users, processes acting on behalf of authorized users, or devices (including other information systems).

(ii) Limit information system access to the types of transactions and functions that authorized users are permitted to execute.

(iii) Verify and control/limit connections to and use of external information systems.

(iv) Control information posted or processed on publicly accessible information systems.

(v) Identify information system users, processes acting on behalf of users, or devices.

How would you be able to prove these things? Document them. Have written records, supplemented by screenshots where you can.

I'd suggest you get started now if you haven't yet. I think we will see vendors asking questions about these baseline cybersecurity controls well before the CMMC 2.0 rules come out.

For those of you who have IT pros on staff, getting this done is simply a matter of delegation. For those of you who do not, it's going to take some leg work and possibly some outside support.

Either way, once you think you've achieved compliance, you might benefit from having an outside expert check your documentation, processes, and protocols for things you may have missed.

The stakes are already high and will only increase as time goes on. **SMT007**

References

1. [52.204-21 Basic Safeguarding of Covered Contractor Information Systems](#). | Acquisition.GOV

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

Symposium on Counterfeit Parts and Materials

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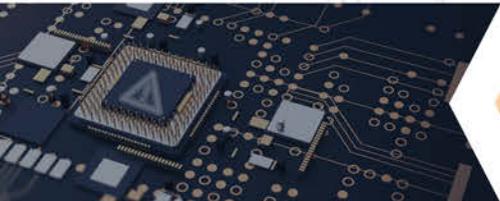
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MilAero007 Highlights



Ultra and Sparton JV (ERAPSCO) Awarded \$11.6M for U.S. Navy Production Contract ▶

Ultra Electronics Holdings plc (ULE) and Sparton DLS, LLC announce the award of a contract valued at \$11.6 million to their ERAPSCO joint venture, against the \$222 million competitive Indefinite Delivery Indefinite Quantity production contract for the manufacture of next-generation sonobuoys for the United States Navy.

Elbit Systems UK JV Introduces Sustainable Aviation Pathfinder for Ministry of Defence ▶

Elbit Systems UK and KBR Inc's joint venture, Affinity Flying Training Services Ltd., has embarked on a series of battery-powered flight tests for the UK Ministry of Defence to assess the feasibility of environmentally friendly alternatives to current military aircraft.

JPL Commits to First-Ever Space Industry Diversity Pledge ▶

Interim Director Larry James joined 22 executives in a commitment to significantly increase the number of women and employees from underrepresented groups by 2030.

Raytheon Missiles & Defense Ships First Lower Tier Air and Missile Defense Sensor to U.S. Army Test Range ▶

The first Lower Tier Air and Missile Defense Sensor, built by Raytheon Missiles & Defense, a Raytheon Technologies business, arrived at the U.S. Army's White Sands Missile Range in April.

Boeing Unveils First T-7A Red Hawk Advanced Trainer Jet to Be Delivered to the U.S. Air Force ▶

Boeing has unveiled the first T-7A Red Hawk advanced trainer jet to be delivered to the U.S. Air Force. The jet, one of 351 the U.S. Air Force plans to order, was unveiled prior to official delivery. The T-7A Red Hawk incorporates a red-tailed livery in honor of the Tuskegee Airmen of World War II. These airmen made up the first African American aviation unit to serve in the U.S. military.

Blue Canyon Technologies Expands Into GEO With Its First CubeSat ▶

Small satellite manufacturer and mission services provider Blue Canyon Technologies LLC, a wholly owned subsidiary of Raytheon Technologies, assisted in the deployment of Ascent, the company's first CubeSat spacecraft bus launched to a geostationary, or GEO, orbit by the Air Force Research Laboratory as part of the U.S. Space Force's Test Program-3 mission.

Airgain, Mobix Labs Collaborate to Develop Future-Proof 5G Technology ▶

Airgain, Inc and Mobix Labs Inc. announced an agreement for the development of strategic, future-proof 5G technology.

Thales, CS GROUP to Develop Parade Drone Countermeasures System ▶

Thales and CS GROUP are working with their partners in France and Europe's defence industrial and technological base on developing the PARADE programme capability to provide permanent deployable protection for critical infrastructure from drone threats.

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Learning the Basics

Maggie Benson's Journey

by Dr. Ronald C. Lasky, INDIUM CORPORATION

Editor's note: Indium Corporation's Dr. Ronald C. Lasky continues this series of columns about Maggie Benson, a fictional character, to demonstrate continuous improvement and education in SMT assembly. Maggie is owner of Ivy Benson Electronics.

Andy Connors had never been so nervous. He was picking up Sue March at her home to get pizza, where they would spend time answering the last five questions of the SMT 101 quiz that was given at Ivy Benson Electronics. The reason for his jitters was that he was going to meet Sue's parents and he hoped he would pass muster. He had reasons to have doubts, as at their last date it became clear to him that Sue was quite a bit smarter than he was. He walked up to the door and knocked.

A handsome, very fit-looking man answered the door. "You must be the Andy Connors that

my daughter can't stop talking about," Burt March said.

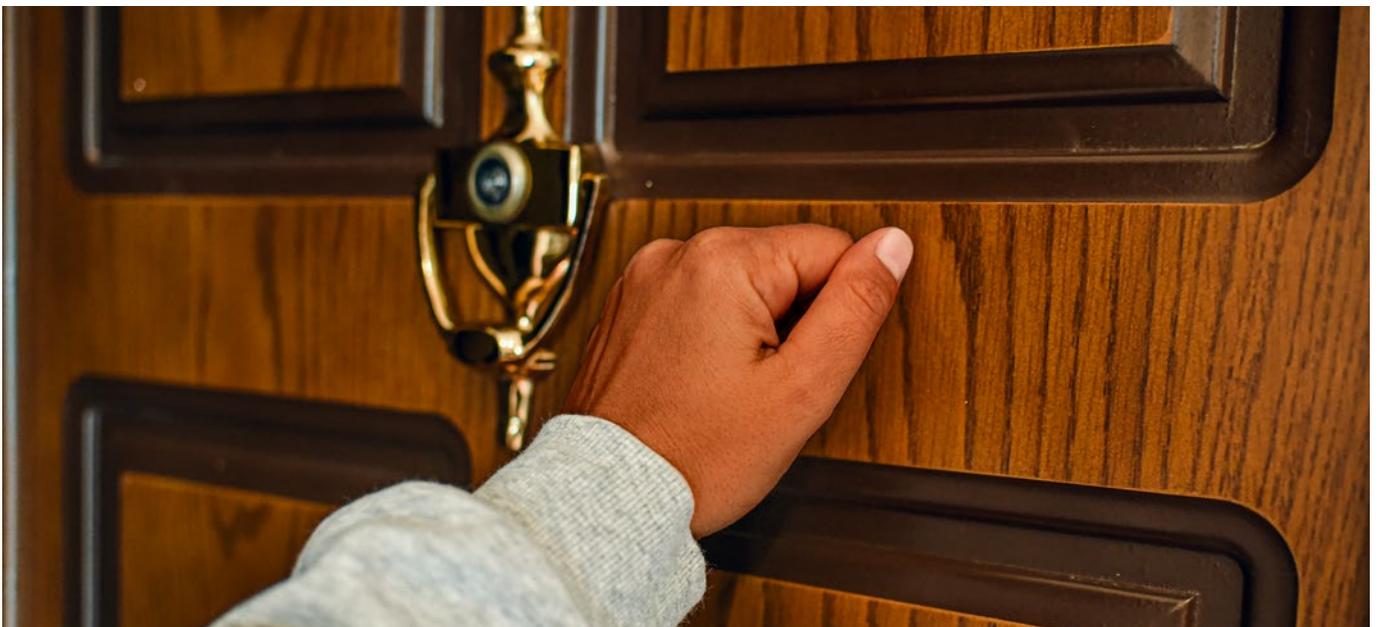
Andy was stunned. "Can't stop talking about?" he thought.

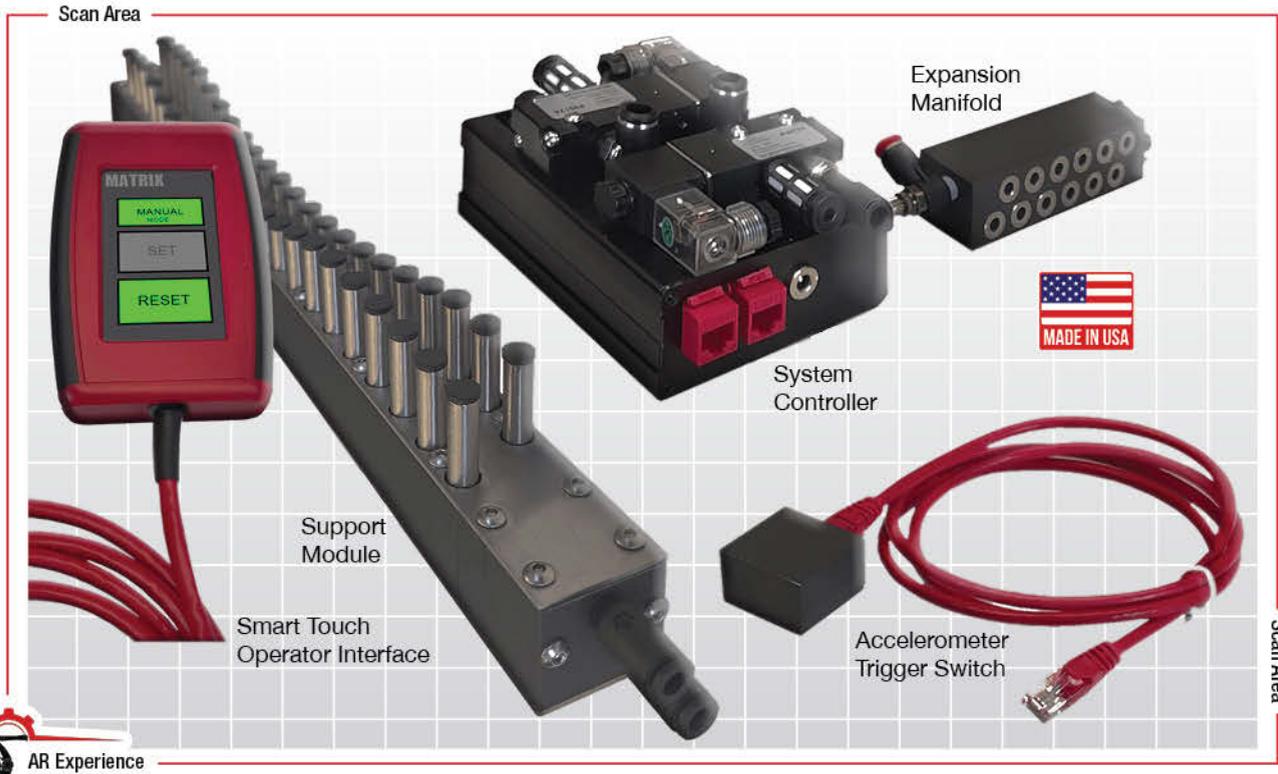
Immediately, Sue came to the door, grabbed Andy by the hand, and pulled him into the house.

"Dad, this is Andy Connors. He is the one who convinced me to go to college part-time. He is also the best worker at Ivy Benson and the nicest guy," Sue said, beaming.

At that moment, an attractive woman came into the room. "Welcome, Andy, it is a delight to finally meet you!" exclaimed Peg March. "Sue has told us so much about you."

Andy almost swooned. He had wondered if Sue had any real interest in him and was not prepared for this heartfelt welcome. He was determined at this point to not let Sue or her parents down.





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After a few minutes of pleasant conversation, Sue suggested that they head out for pizza.

“Wow, your parents are amazing,” Andy said once they were in the car. “They are so nice, and your mom looks like she could be your sister.”

“My mom will love that,” Sue replied. “I can tell that they really liked you. Oh, and they want you to come for dinner soon.” Andy never expected this very pleasant turn of events.

After they ordered their pizza, they settled down to answer the remaining five questions. “Let’s look at number 6,” Andy suggested.

6. In solder paste, what is response-to-pause?

- a) When printing is paused, the viscosity decreases while stirring
- b) Whether or not the paste viscosity increases when printing is paused
- c) Whether or not the paste dries out when printing is paused
- d) When printing is paused, the flux separates from the paste and makes a mess

“Hmmm, I know this is important. Even though the new solder paste was more expensive, Chuck mentioned that was one reason they replaced another solder paste, because ‘it had poor response-to-pause,’” Sue commented.

“Yeah, I remember hearing that, too,” Andy replied.

“Well, I don’t think it could be (a), as Chuck mentioned that the printed volume decreases,” Sue suggested.

“I think (d) is out, too,” Andy commented.

“I don’t think the paste dries out and the poor paste was okay after it was printed a few times,” Sue suggested.

“That leaves (b),” Andy said. After searching online, they found the answer.

“Wow, 6 for 6. I’ll bet our luck runs out soon,” Sue said.

“Let’s look at number 7,” Andy suggested.

7. What does ENIG stand for?

- a) Energizing nitrogen gas
- b) Electroless nickel immersion gold
- c) Evolving nitrogen inerting gas
- d) None of the above

“I haven’t a clue,” Sue moaned.

“Neither do I,” sighed Andy. “Let’s not guess and call this one a miss.”

Sue did a Google search and found the answer. “ENIG stands for electroless nickel immersion gold. It is a surface finish like OSP. Let’s ask Chuck to tell us more about it tomorrow,” Sue said.

“Okay, here is number 8,” Andy said.

8. What is more typical of a solder paste powder diameter?

- a) 5 mils
- b) 30 microns
- c) 25 mils
- d) 5 microns

“I think we can eliminate 5 mils and especially 25 mils. Those sizes are near the aperture diameter of a stencil,” Sue said.

“Twenty-five microns is about one mil and stencil aperture widths are around 10 mils or so, as we saw in question 2. So, I think 30 microns is the best answer,” Andy said confidently.

After searching online again, they found that Andy was correct, and he smiled when he saw that Sue looked impressed.

“Here is number 9,” Sue said.

9. What does CSP stand for?

- a) Compound semiconductor package
- b) Centering SMT package
- c) Chip scale package
- d) None of the above

“That one is easy—chip scale package,” Andy exclaimed.

“Wow, I’m impressed. You got two in a row,” Sue teased.

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“There were a couple of magazines in the breakroom called *Chip Scale Review*. I actually browsed through one or two,” Andy said.

“OK, here is the last one,” Sue said.

10. A process has 10 steps; the yield at each step is 99%. What is the end of the process yield?

- a) 90.4%
- b) 89.1%
- c) 90%
- d) None of the above

Sue took her smartphone, opened the calculator, and then flipped the phone on its side. “The answer is (a) 90.4%,” Sue said.

Andy seemed deflated. He was shocked that she could determine the answer so quickly. He really did need to up his game, he thought.

“How did you do that?” Andy asked.

“Isn’t it obvious that the answer is $0.99^{10} = 0.904$ or 90.4%?” Sue said.

“It wasn’t obvious to me,” Andy said dejectedly.

Sue proceeded to show Andy how to make this calculation. She then felt it was time to discuss the results. “Well, nine out of 10 seems pretty good to me,” she said.

“I agree,” Andy said.

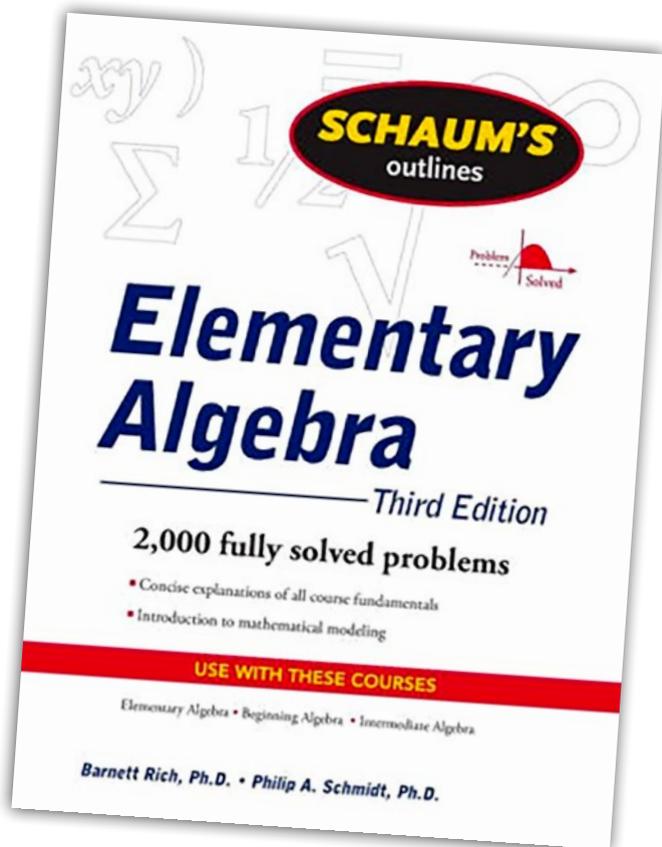
“Hey, how do you feel about the pre-calculus class we are taking that starts next week?” Sue asked.

“I’m so nervous, I’m shaking,” said Andy. “I got a *Schaum’s Outline of Elementary Algebra* and I have to admit that it now seems easy to me. When I was in high school, I saw no purpose for algebra and now I do. Solving some of the problems was kind of fun.”

“Pre-calc seems a little scarier though, I agree,” Sue said. “Hey, isn’t it great that Chuck has developed a class to help us prepare for SMTA Certification?”

“And it’s on overtime pay!” Andy exclaimed.

Sue got up, gave Andy a quick kiss, and grabbed his hand. As Andy stood up, his knees just about buckled.

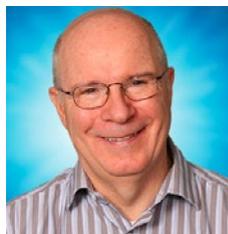


“It’s still early and the weather’s great. There is a waxing gibbous moon tonight. Let’s go for a walk and check it out,” Sue said coyly. Andy had no idea what a waxing gibbous moon was, but the thought of a moonlight stroll with Sue was enticing.

In the following weeks, the staff at Ivy Benson was almost a little annoyed at Sue and Andy as they kept asking all sorts of questions about electronics assembly. **SMT007**

Note: To my knowledge, there is not a source of material to help a technician or engineer new to electronics assembly to learn the basics. In this series, as we watch Sue and Andy learn the basics, I plan for this to be the source.

—Cheers, Dr. Ron



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, or

contact Lasky, [click here](#).

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ABSTRACTS DUE

MONDAY, JUNE 20, 2022



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The Government Circuit: A Robust U.S. Electronics Industry Is in Everyone's Interest

I've been saying for months that decisions made in 2022 will be critical to the future of electronics manufacturing for years to come. After years of government policy neglect, we have unprecedented opportunities to make things better and position the industry for long-term success.



Electronics Industry Welcomes Bipartisan Congressional Proposal to Boost U.S. PCB Sector

The electronics manufacturing industry is welcoming a new, bipartisan proposal in the U.S. Congress that would help bring back the country's printed circuit board sector.

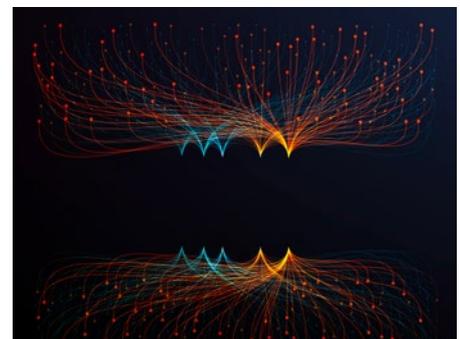


Exploring High Density With Axiom

Nolan Johnson and Barry Matties talk with Axiom's Rob Rowland and Kevin Bennett about the current high-density challenges facing EMS manufacturing. In this interview, Bennett and Rowland zero in on component packaging and feeder technology as critical areas in need of improvement.

Big Data Can Bring Your Business Back

Let's face it, in the past, electronics manufacturing has not been a big business for North America. A majority of electronics are assembled in Asia where supply chains and operating costs offer many economic advantages. In North America, the electronics manufacturing industry has been generally focused on lower volume, high-cost devices, while higher volume products are produced elsewhere.



X-Rayted Files: X-ray Everything!



It should be clear by now that my enthusiasm for X-ray knows no bounds. So, forgive me for not setting my bias aside, but

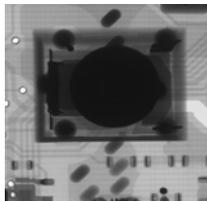
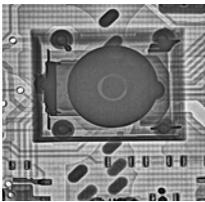
when it comes to X-ray imaging, you probably fall into one of the following categories: you don't need X-ray and you know it, you need X-ray but don't know it, you have X-ray but are underutilizing it, or you are the rarest of birds who has X-ray but just doesn't need it.

ESCATEC Boosts Design Services Offering in Europe in New Partnership with Croatia's Byte Lab

Fast growing, integrated EMS specialist, ESCATEC, fresh from posting a record fiscal year in 2021, has announced a new partnership with noted, Zagreb-based, electronics design house, Byte Lab.



VJ Electronix: Automating the X-ray Inspection Process

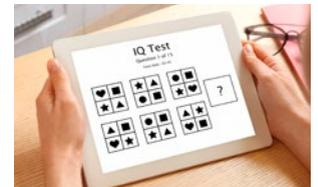


VJ Electronix's Brennan Caissie shares the benefits of a new inspection tool that can be used

on a variety of boards, with an automated system that takes the pressure off the manufacturing floor operators and can provide feedback all the way to the design process.

How Smart Are You?

It is likely that those who are putting together IQ tests will favor the kinds of "smarts" that



they themselves have. Humans are very complex, however. Everyone is different, with natural skills and abilities in a multitude of disciplines: technical, artistic, social, and others.

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We are experiencing shortages like we have never faced in our

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Are Your Existing Machines Enough to Keep Up?

Buy new or make do? It's an age-old debate for manufacturers who are trying to decide how best to manage machine assets inside their manufacturing facilities. New machines are expensive, but so is operating existing machines at a comparative deficit.



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Printed Circuit Board (PCB)

Layout Designer (Designer-Drafter 3/4)

Los Alamos National Laboratory
Los Alamos, New Mexico

Los Alamos National Laboratory (LANL) is a multidisciplinary research institution engaged in science and engineering on behalf of national security. The ISR-5 Space Instrument Realization Group is currently seeking an entry level Printed Circuit Board (PCB) Layout Designer. You'll design and develop rigid and flexible PCBs directly supporting the design, prototyping and manufacturing of innovative space satellites for a variety of important scientific and national security missions.

Requirements:

- 3–5 years relevant experience
- Associate's in engineering or technical field (or an additional 2 years related experience)
- Working knowledge of PCB fabrication or electronics assembly requirements
- Familiarity with PCB layout CAD design tools
- Demonstrated commitment to safety, security environment and quality

Desired Qualifications:

- Basic experience using software tools to produce models, drawings, layouts and sketches of components/systems
- Familiarity with PCB design concepts, IPC design and performance standards
- Experience using PCB design software, such as Eagle, Altium or Mentor Graphics

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Printed Circuit Board (PCB)

Technologist (Engineering Technologist 1 / 2)

Los Alamos National Laboratory
Los Alamos, New Mexico

Los Alamos National Laboratory (LANL) is a multidisciplinary research institution focused on solving national security challenges. The Intelligence and Space Research Division is seeking an experienced Printed Circuit Board (PCB) Layout Technologist to directly support the design, prototyping and manufacturing of innovative space instruments for important science and national security missions.

Requirements:

- 2–5 years related experience
- Bachelor's in engineering technology, science or math (or an additional 8 years of related experience)
- Advanced knowledge of PCB layout CAD design tools/current best practices
- Ability to determine technical requirements/objectives for new PCB designs
- Ability to identify problems, create solutions and effectively navigate institutional systems

Desired Qualifications:

- Experience using Siemens (Mentor Graphics) Xpedition PB design flow software
- Experience interpreting and applying IPC-6012 and IPC-6013 qualification and performance standards
- Experience designing high-speed, controlled-impedance PCBs for digital and RF applications
- Experience designing PCBs for space flight applications

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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

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- 401K retirement plan
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Sales Technical Engineer

ALTIX, a French company, designs, manufactures, markets and services exposure equipment for the printed circuit board, flexible circuit, metal etching, touch panel and other industries. The U.S. subsidiary, focused on the sale and service of Altix equipment in North America, is looking for a sales technical engineer to support their growth.

Responsibilities

- Promote Altix's products by visiting customers
- Serve as a technical lead & product expert to provide technical recommendations to customers
- Gather on-the-ground market intelligence through customer contact
- Ensure sustainable growth in sales, profits, and market presence
- Develop new business and achieve targets for market penetration, sales and profit
- Manage sales partners

Skills & Qualifications

- Minimum 2 to 5 years' experience in sales for capital equipment in the PCB market or related industries
- Business development and marketing background preferred
- 5+ years' North American business leadership experience in related field
- Strong leadership, decision-making and communication skills.
- Proficiency in standard computer software applications such as Microsoft Office
- Excellent written and oral communication skills
- Willingness to travel within the US, Canada and to France for training

Email contact: sylvain.dromaint@altix.us

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Career Opportunities



US-Based Technical Sales Specialist

Polar Instruments, Inc. (Beaverton, OR) is looking for an additional US-based technical sales specialist to assist in selling our growing family of PCB signal integrity tools for the PCB fabrication/design industry and the electronics supply chain.

A background in the PCB industry and fabrication knowledge are an advantage. A B.S. in engineering or physics (or other science or technology degree) and related technical sales experience preferred. Willingness to travel 8-10 times a year for a week at a time and 1-2 weekends.

Polar has been in business for over 40 years and are a small, eclectic group of people spread around the world. Our values are centered on enjoying what we do—which is working to make things just right for our customers. We approach challenge as an opportunity, frequently an adventure. We work together as a team, without politics, and with our team's welfare at the forefront of our concerns. We are successful. We have grown year-upon-year, and we take great pride in pretty much owning our niche in a very large marketplace. We command great respect from our users and industry partners.

If interested, please contact Lupita at jobs.usa@polainstruments.com

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Director of Operations State College, PA

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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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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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- 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
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Wet Process Engineer

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Essential Responsibilities

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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.

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Career Opportunities



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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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:

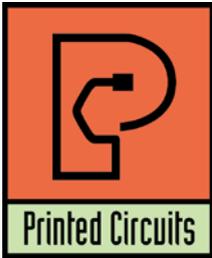
- 5-7+ years of related experience in the manufacturing sector or equivalent combination of formal education and experience
- Excellent oral and written communication skills
- Business-to-business sales experience a plus
- Good working knowledge of Microsoft Office Suite and common smart phone apps
- 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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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



MACHINES FOR PRINTED CIRCUIT BOARDS

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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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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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.

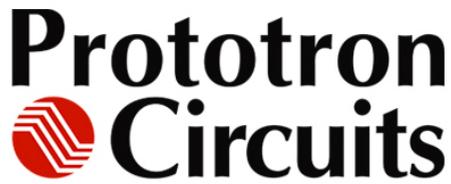
Contact us today to learn about the rewarding careers we are offering. Please email resumes with a short message describing your relevant experience and any questions to careers@ttci.com. Please, no phone calls.

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



Sales Representatives

Prototron Circuits, a market-leading, quick-turn PCB shop, is looking for sales representatives for all territories.

Reasons you should work with Prototron:

- Serving the PCB industry for over 30 years
- Solid reputation for on-time delivery (99% on-time)
- Excellent quality
- Production quality quick-turn services in as little as 24 hours
- AS9100
- MIL-PRF- 31032
- ITAR
- Global sourcing
- Engineering consultation
- Completely customer focused team

Interested? Let's have a talk.

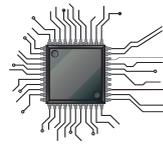
Call Dan Beaulieu at

207-649-0879

or email to

danbbeaulieu@aol.com

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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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Career Opportunities



eptac

TRAIN. WORK SMARTER. SUCCEED.

Become a Certified IPC Master Instructor

Opportunities are available in Canada, New England, California, and Chicago. If you love teaching people, choosing the classes and times you want to work, and basically being your own boss, this may be the career for you. EPTAC Corporation is the leading provider of electronics training and IPC certification and we are looking for instructors that have a passion for working with people to develop their skills and knowledge. If you have a background in electronics manufacturing and enthusiasm for education, drop us a line or send us your resume. We would love to chat with you. Ability to travel required. IPC-7711/7721 or IPC-A-620 CIT certification a big plus.

Qualifications and skills

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

Benefits

- Ability to operate from home. No required in-office schedule
- Flexible schedule. Control your own schedule
- IRA retirement matching contributions after one year of service
- Training and certifications provided and maintained by EPTAC

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SIEMENS

Siemens EDA Sr. Applications Engineer

Support consultative sales efforts at world's leading semiconductor and electronic equipment manufacturers. You will be responsible for securing EM Analysis & Simulation technical wins with the industry-leading HyperLynx Analysis product family as part of the Xpedition Enterprise design flow.

Will deliver technical presentations, conduct product demonstrations and benchmarks, and participate in the development of account sales strategies leading to market share gains.

- PCB design competency required
- BEE, MSEE preferred
- Prior experience with Signal Integrity, Power Integrity, EM & SPICE circuit analysis tools
- Experience with HyperLynx, Ansys, Keysight and/or Sigrity
- A minimum of 5 years' hands-on experience with EM Analysis & Simulation, printed circuit board design, engineering technology or similar field
- Moderate domestic travel required
- Possess passion to learn and perform at the cutting edge of technology
- Desire to broaden exposure to the business aspects of the technical design world
- Possess a demonstrated ability to build strong rapport and credibility with customer organizations while maintaining an internal network of contacts
- Enjoy contributing to the success of a phenomenal team

***Qualified applicants will not require employer-sponsored work authorization now or in the future for employment in the United States. Qualified Applicants must be legally authorized for employment in the United States.*

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Career Opportunities



Arlon EMD, located in Rancho Cucamonga, California, is currently interviewing candidates for open positions in:

- Engineering
- Quality
- Various Manufacturing

All interested candidates should contact Arlon's HR department at 909-987-9533 or email resumes to careers.ranch@arlonemd.com.

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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U.S. CIRCUIT

Plating Supervisor

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

Competitive benefits package.

Pay will be commensurate with experience.

Mail to:
mfariba@uscircuit.com

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Career Opportunities



APCT, Printed Circuit Board Solutions: Opportunities Await

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

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

We invite you to read about APCT at APCT.com 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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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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Career Opportunities



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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For information, please contact:

BARB HOCKADAY

barb@iconnect007.com

+1 916.365.1727 (PACIFIC)

I-Connect007
GOOD FOR THE INDUSTRY

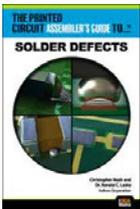
WATCH AND LEARN

Predicting Reliability in Electronics

In this engaging, 11-part micro webinar series, topic experts Graham Naisbitt and Chris Hunt examine the history of the influences of electrochemical migration (ECM) and the evolving use of Surface Insulation Resistance (SIR) testing that has been developed over the past 25 years by GEN3 and its association with the British National Physical Laboratory. GEN3 and NPL have created the standard that has now been in widespread use around the world since the turn of the millennium.



The Printed Circuit Assembler's Guide to...



Solder Defects

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

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



SMT Inspection: Today, Tomorrow, and Beyond

by Brent Fischthal, Koh Young America

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



Smart Data: Using Data to Improve Manufacturing

by Sagi Reuven and Zac Elliott, Siemens Digital Industries Software

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



Process Validation

by Graham K. Naisbitt, Gen3

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



Advanced Manufacturing in the Digital Age

by Oren Manor, Siemens Digital Industries Software

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

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