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## IPC APEX EXPO 2023 Preshow Issue

In this issue, we bring you preview information for IPC APEX EXPO 2023. Consider this issue your roadmap for success while you're at the show in San Diego.

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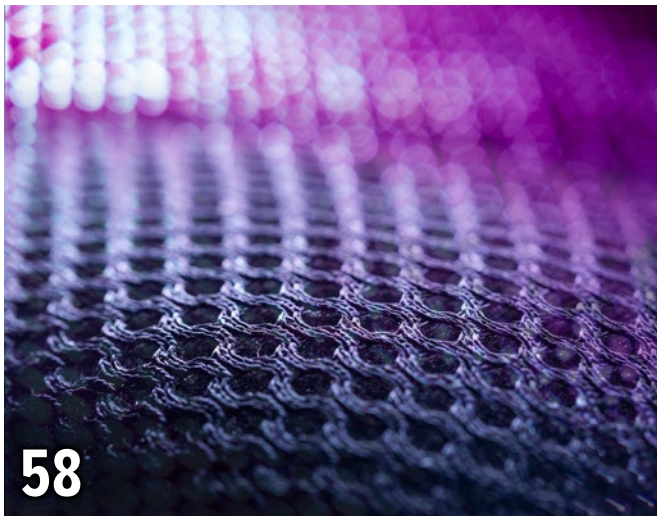
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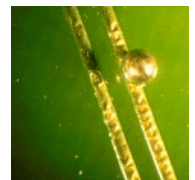
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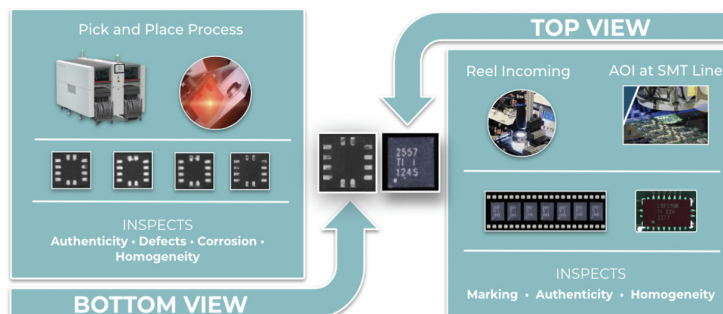
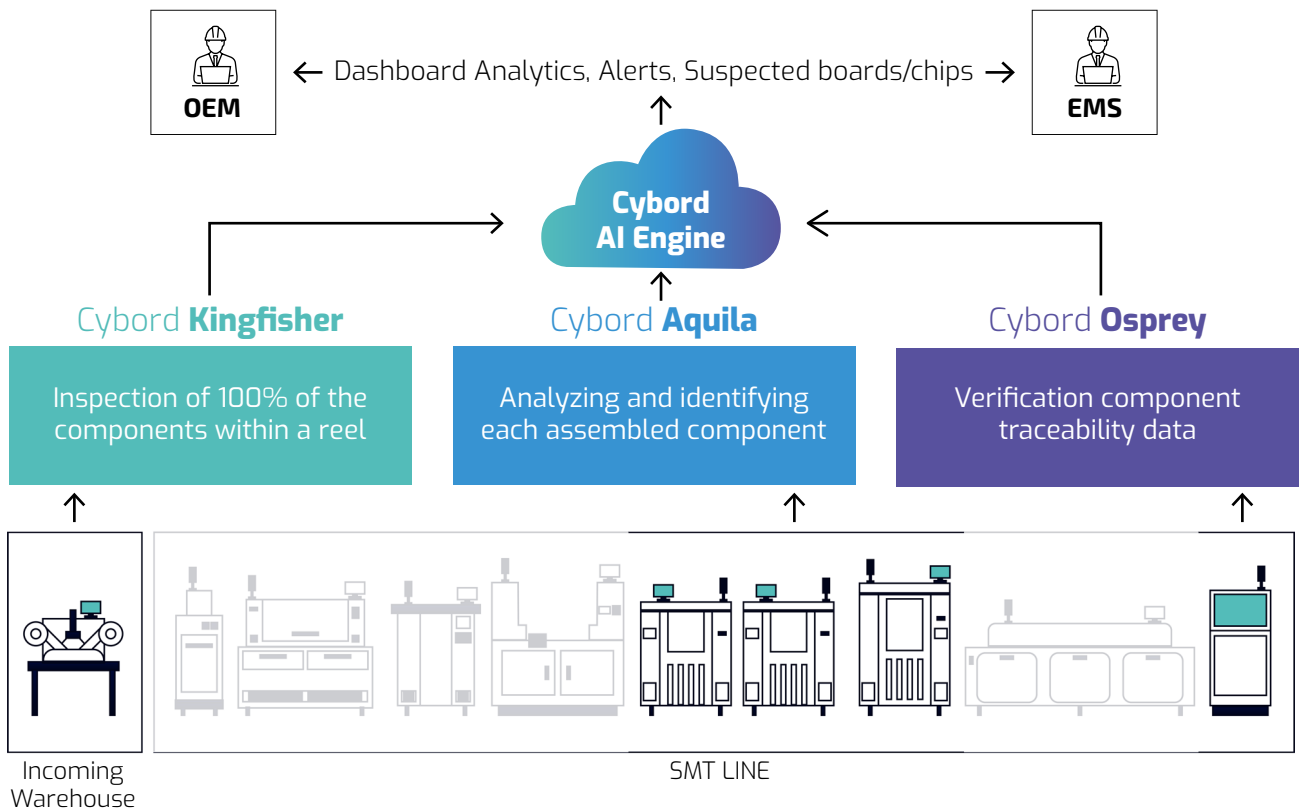
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# Traditions: The Old and the New

## Nolan's Notes

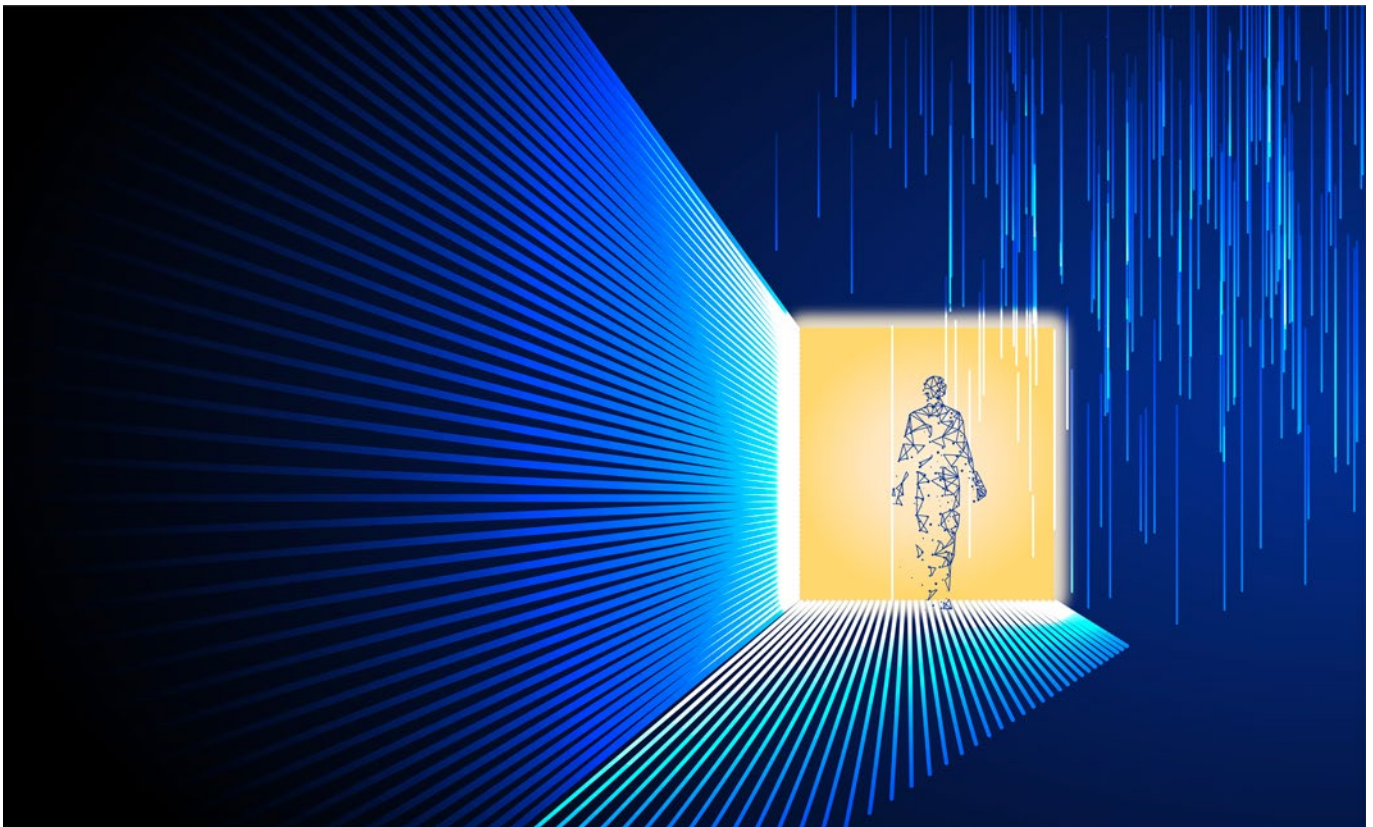
by Nolan Johnson, I-CONNECT007

December is a month full of traditions. They may be religious, community, family, or entirely personal. They may be related to the calendar or business cycles, but whatever the reason, December certainly seems to be driven by tradition. While traditions often get a bad reputation as stodgy and tired, they aren't all bad.

For example, we use this last month of the year to prepare for IPC APEX EXPO. The upcoming conference and trade show

is scheduled for Jan. 21–26, 2023, at the San Diego Convention Center. As we go to print, the show floor boasts 362 exhibitors.

Of course, traditions have a way of evolving—sometimes for the better, other times not so much. The adage, “The more things change, the more they stay the same,” applies particularly well to traditions. Do traditions change? Yes. In 2024, for example, IPC APEX EXPO will move slightly north to the Anaheim Convention Center. Anaheim will still be sunny.



When we consider traditions, we often look back to see how we did it before. Case in point, here's what I wrote for our December 2021 issue previewing the 2022 show:

*"There is so much that is new, or different, than in previous years. Committees will function just a little differently this year; the EMS Leadership Summit has retooled in some exciting ways to meet changing needs; social events have morphed and evolved to bring freshness and relevance to the program; and a big highlight is how the technical tracks are thriving and growing."*

This evolution of traditions will continue with the IPC APEX EXPO 2023 program. In this issue, which is filled with details direct from the IPC organizing staff, Dr. John Mitchell gets us off to a great start with his column, "Advance in a New Era." Then we launch right into details about the 2023 Technical Conference, which explores the changes IPC has made this year. With some tweaks and adjustments, building on the changes started in 2022, the IPC staff makes the claim that the technical tracks are the strongest and highest quality content in recent memory.

But that's not all. The standards committee work, which sure seemed to accelerate under COVID restrictions, continues apace. The IPC Education Foundation's STEM program has grown significantly this year, doubling its previous high-water mark for student participation. The Women in Electronics reception fields a strong program once again, and the IPC training committees continue to increase their value proposition to the industry.

In the spirit of helping you plan your time at IPC APEX EXPO to the fullest, we're including the event schedule, details on special sessions you won't want to miss, how to use the event app on your smartphone, show floor highlights, the skinny on social/networking events, hints of new awards for member contributions, information on professional development courses, and new offerings such as the E-textiles track and the India Pavilion.

Need help justifying your trip to your management? Yeah, sometimes, we do. Just another one of those business-related traditions, right? IPC APEX EXPO delivers so much potential for professional growth, it seems obvious that you should be there, but sometimes you need to make a case for it. To help, we include a summary of the talking points to justify your week away and point you to deeper resources at the IPC website.

Once you're there, of course, be sure to stop by the I-Connect007 booth (#2019), right in the center of the show floor. We'll be keeping up our own traditions: Conducting dozens of *Real Time with...* interviews, greeting passers-by, and learning more about the industry. Additionally, we'll have more reporters covering the show so we can provide you with comprehensive coverage in our annual *Show and Tell Magazine*, which publishes within just a few short weeks of the show. Honestly, it's our conversations with you that keep us plugged into what's happening in the industry. The more we know and understand, the more we can reflect the trends and issues back to you in our published content.

In short, we can wait to be at IPC APEX EXPO 2023. As we read and prepped the material for this issue, it became only clearer what a valuable resource it is to gather together as an industry, connect with, and learn from, one another. Formulas and traditions have meaning and value; we rely on them. Yet they build on themselves, and we are excited to see where this event takes us.

May your December be full of joy, peace, and connection with loved ones whether family or friends. On behalf of IPC, and I-Connect007, we can't wait to see you January in San Diego. **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](#).



# Advance in a New Era

## One World, One Industry

Feature Column by Dr. John Mitchell, IPC PRESIDENT AND CEO

At IPC APEX EXPO 2023, we look forward to connecting with you as we “Advance in a New Era of Electronics Manufacturing.” This year’s event will be one of our most exciting as we share ideas, insights, and new discoveries on topics ranging from substrates, packaging, and automation to data analytics, cybersecurity, and Factory of the Future.

IPC APEX EXPO is the ideal place for electronics manufacturing industry members to meet and collaborate with peers, leaders, and innovators from around the world, not only during educational sessions, but also on the show floor, in standards development committees, and at a variety of networking events and receptions.

What will you enjoy at IPC APEX EXPO this year?

The show floor will feature the largest gathering of exhibitors in North America from every step in the electronics manufacturing supply chain. Make sure to walk the show floor to meet the industry’s leading equipment manufacturers, suppliers, and innovators to compare solutions, connect with existing suppliers, and find new partners.

We’re excited to present three keynote speakers at IPC APEX EXPO this year, with two speaking during luncheons for the first time. We welcome Emily Callandrelli, mechanical and aerospace engineer and the host and co-producer of “Emily’s Wonder Lab” on Netflix, who will speak about the sustainability, economics, and advocacy of space exploration. Our second luncheon speaker is Shawn DuBravac, IPC’s chief economist, who will provide insight into

### KEYNOTE SPEAKER:

**EMILY CALANDRELLI**

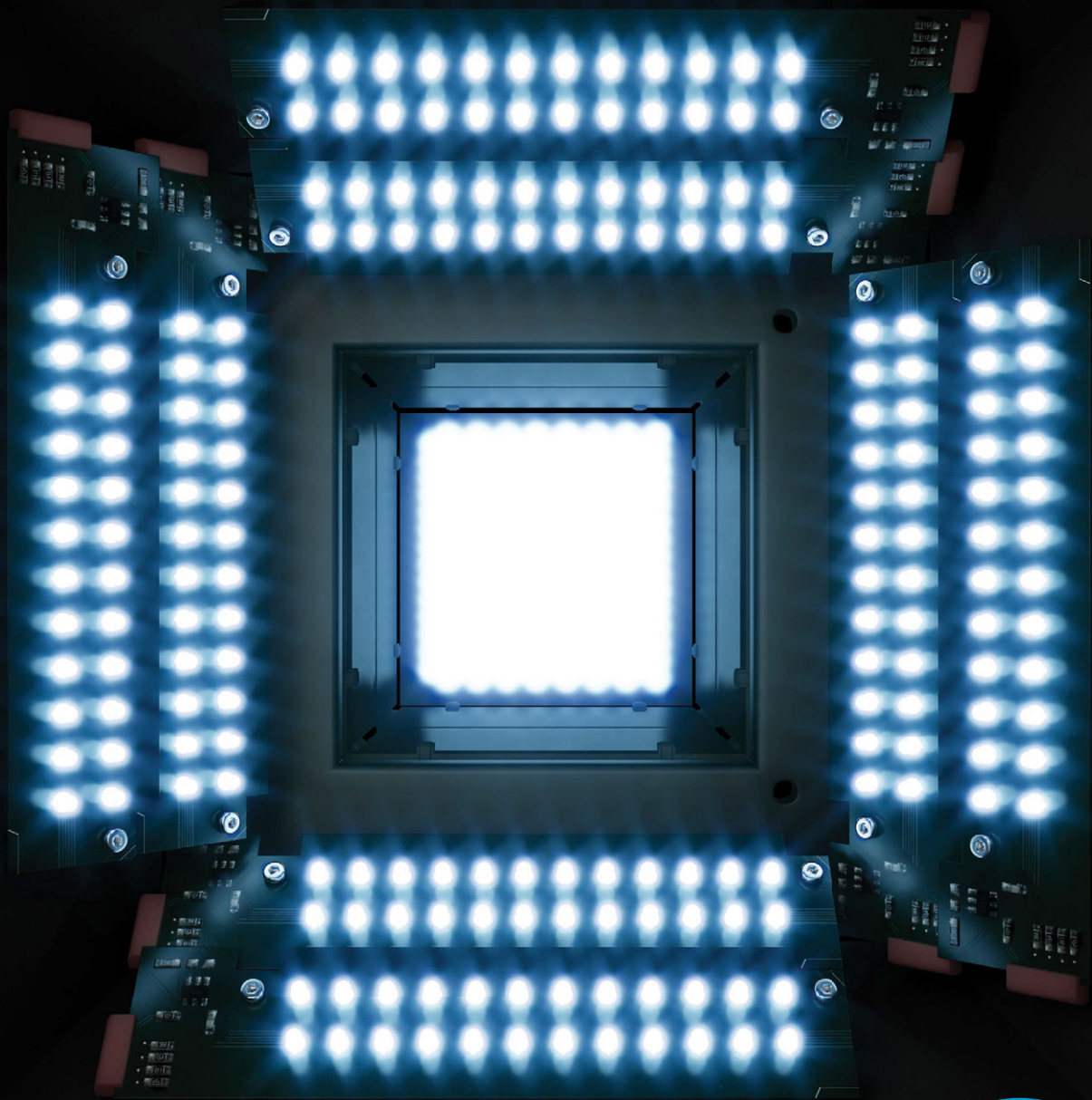
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emerging technology themes and the micro trends defining the future of electronics; and I look forward to sharing more on workforce modernization.

For the first time, IPC E-Textiles, the international conference for the e-textiles industry, will be co-located with IPC APEX EXPO. This global e-textiles industry event allows product designers, technical experts, and company executives from around the world to collaborate on new ideas, view and get hands-on access to the latest innovations, and learn how to build reliable products.

The EMS Leadership Summit on Jan. 23 will bring together current and future industry leaders to solve problems, build business networks, and share insights on doing business better. Focused on high-level topics that drive business growth and financial success, leaders will gather insights from experts and discuss both their current and potential new best practices during panel discussions and roundtables. This meeting of minds inspires action and builds resources for participants, future leaders, and the greater EMS industry.

Our educational offerings at the show have always been unique and 2023 will be no exception. IPC's Technical Program Committee (TPC) created an expert lineup of speakers and instructors in technical education and professional development. Our carefully curated Technical Conference will include presentations featuring topical studies, new technologies, advanced materials, and the latest processes that help improve the efficiency and quality of your manufacturing. Attendees will have the opportunity to select from five hot topic tracks: Factory of the Future and future technologies; PCB fabrication and materials; quality, reliability, test, and inspection; assembly and materials; and high-density interconnects and microvias. Two special Technical Conference sessions will also cover advanced packaging and e-mobility. Professional development courses will include something for everyone, from

Join panel discussion leader  
Yolita Wildman Nugent, Betazip, for  
"Business and Economics Impacts—  
the Real World of Product Development,"  
at IPC E-Textiles 2023.



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How do you ensure that embedded electronics are stretchable and flexible? Don't miss Jessica Stanley's presentation at IPC E-Textiles 2023, "Enabling Stretchable LED Circuits for Wearable Applications Through 3D Geometry," Jan. 23, 2023.



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advanced classes exploring the details and depth of specific topics, to informative classes catering to engineers just beginning their careers.

If you're interested in actively participating in the development, review, and update of the electronics industry's critical standards and guidelines, attend some of our more than 100 standards development committee meetings. Standards committee meetings are the perfect place to meet and collaborate with new peers, industry leaders, and innovators.

For those visiting IPC APEX EXPO for the first time, we welcome you to the largest gathering of electronics professionals in North America. We are happy that you've chosen to spend your time with us. Be sure to take advantage of the many networking opportunities offered by signing up for educational sessions that are directly applicable to your work; there, you will meet manufacturing industry professionals from

around the world who are facing (and solving) challenges like yours. For returning attendees, we welcome you back with open arms. One of the best things about it is the community we've built over the years, and we look forward to reconnecting with you again.

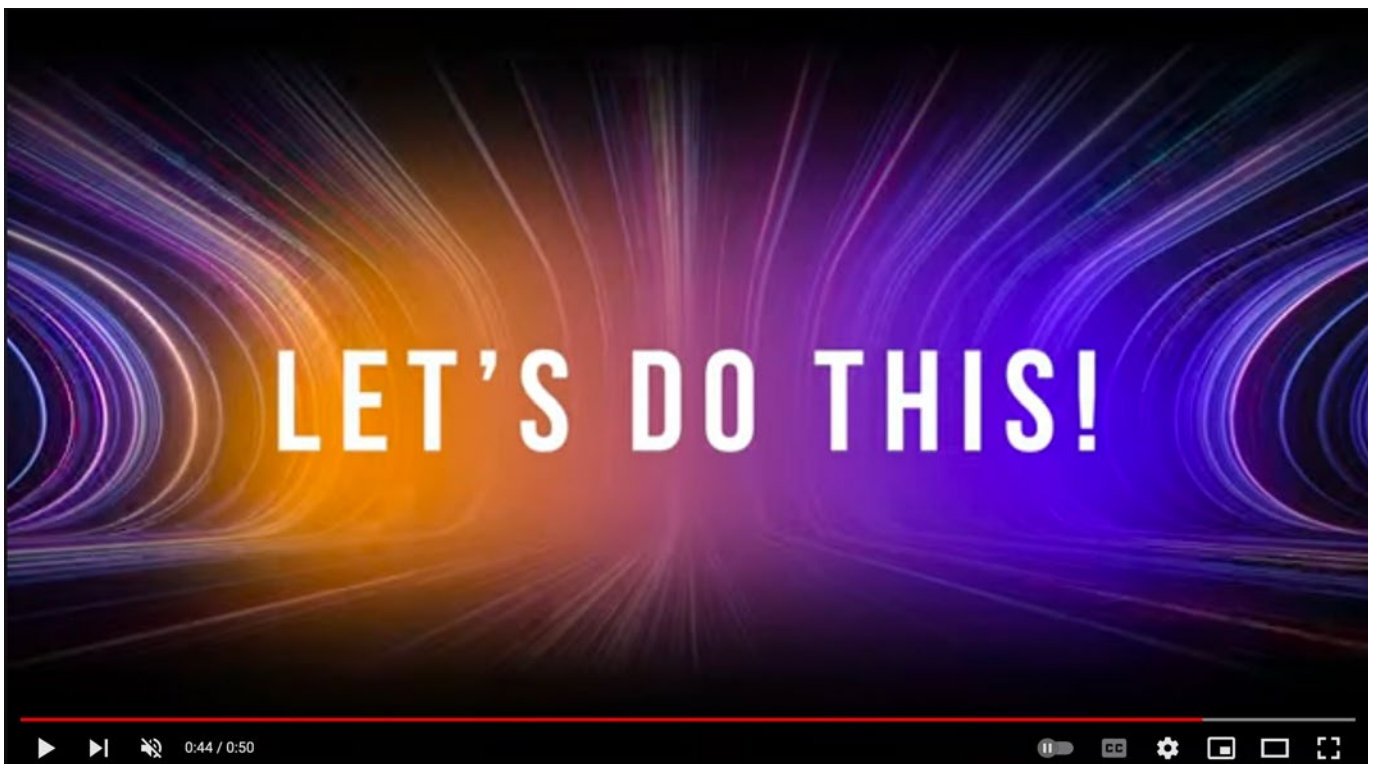
If you're active on social media, please use the hashtag #IPCAPEXEXPO on Twitter, Facebook, Instagram, and LinkedIn to share your experience, post photos, and continue the conversation with our social community.

As one of our many attendees said, "I come to IPC APEX EXPO because the whole industry is here." We are all here, and we are looking forward to seeing you in sunny San Diego. **SMT007**



**Dr. John Mitchell** is president and CEO of IPC. To read past columns, [click here](#).

## VIDEO: Download the IPC APEX EXPO 2023 Justification Toolkit





# Industry Innovation Starts Here

Article by IPC Staff

If it isn't clear already, your money, time, and effort will be well spent attending IPC APEX EXPO in January. Here, we've outlined the top six reasons why this event will be the highlight of your year. We've done all we can to make the event not only memorable, but a show that allows you to connect with industry peers, learn how to enhance your skills, help advance the industry, and discover new insights on products and strategies from industry innovators.

## Connect

Advance your network on a global scale on the show floor, at social receptions, and at our new Career Networking Event featuring special guests from the Emerging Engineer program. Engage in a discussion on career development strategies and hear stories about best and worst career decisions.

## Lead

Equip your business to be a leading industry competitor when you attend Factory of the Future track sessions, where you will learn to solve real business challenges and identify new technologies that modernize industry processes.

## Build

At IPC APEX EXPO 2023, you'll interact with the latest innovators, meet world-leading manufacturers on the show floor, and discover how you can build electronics better.

## Learn

This year's Professional Development offerings include 36 courses and a new business track featuring "Customer Contract and Legal Boot Camp for Engineering Professionals," led by Jeffrey Roth and Patrick Sebastia II, F&B Law Firm.

## Advance

Be part of taking electronics manufacturing into a new era of excellence. Actively participate in the development, review, and updating of the industry's



critical standards and guidelines at our standards development committee meetings.

## Discover

Discover new insights on products, strategies, and solutions from your peers, subject matter experts, and innovators. Take home real business solutions to address your challenges.

## Making the Pitch

Bolster your formal request to attend IPC APEX EXPO 2023 to your manager. Every organization is different, so we have compiled a list to help persuade your boss to support your attendance at IPC APEX EXPO 2023. **SMT007**

### Here's Something to Consider

**Best rate:** Visit the registration page and determine your rate. Note that all rates increase after Dec. 16. Did you know that becoming an IPC member can save you money on registration? Or that group rates are available?

**Session Content:** Identify specific Technical Conference sessions and Professional Development courses that are relevant to both your organization and your work. Create a list of how attending these sessions will positively impact your work.

**Vendor contacts:** Map out your visit by choosing exhibitors you want to meet with at the event. Discover the latest technologies and innovations on the show floor.

**Investment:** This conference isn't an expense, it's an investment. What is the return on investment (ROI) when you attend? You should be able to showcase the benefits/value to your organization in relation to the expense it will incur.



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# Let's Get Technical

Feature Article by Julia Gumminger  
IPC INTERNATIONAL

IPC members are constantly working to move the electronics industry forward by developing new technologies, innovative processes, and testing methods—and working to find solutions to known technical challenges. The IPC APEX EXPO Technical Conference is the premier forum in North America where these challenges, solutions, and innovations are shared among colleagues and competitors alike.

Sometimes the processes and methods used to organize such a conference require some innovations as well. Thanks to the many hours of dedication and attention to detail; an updated peer review process; and new tools utilized by the Technical Program Committee (TPC), which is chaired by both Dr. Stanton Rak, of SF Rak Company, and Dr. Udo Welzel, of Robert Bosch GmbH, the 2023 Technical Conference at IPC APEX EXPO 2023 will feature the highest quality technical program.

The TPC received over 120 technical paper abstracts during the open call for participation and reviewed them all in a double-blind peer review process. Eighty-five papers were chosen to undergo the next phase of the peer review process. Each TPC member contributed many hours of their time to review and offer feedback to the authors. The Technical Program Committee consists of subject matter experts from companies such as: Robert Bosch GmbH, NASA Goddard Space Flight Center, IBM Corporation, Collins Aerospace, Continental Automotive Systems, Bose Corporation, John Deere Electronic Solutions, TTM Technologies, Indium Corporation, Averatek, Northrop Grumman, Aegis Industrial Software, and others. Each paper submission was reviewed by at least two reviewers with areas of expertise similar to the authors. This ensured the technical merit could be reviewed as well as the novelty and potential impact of the data.



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An updated IPC Non-Commercialism Policy was strictly adhered to during this process, ensuring that the conference's technical presentations are truly "generic" in their technical data. Welzel shared, "An updated, comprehensive non-commercialism policy provided full transparency on this sensitive matter for both contributors and the reviewers from the Technical Program Committee, thereby avoiding misunderstandings and ambiguities."

Ultimately, the 70+ papers making up the 2023 IPC APEX EXPO Technical Conference represent the highest quality technical content from authors around the world. The TPC members are very excited about the upcoming presentations, which are organized into topical tracks.

"The combination of a broad coverage of different topics related to electronics assembly technology, along with the high level of technical depth and detail in these presentations, provides a comprehensive overview of the current hot topics, challenges, and solutions. This combination of 'breadth' and 'depth' is quite unique and will attract many attendees as well as contributors," said Welzel.

Rak said, "The 2023 Technical Conference will introduce two new technical sessions on 'High Reliability for Extreme Environments,' which is exciting for individuals working on Class 3 electronics applications. The 2023 Technical Conference has approximately 12 papers that have direct relevance to the automotive electronics space, e.g., design, test, reliability, simulation, and assembly. Many

of the authors are highly regarded industry experts in addition to some newcomers. The presentations are of high interest to me since I am active in the field."

Welzel is looking forward to learning from the conference presentations. He added, "Printed boards are now expected to operate in harsher and harsher environments. Being responsible for PCB technology development for automotive electronics, I am looking forward to those papers dealing with the quality and reliability of advanced printed boards, especially on topics like microvia quality and reliability."

The 2023 conference features five tracks on Tuesday and Wednesday, including:

- Factory of the Future and Future Technologies
- PCB Fabrication and Materials
- Quality, Reliability, Test, and Inspection
- Assembly and Materials
- High-Density Interconnects and Microvias

The diversity of the presenting authors is also impressive; 18 countries are represented by presenting authors. Fifteen authors are next generation (five years or less in the industry), and 27 presenting authors hold doctoral degrees.

"From the perspective of a long-time TPC member, I can say that this year has been by far the most organized and efficient IPC APEX EXPO planning process cycle I've participated in," said Todd MacFadden, technology development engineer at Bose. "This year, the committee used new tools and procedures to review and evaluate the technical submissions, and those tools were highly effective at ensuring consistent review metrics, facilitating edits, and tracking review progress. At the same time, authors were given better, clearer guidance than in previous years regarding paper format and expectations on content. As a direct result of these changes, the quality of the submissions is higher and

more consistent, and the technical program is tighter overall. Interesting point of note: There are more PhD authors this year than in any previous year.”

Additionally, the 2023 Technical Conference is piloting two special sessions on Thursday in the emerging growth areas of e-mobility/EV automotive and advanced packaging. The special sessions will be curated panel discussions designed to convey recent information in an audience participation format.

IPC APEX EXPO's 2023 Technical Conference promises to showcase the latest original technical data from the world's leaders

in electronics manufacturing research. The Technical Conference paper presentations will cover the newest and unpublished results, techniques, materials, processes, and trends. IPC APEX EXPO 2023 will address the biggest issues facing the \$2 trillion global electronics industry, including topics like boosting operational efficiency; improving product quality and reliability; innovations in advanced HDI and PCB HDI technologies; and the outlook for Factory of the Future trends. **SMT007**

**Julia Gumminger** is manager of professional development and events for IPC.

---

## EMS Leadership Summit at IPC APEX EXPO 2023

**EMS Leaders of Today and Tomorrow Helping Each Other and the Industry to Prosper**  
**Monday, Jan. 23, 8 a.m. to 5 p.m., 6 p.m. Networking Dinner**

The EMS Leadership Summit brings together current and future industry leaders to solve problems, build business networks and share insights to doing business better. Focused on high level topics which drive business growth and financial success, leaders gather insights from experts and discuss their own and potential new best practices during panel discussions and roundtables. This meeting of minds inspires action and builds resources for participants, future leaders, and the greater EMS industry. Relax and continue making connections at the EMS Networking Dinner after the summit adjourns. Dinner included with your summit registration.







# Standards Committees: Moving **Faster**, Working **Better**

Feature Interview by the I-Connect007 Editorial Team

Standards committee work is where much of the heavy lifting takes place for industry standards. To the inexperienced eye, the committee process can also seem as perplexing as it is crucial. In this conversation, Teresa Rowe, IPC's senior director of assembly and standards technology, highlights what to expect from standards committee sessions at IPC APEX EXPO 2023. New committees, revisions, leadership, awards, and thoughtful pauses to celebrate achieving milestones are all part of the IPC APEX EXPO standards committee experience.

**Nolan Johnson:** Teresa, looking ahead to IPC APEX EXPO 2023's committee work, what is meaningful and compelling for attendees?

**Teresa Rowe:** From a standards development perspective, we have new projects. First, we have a new project on magnification, as well as

projects for Factory of the Future. We have a lot of leading-edge technologies, and we have some celebrations for the completion of some of our documents, IPC/WHMA-A-620E being one of them. We're continuing our work to release more things that industry is anxiously awaiting in 2023. It's an opportunity for us to see each other face to face and, as I like to say it, "families" getting together and having reunions.

**Johnson:** Is there a sense that committee work is accelerating?

**Rowe:** Yes. There is a demand from industry for standards to be on the top of their game and it's a well-known fact that it takes a long time for some things to get into the documents. We must look at test data; sometimes we set up tests ourselves or with the groups and work through what that means for industry. But



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at the end of the day, industry's expectation is that we provide them with the standards requirements that are accepted by that same industry, so that they can build for their customers.

**Johnson:** Let's walk through some of the committee work you just highlighted, such as magnification.

**Rowe:** We've had a standard for a very long time. It's very old; IPC-OI-645, which is referenced in one of our very popular documents. We realized that it needs to be updated. The standards group has taken an action item to start looking at the older standards in our library and to either reaffirm, revise, or withdraw them and make them obsolete. Because of the conversation with that group, they realized they also needed a guidance document that helped industry to use magnification. Things are getting smaller, and people can't see them, so there's a whole new effort with that. In addition, factory of the future has two new magnification projects for AOI and AOX and we're planning to bring those on board.

**Johnson:** That's a nice segue to the factory of the future. What's happening there this year?

**Rowe:** We're just getting our committees formed, and sometimes the most difficult part is to get a project off the ground. We're looking for anyone who might be interested in working on these projects, those who want to dedicate their time to help themselves, their company, and industry to reach consensus on what's needed.

**Johnson:** What's the best way to get involved in a committee?

**Rowe:** Please [click here](#) for more information and to make a request. All requests are



Teresa Rowe

reviewed by technical standards staff. Volunteers are added to the groups, the staff liaisons will set up meetings, and you'll get access to IPC Works.

Our communication tool for our standards development projects is through IPC Works. This platform provides an opportunity for networking and building industry relationships. It all starts with coming to IPC's website, where you can sign up and ask to join a committee.

**Johnson:** The idea of joining a committee and getting involved in standards work might seem just a little bit daunting or scary to some. What can they expect their experience to be like?

**Rowe:** I was one of those people a long time ago, so just give it a try. Think of when you tried something new, like jumping into a swimming pool. Were you a little scared? Absolutely. Standards development might not be for everyone, but at the same time, you might find you love the chase. Not only do you join technical people talking about technical stuff, but you learn things you can take back to your job.

When you're new to a committee, the best thing is to come into the room, walk up to a leader and say, "Hi, can you introduce me to someone I can sit by so I can learn the ropes?" The longtime task group members really enjoy taking new members under their wings and helping them navigate. They'll explain what voting means, the rules for discussion, and so forth. So, just come up and say "hello." Ask a question or two. Everyone is new the first time; the second time you'll be a pro.

**Johnson:** What can IPC members expect in upcoming releases of standards?

**Rowe:** We have several standards scheduled to release in 2023. Most notably, we have IPC-A-600 and IPC/7711/21 on the list, as well as

IPC-A-610 and J-STD-001. Those are four very popular industry documents. Of course, there are design documents being worked on, and we have the greener cleaners document, IPC-1402, that was released recently. There's a lot of change coming up for our industry; in terms of standards, IPC APEX EXPO will be an opportunity to see what's out for review of the new revisions.

I want to mention, the IPC/WHMA-A-620 task group will not only be having a party, but they have started on the next revision, due out in 2025. That team already has a series of questions and comments to work on and will be meeting for a whole day to keep moving forward.

**Johnson:** When do committee meetings start and end? What's the period in which they run?

**Rowe:** They run all day Saturday, Jan. 21, through Thursday, Jan. 26. In many cases we have as many as a dozen meetings happening at one time. To make everything fit, IPC standards committee staff and volunteers are sometimes concurrently running meetings.

To be more sequential, standards committee meetings would otherwise need a month or two and does anybody have time for that kind of commitment? The tradeoff is that we run concurrently for a week. It's very busy, but it works.

**Barry Matties:** I'm curious about the Emerging Engineer program and their participation in the standards committee work. What are you seeing as far as participation and are you integrating them in by design?

**Rowe:** The Emerging Engineer program has been an exciting and refreshing opportunity for us. Many of our emerging engineers, who have either finished the three-year program or they're somewhere in the second half of their three-year program, have started to take on leadership roles.

We have leaders who have been in task group leadership roles for a while; they're stepping aside, and emerging engineers are taking those roles. They are bringing fresh ideas, and energy in some cases, to projects that we've been working on. They not only come to the program to learn, but to be mentored. The mentors are those who have been in standards development for years and they guide the young engineers through the process of taking on those leadership roles so that they can become fully engaged in their IPC contributions.

**Johnson:** Any surprises?

**Rowe:** For many years, IPC has given committee service and leadership awards. We wanted to look at having our standards development people help with the recognition of those who have done their best with their contributions.

This year, we are introducing a new awards program with two key awards. Everyone on a task group will receive a certificate that says they've participated in that revision activity when that revision or that document is finished.

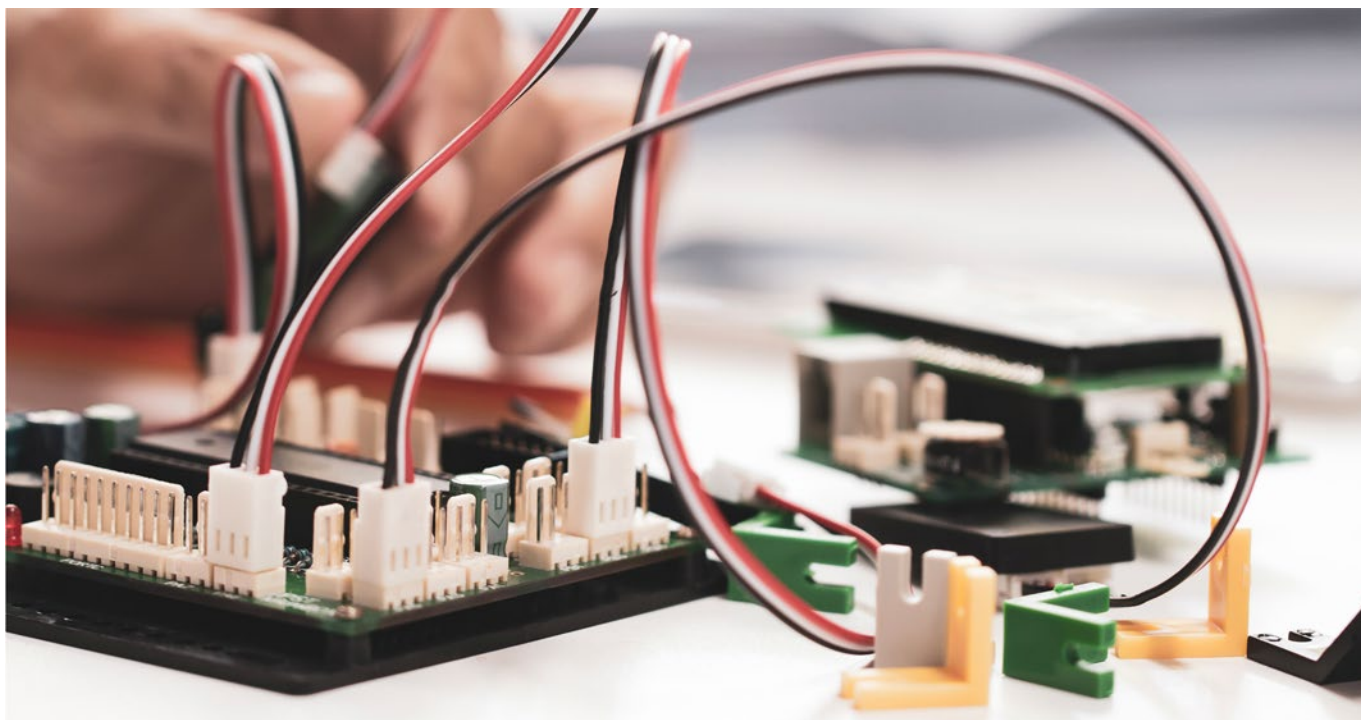
Going forward, anyone who worked on those committee projects for the previous year can be nominated for two new awards. One is the Committee Leader of the Year and the other one is the Committee Member of the Year. These awards have names, but we will not be revealing the names until the show. The nomination period for the 2023 awards is now closed and our nominations selection committee will be providing their recommendations for the winners of those two awards.

When people realize who the awards themselves are named after, and see how they're presented, I think they will understand that we have really changed this up. This is exciting for us.

**Matties:** Thank you so much, Teresa.

**Rowe:** You're welcome. I'm always happy to talk about standards. SMT007





# STEM Program: Evolving and Growing

Feature Article by Charlene Gunter du Plessis  
IPC INTERNATIONAL

IPC has a responsibility to its current members but also in attracting and retaining new talent to the electronics manufacturing industry. This is no more evident than in the STEM event hosted by the IPC Education Foundation at IPC APEX EXPO. For the 2023 event, more than 500 students from nearly a dozen high schools are expected to participate in hands-on activities, touring the show floor, and learning from industry experts. The Career Panel Luncheon will expand across the in-person event as we broadcast and stream to schools across the United States.

## Putting It in Perspective

The IPC STEM outreach event started in 2018 and more than doubled its size of that first year. We are very thankful for the support that we get from industry that allows us to bring this event to the San Diego Unified School Dis-

trict. We have made an impact and have collaborated with nine participating high schools over the past five years. To put some numbers in perspective, we started with about 50 students and now we have more than 500, which is also the reason behind expanding the event from one to two days.

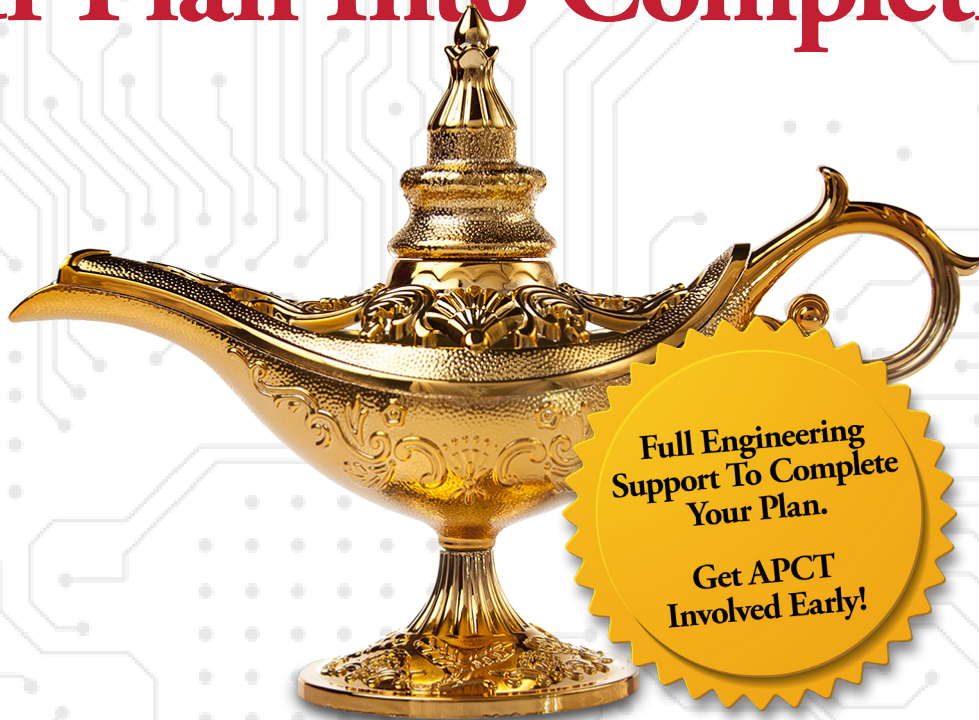
Overall, the goal of the event is to create awareness, which is part of our mission statement to showcase the industry, and to educate and inform the students that there are different careers to consider and various career path entry points based on their skills when entering the electronics manufacturing industry.

## Event Details

This year, the STEM event will take place on Wednesday, Jan. 25 and Thursday, Jan. 26. It is an immersive experience where students have an opportunity to connect with the industry

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by talking to industry representatives, exhibitors at their booths, and to learn specific skill development tracks which include hands-on soldering, PCB design, and engagement opportunities for students and industry to connect through the show floor tour, booth visits, career panel, and career roundtable discussion.

**Soldering:** The students will participate in a hands-on soldering, pin build activity. They are always very excited to showcase what they've soldered on a PCB board. It is a fun activity with interactive components such as LED lights that flicker. You'll see these flickering LEDs on their clothing as they walk around on the show floor, so be sure to acknowledge their soldering skills when you see them.

**Design:** We are very fortunate to have support from Altium and Arduino for the PCBBeTheChange design competition. The aim of this competition is to inspire students to consider a career path in PCB design while solving an environmental problem within their respective countries. We have approximately 210 different teams competing across 26 countries. We will showcase the winners of both the high school and university/college sections.

**Show floor tour:** Groups of students will tour the IPC APEX EXPO show floor. Those

who are familiar with this event know IPC attracts between 9,000 and 11,000 attendees as exhibitors, suppliers, industry representatives, and other interested parties. This is an amazing opportunity for students to participate in a very large event with a single focus. Students stop at assigned exhibitor booths, engage by asking career-related questions, and learn about the industry.

**Career panel luncheon:** Students will gather to participate in a lunchtime career panel discussion comprised of various industry experts such as our event sponsors and IPC Emerging Engineers who bring a variety of skills, backgrounds, and different career stories to inspire the students. I believe this widens the knowledge and decision-making aspects for a student to know: "If I really want to be an engineer, this is what I need to do." The panel will be moderated by IPC President and CEO Dr. John W. Mitchell. It will be recorded and broadcasted to many schools across the United States.

**Roundtable discussion:** We realize that it can be difficult for students to ask very personal questions during the Q&A part of the career panel and therefore we have implemented this opportunity for students to engage with industry members. It is an honest, transparent, and open setting where students can receive real answers organically. They need real answers from real people sharing real stories. We feel that authenticity is needed to change the perception that people might have about electronics manufacturing.

## You Can Be a Sponsor

We are very thankful for the support from TTM Technologies as the premier sponsor of the overall STEM event. We always have sup-

port from Weller Tools, whose members will dedicate their time and support with the soldering track. Altium and Arduino, as I mentioned, supporting our design track, and Magi-Ray sponsors the Breakfast for Champions. In addition, we have collaborating sponsors, including Mycronic, which has been a past supporter as well. We could not showcase the impact that we are making in the lives of these students and teachers without the support from I-Connect007 as our official media sponsor, and we are very thankful for that.

We have detailed information at [ipcef.org](http://ipcef.org) under the Events tab where we mention the sponsorship opportunities still available.

## Why This Is So Important

This event supports the industry by developing a pipeline of new talent. It resonates the mission of the IPC Education Foundation because to build and support the industry, you must create awareness of the various types of careers available: opportunities, positions, entry points, and skills needed. This STEM event touches on all these aspects. We feel that if you can create awareness or “access points to knowledge share” with content, hands-on experiences, and engagement opportunities with industry, you can steer them toward pursuing a career in the industry.

Since we started the STEM event in 2019, we have conducted surveys before and after the event. We wanted to gauge the interest of students considering a career in electronics manufacturing and it has been proven year over year that the event contributes to their decision-making. Besides maintaining a 95% to 100% overall satisfaction rate, we learned that there is a 33% increase in students who now will consider pursuing a career in this exciting industry.

## A Pipeline to New Talent

Through strategic activities like this we can provide valuable information to the industry and will dedicate our efforts by incorporating opportunities to test responses by the participants through the event.

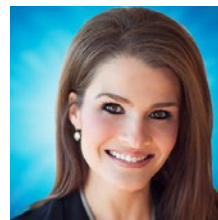
Whether you are in high school, have an associate degree, are a recent graduate from an engineering school, a veteran, or someone who wants to consider making a career change, there is ample opportunity available. As the Foundation, we are very proud to have an event mainly focused on high school students. We have other designated programs available to students in college and university such as the IPC Student Chapter program that offers students with industry-relevant content, connections through facility tours and speaking engagement opportunities on or off campus, as well as scholarships.

## Of Special Note

Every year we meet a diverse group of students and among them there will be a dedicated group of 25 girls who form part of the Girls in STEM at Olympian High School in Chula Vista, California. It's exciting to see such a large group that is specifically female focused.

The Foundation will focus on exciting opportunities to continue connecting talent with industry in 2023 and we cannot wait to share what we've been working on with everyone.

If you have further questions, would like to volunteer for a roundtable discussion or to be a sponsor, please contact me. **SMT007**



**Charlene Gunter du Plessis** is the senior director of the IPC Education Foundation.





# MilAero007 Highlights



## Sunstone and I-007eBooks Launch Book on Designing for Reality ▶

I-007eBooks is excited to announce the release of the latest title in its series for designers, *The Printed Circuit Designer's Guide to... Designing for Reality*. This book covers both written and unwritten rules for how to create a realistic, manufacturable design.

## American Made Advocacy: The CHIPS Act is Just the Beginning ▶

Now that the much-heralded CHIPS and Science Act has been signed into law, the work to secure the entire microelectronics ecosystem must begin. We have a long way to go in restoring balance and resilience in our critical supply chains.

## Flexible Thinking: The Chameleon of Interconnection Technologies ▶

Flexible circuits are arguably the first instantiation of electronic interconnections. A flexible interconnection structure was first disclosed in patent literature by Albert Hansen—unearthed by gifted researcher, innovator, and self-described technology generalist Dr. Ken Gilleo.

## EMC Gains License to Produce Arlon Products ▶

Arlon Electronic Materials, Rancho Cucamonga, CA, is pleased to announce the company has entered into a licensing agreement with Elite Materials Co. Ltd. (EMC), Taiwan. Under the terms of this agreement, EMC will commence volume production of Arlon's flag ship polyimide material 85N.

## USPAE Entering Rapid Growth Phase to Better Connect Industry, Government ▶

The U.S. Partnership for Assured Electronics is entering a new phase of rapid growth to better connect the electronics industry with government needs and opportunities.

## Standard of Excellence: The Power of Partnerships ▶

Now more than at any other time in our history, solid partnerships hold the key to success for all companies. If the past two and a half years of challenges and issues have taught us anything, it is that by increasing the number of stronger partnerships we have, the more we can accomplish and the more secure our companies will be able to handle the future.

## Lockheed Martin: U.S. Army's Q-53 Multi-Mission Radar Demonstrates Counter-UAS Mission ▶

The U.S. Army's AN/TPQ-53 (Q-53) Multi-Mission Radar successfully integrated with an Army command and control system and provided tracking data to launch a counter unmanned aerial system (C-UAS) defeat system in Yuma, Arizona.

## Collins Aerospace to Provide U.S. Air Force with Strategic Mission System Capability Utilizing OpenVPX Standards ▶

Collins Aerospace has been selected by the U.S. Air Force to develop a modern Very Low Frequency (VLF) receiver that will help modernize its strategic mission capability. The company was awarded a 30-month, \$42 million Period of Performance (POP) contract.



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# Women in Electronics Reception

Feature Article by Alicia Balonek

IPC INTERNATIONAL

Emily Calandrelli, IPC APEX EXPO's opening keynote speaker and featured speaker of our Women in Electronics Reception, is an MIT engineer turned Emmy-nominated science TV host. She's the host and co-executive producer of "Emily's Wonder Lab" on Netflix, she's featured as a correspondent on Netflix's "Bill Nye Saves the World" and an executive producer and host of FOX's "Xploration Outer Space."

Emily's educational background is in engineering and policy. At West Virginia University she received a bachelor's in mechanical and aerospace engineering. While at WVU she was awarded the Goldwater scholarship for research and Truman scholarship for policy work. She received her master's from MIT in aeronautics and astronautics as well as technology and policy.

Emily was invited to deliver the keynote for IPC's Women in Electronics Reception at IPC APEX EXPO as her mission and goals align with IPC's dedication to support of Women in STEM. Although just like IPC, there are many other groups supporting women once they enter such a field, how are we encouraging younger females to join a field commonly dominated by men?

In an interview with Sabrina Doyle on the Jasper Venture Beyond blog, Emily addresses the issue head on and shares her personal thoughts on why encouraging more women to go into science, technology, engineering, and mathematics is so important.

This issue is important to Emily because she is a woman in STEM and could be considered a minority. There are many factors that make this so, and she's interested in identifying those factors and changing the barrier into STEM for the next generation.



Emily explains we need to normalize the idea of women in STEM through books, TV, movies, and in the media. We need to have just as many STEM toys advertised to girls as we do for boys (or more that are simply gender neutral). We need for people to acknowledge the bias they have in hiring and promoting. There's a lot of work to be done, but it's currently underway and she's hopeful that meaningful change is coming.

Emily is addressing this issue through her own efforts by authoring the picture book, *Reach for the Stars*; the science experiment book, *Stay Curious and Keep Exploring*; and the science chapter book series, the *Ada Lace Adventures*. The third book in the series was launched to the International Space Station through the Story Time from Space program.

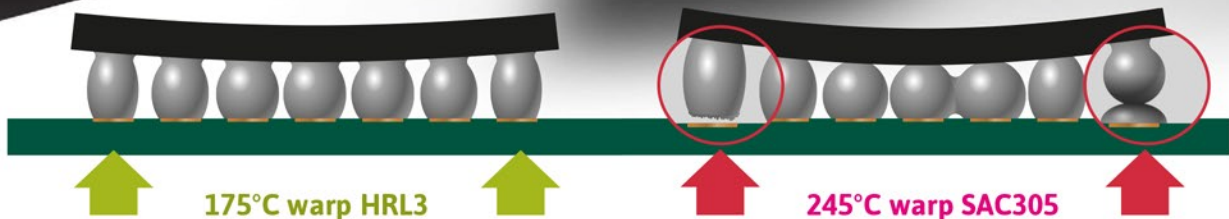
Her website has an entire page of resources available for young girls who are interested in STEM which include: YouTube channels, television shows, books, Twitter, and Instagram influencers and even toys.

The Women in Electronics Reception at IPC APEX EXPO is from 6 to 7:30 p.m. Jan. 24. We certainly hope you join us to hear Emily's insights on how we can play a more active role in introducing the young females in our lives to the unique opportunities that are available to them for a career in STEM. **SMT007**

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# Next-level Professional Development

Feature Article by Julia Gumminger

IPC INTERNATIONAL

IPC APEX EXPO 2023 will offer a refreshed Professional Development Course program. This year's conference includes something for everyone, including informative courses catering to technical managers ready to level up their careers. Thirty-six courses will be offered on Sunday, Jan. 22 and Monday, Jan. 23.

Attendees will find both updated content from veteran instructors and innovative courses from new instructors. The diversity of educational content includes courses that focus on understanding and applying IPC standards; Factory of the Future technologies; quality and reliability; and a legal boot camp. Participants in these courses will gain new knowledge and real-world skills that will equip them to rapidly respond to changing demands for new technologies, materials, and processes.

As engineers progress in their careers and become the next generation of leaders in their companies, business and legal skills will likely become part of their job descriptions. IPC approached Allen Anderson and his colleague, Patrick Sebesta from F&B Law Firm P.C., with

a request for a course designed for engineers who have worked in the technical career track and now find themselves in management overseeing contracts and risk management issues. "Customer Contract and Legal Boot Camp for Engineering Professionals" is a brand-new course, custom-designed for IPC's audience.

"Whether you are a technical professional in an OEM, an EMS provider, a PCB, a cable or wire harness manufacturer, or any other electronics industry supplier, understanding key contractual provisions and associated legal ramifications is critical to every team member's role in negotiating and executing effective customer contracts," Anderson says. "This added dimension to a technical background helps enhance a manager's—and thereby the company's—ability to obtain and execute equitable agreements with commensurate risk for return, avoid significant compliance and risk pitfalls, and protect company assets and intellectual property."

Dr. Mo Abuali, CEO of IoTco, will be teaching another course meant to fill a gap in profes-





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sional knowledge and help leaders prepare for the factory of the future. “Leveraging Industry 4.0 Toward Zero-Downtime, Zero-Defects Manufacturing,” another brand-new course, will benefit not only executives leading operations of manufacturing companies, but also directors, managers, and advanced data science professionals.

Abuali says of the course, “Although some have already begun their journey, many manufacturers are still talking about digitizing their manufacturing floor and wondering if it’s a worthwhile investment. Industry 4.0 describes the evolution of industry toward interconnectivity, automation, advanced analytics, and basing decisions on real-time data capture from the shop floor.”

This course will provide attendees with a broad understanding of key Industry 4.0 solutions that marry physical production and operations with Smart digital technology, plant connectivity, artificial intelligence, and predictive analytics—all to create a connected ecosystem for organizations to level up their uptime, quality, and overall productivity.

Dr. Nahid Majd, associate professor in computer science at California State University San Marcos, will demystify the topics of “Blockchain, NFT, Cryptocurrency and Metaverse,” and discuss how these applications might be used in supply chain management for electronics manufacturing.

The opportunities are great in manufacturing, Dr. Majd says. “NFTs could provide trustworthy maintenance of digital data associated with each electronic product that has been manufactured, tested, and used in

an electronic device,” says Dr. Majd. “Also, because NFTs contain an immutable record of transactions on the blockchain, any third party can easily confirm the origin and ownership of a product.” This brand-new course will offer attendees another option for bringing their factories into the future.

Continuing the Factory of the Future course offerings, Michael Ford, senior director of emerging industry strategy at Aegis Software, will teach a course titled “Application of

IPC Smart and Secure Digital Transformation Standards.” Ford says, “The most important requirement for Smart manufacturing is the secure interoperability of data, with freedom to mix and match hardware and software solutions from chosen vendors.”

Several new IPC standards, including CFX, IPC-2581, HERMES, Digital Twin, Traceability, Cybersecurity, Model Based Design, etc., specifically define various requirements that together create this holistic manufacturing and supply-chain ecosystem. Ford will be joined by a team of industry leaders from many companies across the industry who will explain how the adoption of solutions based on each of these standards can map out the most practical and cost-effective path toward Smart digital transformation. The course is geared toward managers and engineers of both OEM and EMS companies and will reach across all disciplines of design and manufacturing, including production, engineering, quality, supply-chain, maintenance, design, lifecycle management, automation projects, and finally, information technology.



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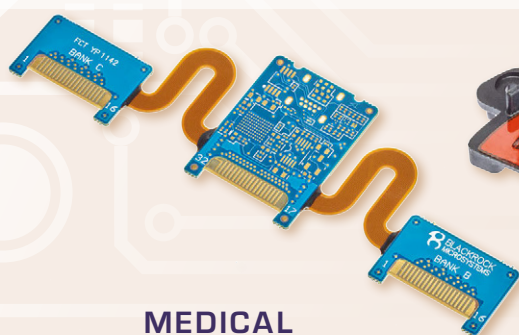
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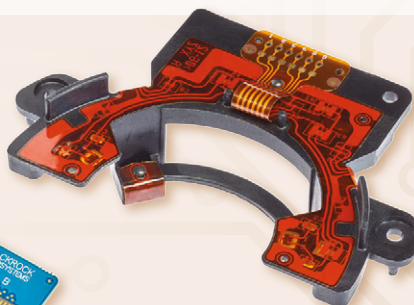
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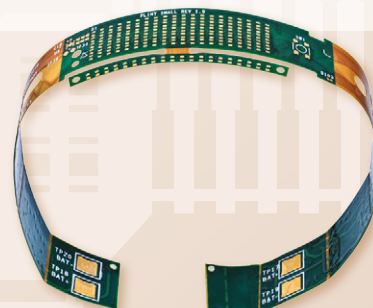
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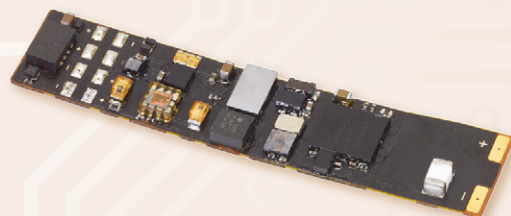
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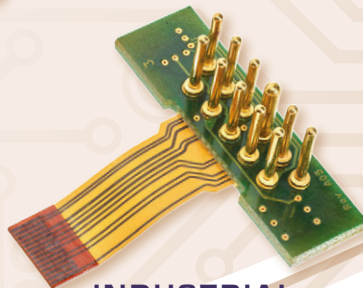
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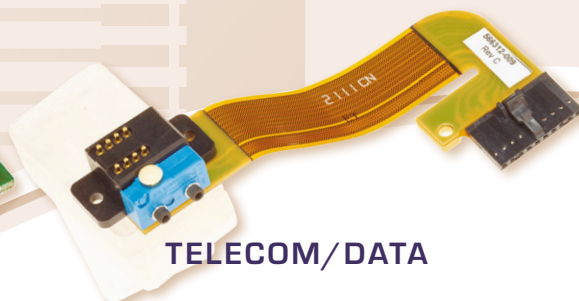
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Kat Ermant, lead prototype technician with Peloton, is harnessing the power of a technology that some consider futuristic but that is very much a part of current manufacturing processes: additive manufacturing, or 3D printing. Ermant's new course, "3D Printing as a Tool: Harnessing the Language of Additive Manufacturing," will offer designers, engineers, and managers a common language to be able to work together utilizing additive manufacturing as a tool for rapid prototyping. This session will cover the fundamentals of office and user-friendly 3D printers; the software applications needed to operate them; the file prep for printable models; finishing requirements; and how to communicate with service bureaus, vendors, and technicians. Participants will learn to speak the same additive language as 3D printing professionals to increase efficiency, lower costs, and speed up lead times.

"Electronic Textile Evaluation Methods for Product Designers and Engineers," a new course by Madison Maxey, CEO and founder of Loomia Technologies, is another course meant to bridge the knowledge and communications gap for professionals who wish to understand and apply newer technologies in their work. Recommended for product designers, industrial designers, electrical engineers, mechanical engineers, and product design engineers who regularly look at new product development where unique electromechanical challenges may arise, this course will provide a primer on how to engage with electronic textiles for new product development. Attendees working in areas such as medical devices, wearables, automotive interiors, and robotics may all benefit from this course. Attendees will walk away with a clearer picture of when electronic textiles may be relevant to their engineering, which type of technology is ideal for their application, and how to thoroughly evaluate a technology when selected.

Dr. John Lau of Unimicron Technology Corporation will be leading the "Heterogeneous Integration (System-in-Package)" course. As

advanced packaging becomes more central to electronics manufacturing, this course will offer attendees an introduction to the technological terms, trends, and challenges facing heterogeneous integration.

Frank Uibel's "Press-fit Technology—Value Chain, Physics, Process and Standards," another course focused on assembly, will discuss updated IPC standards IPC-9797 and HDBK-9798. Insight into the production, design, and application of compliant press-fit pins and components will be covered, along with new materials and surface finish technologies being introduced to the market. Know-how in stamping, plating, and press-in processes will be reviewed; along with testing and acceptance criteria, with a focus on high reliability, harsh environment applications, and the underlying physical contact mechanisms responsible for the quality of the pin to PB connection. Implementation of the standards and how they interact with other IPC documents will provide a holistic picture about high reliability press-fit technology. Attendance is encouraged from anyone in research, development, industrialization, sales, purchasing, or quality engineering with a background in assembling electronics or its components.

Professional Development Courses at IPC APEX EXPO 2023 will offer the highest-quality educational content delivered by experts in all areas of the electronics industry. As major world events impact supply chains and affect consumers' demand for products and materials, IPC's Professional Development Courses offer a venue to learn about best practices, lessons learned from challenges in the field, cutting-edge technology, and trends with updated IPC standards. **SMT007**



**Julia Gumminger** is manager of professional development and events for IPC.

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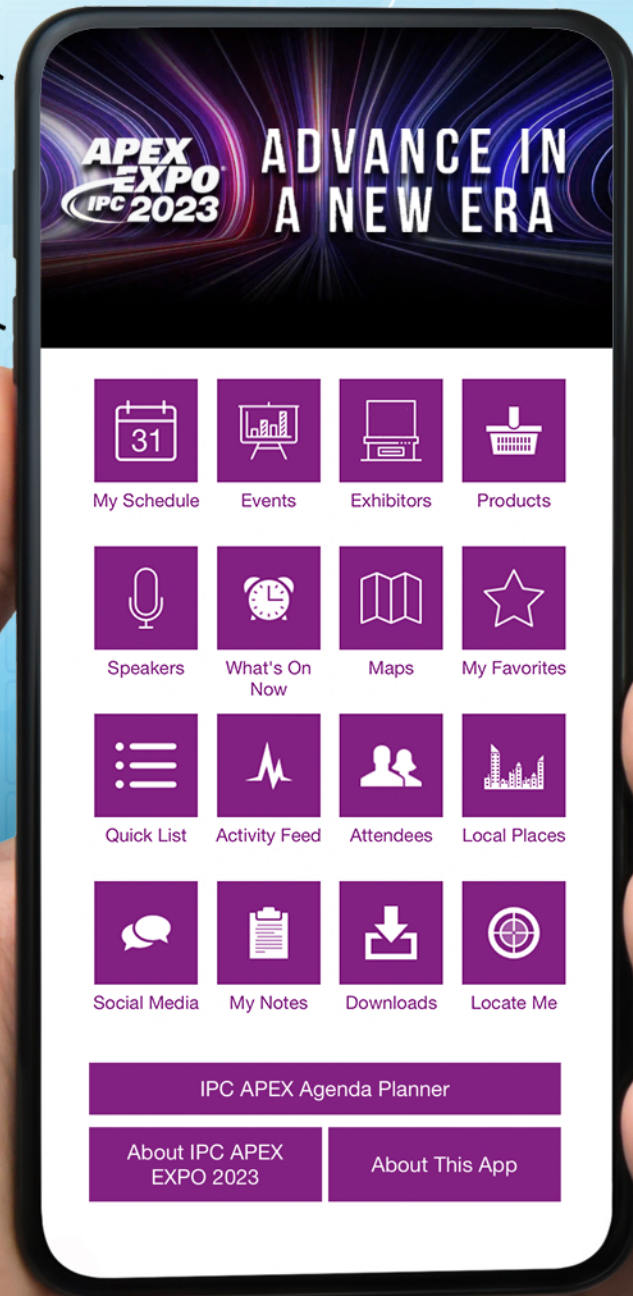
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# Eliminating Solder Balls in Hand Soldering

## Knocking Down the Bone Pile

by Bob Wettermann, BEST INC.

### Cause of the Problem

While solder balls can be produced during both SMT reflow and wave soldering, PCB hand soldering during touch-up or rework can result in solder ball formation. When moisture or other impurities entrapped in or on the surface of the PCB or component outgas during the hand soldering process, solder balls form. Baking out or cleaning the PCB or the component and comparing the results can help determine if this is the case. Soldering irons used to reflow solder paste during rework may also heat the paste too quickly and prevent the flux from fully activating, which causes the solder to oxidize and form solder balls.

### Solutions to the Problem

Solder balls form when the flux becomes molten and fails to clean all the soldering surfaces, which prevents the solder from coalesc-

ing into a single mass. The oxide coating that forms around smaller solder balls inhibits the solder from coming back together. Turning down the temperature of the soldering tip or using a lower tip temperature cartridge may solve the problem.

Because the soldering tip can only activate so much of the flux in each amount of time, slowing down the wire solder feed rate (Figure 2) or reducing the amount of solder being fed to create the solder joint (Figure 3) can also help prevent solder balls from forming. Fully activating the flux is the key to preventing oxide layers from forming.

Utilizing a slightly more active flux that can withstand this temperature ramp is another option for preventing oxide layer formation. Using a hot air or IR reflow source with a slower defined ramp rate can eliminate the solder balling problem when using paste for

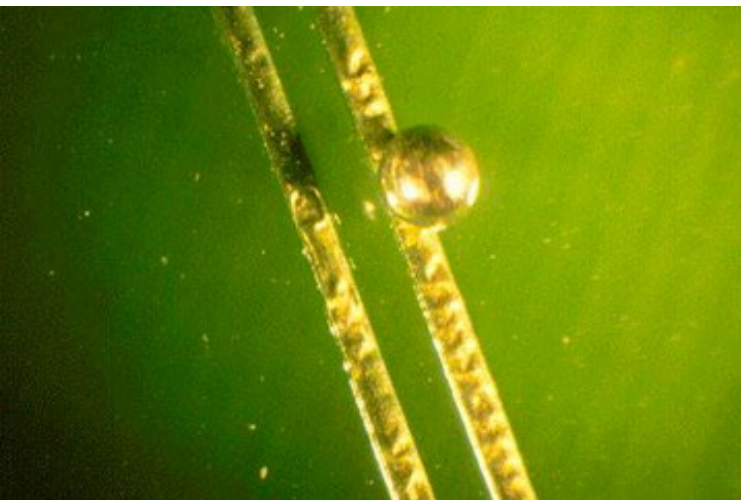


Figure 1: When a solder ball is produced.



Figure 2: Feeding solder wire too quickly can lead to solder ball formation.

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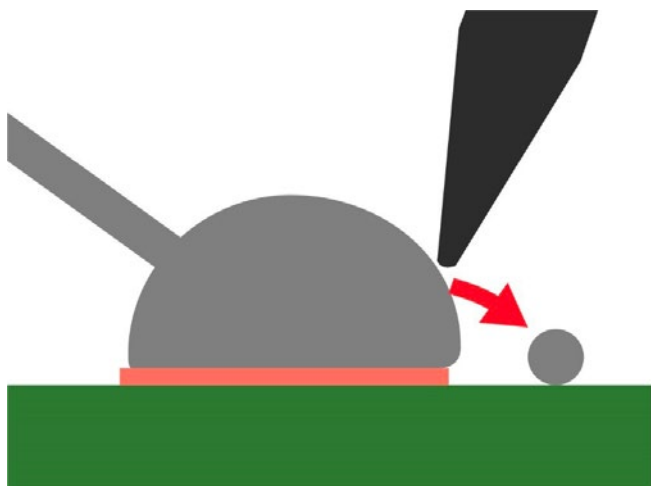


Figure 3: Too much or “heavy” solder can lead to solder ball formation.

rework. A slower ramp rate ensures that the flux is fully activated, thus preventing solder balls from forming.

Soldering techs need to be adequately trained in hand soldering and the variables affecting outcomes to reduce the chances of solder ball formation. Training should include adequately reinforcing the correct materials, choosing the correct tip as a heat bridge between the lead and the land, maintaining the correct tip temperature, and keeping the soldering tips clean. Inexperienced soldering technicians may feed in too much solder too quickly (See Figure 1).

Another area to consider when assessing the likelihood of solder contamination is component lead contamination. Potential sources of contamination include improper storage of the components, improper MSD controls of the component, and the cleanliness of the tape, tray, or stick the components are stored in.

With the proper solder training, or in some cases retraining, soldering technicians can pick up better habits and help diagnose problems as they happen.

## Reminder of the IPC-A-610 Spec on Solder Balls

A refresher is in order on what the inspection standard says about solder balls. Solder balls (IPC-A-610H 5.2.7.1) become a defect when:

1. The presence of a solder ball reduces the distance between the solder ball and another conductive surface to below the minimum electric clearance.
2. The solder ball is not entrapped, encapsulated, or attached, or can become dislodged in the service environment. A solder ball rolling around in an electronics enclosure is not acceptable.
3. The solder ball is entrapped in coating or flux residue such that other form, fit, or functions of the electronics assembly cannot be maintained.

## Removing Solder Balls

Solder balls can be removed by several means. For solder balls entrapped in flux residue, an orangewood or plastic stick can dislodge the solder balls. The challenge is making sure that solder balls dislodged in this manner do not get “lost” in the assembly and create a future reliability issue. Large solder balls can be removed with a soldering iron, flux, and soldering braid. If entrapped by a conformal coating or other material layer, the coating will need to be removed prior to eliminating the solder balls.

While solder balls typically appear in other PCB assembly processes, those formed in hand soldering can be mitigated through a variety of methods including proper flux usage; proper soldering tip and temperature selection; and by keeping the materials in the soldering process free from moisture and contaminants. **SMT007**



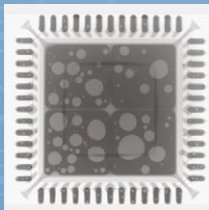
**Bob Wettermann** is the principal of BEST Inc., a contract rework and repair facility in Chicago. For more information, contact [info@solder.net](mailto:info@solder.net). To read past columns, [click here](#).

# Pyramax Technology to Eliminate Solder Voids

## Pyramax Vacuum

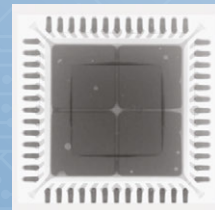


Vacuum reflow is a proven solution for PCB assemblies or products that require low solder voiding for critical performance applications. Pyramax Vacuum has been designed with the requirements of large EMS, OEMs and high-volume automotive segments in mind. The system features controlled heating within the vacuum chamber enabling industry leading thermal uniformity and the tightest control of liquidus time. Processing temperatures of up to 350°C can be achieved with vacuum levels lower than 20 Torr. Integrated controls and fully automatic vacuum operation are achieved via BTU's proprietary WINCON™ control system.



Traditional Reflow

Voiding occurs when flux or solder paste oxidation is entrapped in the solder joint. Shown here is an MFL processed with and without vacuum reflow. BTU's vacuum reflow solution is designed to reduce voiding to <5% (process dependent).



Vacuum Reflow

**Pyramax**

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For additional voiding data scan the code to download the paper  
**Operation of a Vacuum Reflow Oven**

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# The First India Pavilion



Feature Article by Gaurab Majumdar

IPC INTERNATIONAL

For the first time, IPC APEX EXPO will host an “India Pavilion,” showcasing 16 Indian companies promoting India’s electronics manufacturing capabilities. The initiative was undertaken by the Ministry of Commerce & Industry, Government of India, and implemented by the Indian government agency, Electronics and Computer Software Export Promotion Council (ESC) India.

It is the Indian government’s goal to introduce Indian companies to the global market. Indian companies representing EMS providers, wire harness manufacturers, material suppliers, design companies, and PCB manufacturers will be part of the India Pavilion at IPC APEX EXPO 2023. The government of India places a high priority on electronics hardware manufacturing, as it is one of the crucial pillars of “Make in India,” “Digital India,” and “Startup India” programs, all geared to ensure that India becomes a global design and manufacturing hub.

India’s electronics manufacturing production is led by mobile phones, IT hardware

(laptops, tablets), consumer electronics (TV and audio), industrial electronics, automotive electronics, electronic components, LED lighting, strategic electronics, wearables, and telecom equipment production. India is poised to become a global manufacturing hub and is expected to export approximately \$120 billion by 2026. This market-size explosion has been catalyzed by COVID-19-led growth of digital consumption. Electronics manufacturers are also seeking diversification of global value chains, so it makes sense for India to be a focus area. The policy of “Make in India” and the large OEMs looking to “Buy in India” have helped the EMS industry grow and solve supply chain issues. The Indian ESDM industry is focusing on PCB manufacturing within India and large companies are looking at investment opportunities within the country.

Supply chain disruptions during the pandemic forced many companies in the United States to rethink their sourcing strategies to reduce dependency on one country for their supplies. Today, the EMS industry is being





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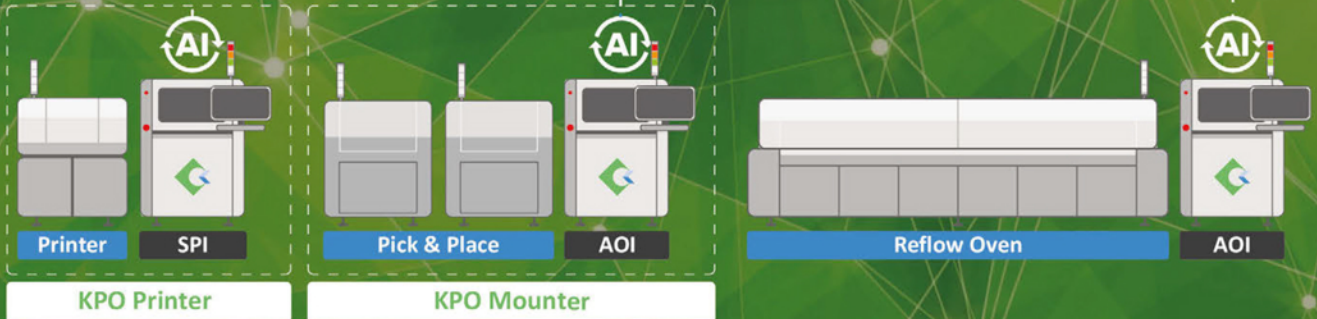
# KSMART SOLVES PROCESS ISSUES WITH AI-POWERED MULTIPOINT INSPECTION

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**Table 1: Indian Companies Participating in IPC APEX EXPO 2023**

Company Name	Sector	City	Website
Zeal Electromech Pvt Ltd.	PCB Assembly/Rework	Pune	zealelectromech.com
Fine Track Systems	PCB Fabrication & Assembly	Gandhinagar	finetraksystems.com
Aimtron Electronics Pvt Ltd.	Electronics Design/EMS	Vadodara	aimtron.in/electronics-manufacturing-services
Cyronics Instruments Pvt Ltd/	Electronics Test & Meas.	Pune	cyronics.com
Vinrox Technologies	Electronics Design/EMS	Vadodara	vinrox.com
Om Circuits Pvt Ltd.	PCB Manufacturer	Delhi	omcircuitboard.com
Advantek Fuel Sys Pvt Ltd.	PCB Assembly	Delhi	
Wuerth Elektronik India Pvt Ltd.	PCB Design & Solutions	Bangalore	we-online.com/web/en/wuerth_elektronik/start.php
Kaynes Technology India Ltd.	Electronics System Design & Mfg.		kaynestechology.co.in
Tescom	PCB Design/EMS	Bangalore	tescom.co.in
Rossell Techsys	Wire Harness Eng. and Mfg.	Bangalore	rosselltechsys.com
BPL Limited	Consumer/Medical/PCB Mfg.	Bangalore	bpllimited.com
Sahasra Electronics Pvt Ltd.	PCB Design/Assy/Wire Harness	Delhi	sahasraelectronics.com
UKB Electronics Pvt Ltd.	Electronics Product/Wire Harness	Pune	ukbelectronics.com
Protolab Electrotechnologies Pvt Ltd.	Printed Electronics/Devices	Mumbai	protolab.in
Siena ECAD	PCB Analysis/Design Engineering	Bangalore	siennaecad.com

hit with component and raw material source shortages, particularly for bare PCB boards. Trade wars with certain countries have brought these challenges to the forefront. Electronics manufacturers are also seeking diversification of U.S. value chains, resulting in India becoming a focus area. IPC APEX EXPO 2023 will provide a great platform for participating IPC members in India to forge strategic partnerships with U.S. companies while providing exposure for investing and opening operations in the United States.

Since 2010, IPC India has helped OEMs, EMS providers, PCB manufacturers, cable/wiring harness manufacturers, and electronics industry suppliers “build electronics better” through training and certification. IPC’s India office has certified over 11,000 professionals in the industry, helping companies enhance the quality and reliability of their products. Several Indian SMEs, exporters, and public sector organizations are engaged with IPC resources. In addition to training and certification oppor-

tunities, IPC India provides annual business networking platforms such as Integrated Electronics Manufacturing and Interconnections (IEMI) events.

Electronics trade and investment have been growing quite significantly in India and IPC would like to support the government of India by providing opportunities that will help electronics manufacturers. In 2020 and 2021, COVID-19 impacted the electronics industry globally. But based on the rebound we have seen in 2022, especially during the second half of the calendar year, I believe 2023 will be the year to completely regain confidence and build new connections. IPC APEX EXPO 2023 will be an important platform for Indian exhibitors and delegates to look for new business opportunities, and I am very excited about this opportunity to showcase India’s manufacturing companies. **SMT007**

**Gaurab Majumdar** is executive director, IPC India.



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# Reconnecting the Social Network

Feature Article by Alicia Balonek  
IPC INTERNATIONAL



If the past two years have emphasized anything, it would be the importance and value of face-to-face networking at events. Face-to-face interactions help create lasting relationships with new connections and help strengthen existing relationships with industry friends and colleagues.

Thousands of industry leaders, manufacturing innovators, and subject matter experts from across the globe will convene in San Diego for IPC APEX EXPO 2023, making it the place to be to help you connect with representatives from the entire electronics manufacturing supply chain. We have a full line-up of networking events planned for IPC APEX EXPO 2023 that you don't want to miss.

## Show Floor Reception

**Tuesday, Jan. 24, 5 to 6 p.m.**

The industry's largest networking event, the IPC APEX EXPO Show Floor Reception, is your opportunity to network with industry colleagues and connect with the industry's leading equipment manufacturers, suppliers, and innovators. Included in all registration packages, *including the Event Essentials tier (Exhibit Hall-only registrations).*

## Ice Cream Social

**Wednesday, Jan. 25, 2:30 to 3:30 p.m.**

Satisfy your sweet tooth while networking with industry colleagues, subject matter experts, and the industry's leading equipment manufacturers, suppliers, and innovators. *Included in all registration packages, including the Event Essentials tier (Exhibit Hall-only registrations).*

## Newcomers Welcome Reception, Sponsored by SICK

**Monday, Jan. 23, 5 to 6 p.m.**

Maximize your time at IPC APEX EXPO with some advice from a few insiders while you enjoy cocktails and hors d'oeuvres with your colleagues and learn how you and your company can get the most out of your attendance at IPC APEX EXPO 2023. *Included in all registration packages, including the Event Essentials tier (Exhibit Hall-only registrations).*

## Women in Electronics Reception

**Tuesday, Jan. 24, 6 to 7:30 p.m.**

"Where Are All the Women in STEM?"

Emily Calandrelli, mechanical and aerospace engineer, host and co-producer of "Emily's Wonder Lab" on Netflix, and executive producer and host of "Xploration Outer Space" on FOX will provide insights on how women in STEM can play a more active role in introducing young females to the opportunities available to them for a career in STEM. *Included in all registration packages, including the Event Essentials tier (Exhibit Hall-only registrations).*

## Career Connections Networking Event (new this year)

**Wednesday, Jan. 26, 6 to 7:30 p.m.**

This networking event will provide an opportunity to meet your colleagues and peers in the electronics industry. Special guests from the Emerging Engineer program will lead a discussion on falling into your career by taking risks and looking for opportunities. Bring your questions and your colleagues to this event to either listen in or share your best (and worst) career decisions and how those decisions have both shaped where you are today and determined where you want to be in the future. *Advance/separate registration required. SMT007*

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



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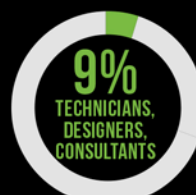
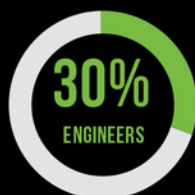


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# Launching IPC Community Magazine

Article by Michelle Te  
I-CONNECT007

IPC is well known for its cutting-edge standards development, certification and training, advocacy, and industry intelligence reports that directly impact its members.

Now, IPC leads the industry in yet another direction—the launch of an industry-specific quarterly magazine, *IPC Community*, that celebrates member success while sharing the important work being done within IPC to better serve its members and the greater electronics manufacturing community.

In fact, when IPC President and CEO John Mitchell travels on behalf of IPC, his interactions with others often center on creating connections through a healthy global ecosystem. He wants those he meets to see and feel the importance of that message. With a mission to help members “build electronics better,” Mitchell wants them to understand they’re all working toward the same goal.

To further enhance that goal, *IPC Community* digital magazine will share and celebrate member success stories, committee and stan-

dards updates, education and workforce training developments, Factory of the Future solutions, advanced packaging updates, member profiles, and more. It’s news and information to help you be more competitive and profitable.

“We have so many good things going on within our organization, it’s challenging to deliver content where our members can easily read, consume, and share it in a single place,” says Brian Knier, IPC chief marketing officer. IPC effectively uses its website and social media channels, but was looking for something even more creative, with a way to tell great stories about what’s happening inside IPC and in the greater member community.

“We are a member organization and this is primarily a member magazine,” Knier says of *IPC Community*. “We also serve a larger community, so our hope is that when you read this, you will see all that IPC is doing to help the greater electronics community.”

But it’s more than that, he continues, because it’s an opportunity to infuse “community”



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into everything that IPC does. To help celebrate the success stories of IPC members, IPC turned to its new IPC Publishing Group (I-Connect007) to coordinate efforts. “It only made sense to



partner with I-Connect007, and it’s been fabulous so far,” he says. “This partnership is what has allowed us to create the magazine, and it’s been a pleasure to work together.”

Both IPC and I-Connect007 understand that it’s the members, and readers, that make every effort vital to moving forward.

“It’s our members that make IPC so strong,” Knier says. “We need to celebrate them, and for us to feel more connected to the very people who keep us going, who make all of this happen. When our members are successful, it helps others to be successful.”

In just one example, Teresa Rowe, senior director of assembly and standards technology, was bursting with pride as she related the cake celebration for one of her volunteer committees after three years of review before their standard was finally published. These committee members devoted many hours debating over the finer points of IPC/WHMA-A-620C [standard is now on E revision] before finally deciding it was ready to be published. It was the penultimate ending to some really important work. In each issue of *IPC Community*, we will continue to share success

stories like these between IPC and its members. I’m sure you’ll have some of your own.

But that’s not all the *IPC Community* will share. The IPC team knew an extremely valuable

resource would be content that directly affects the financial health and well-being of IPC members. To that end, each issue will feature an exclusive market report from Shawn DuBravac, IPC chief economist. Shawn will research and write this content exclusively for IPC members which may be crucial to your bottom line—right now.

“This will be ‘must read’ content that has a direct market impact,” Knier says. “It will be timely and relevant. We know this will be of high value and will be something you’ll be looking for in every issue. So, please, give us feedback. Let us know if this is something you want.”

At my core, I’m a storyteller, and I believe that no matter where you go in life, there are great stories to be told. What’s your story? What will you share with us? How will you help us celebrate your success? What can you share that might inspire someone else also working to stay competitive in this ever-changing, fast-paced industry?

I’m excited to manage this new publication, so please don’t hesitate to reach out with story ideas or to provide feedback after we launch the first issue. The magazine launches during the week of IPC APEX EXPO 2023 in both a digital and printed format.

To subscribe to IPC Community, [click here](#). This is something definitely not to be missed! To learn more about advertising opportunities, contact [Barb Hockaday](#). Download the media kit [here](#). SMT007

**Michelle Te** is managing editor of *IPC Community* and columnist coordinator at I-Connect007.



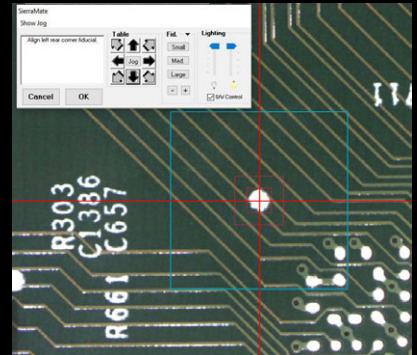


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# The Value of Training Committees

Feature Article by Zenaida Valianu

IPC INTERNATIONAL

IPC APEX EXPO 2023 is right around the corner and the training groups are assiduously preparing for these meetings. IPC certification programs, built around IPC standards, play a key role in bringing value to the electronics industry. They are created and approved by training committees consisting of subject matter experts and trainers from around the world.

Committee members volunteer their time and expertise to improve the existing standards-based certification programs and to develop new programs based on industry needs. These committees support the IPC Education Team in developing, updating, and maintaining the training program materials, and provide industry expertise to the development, evaluation, and revision of the certification program.

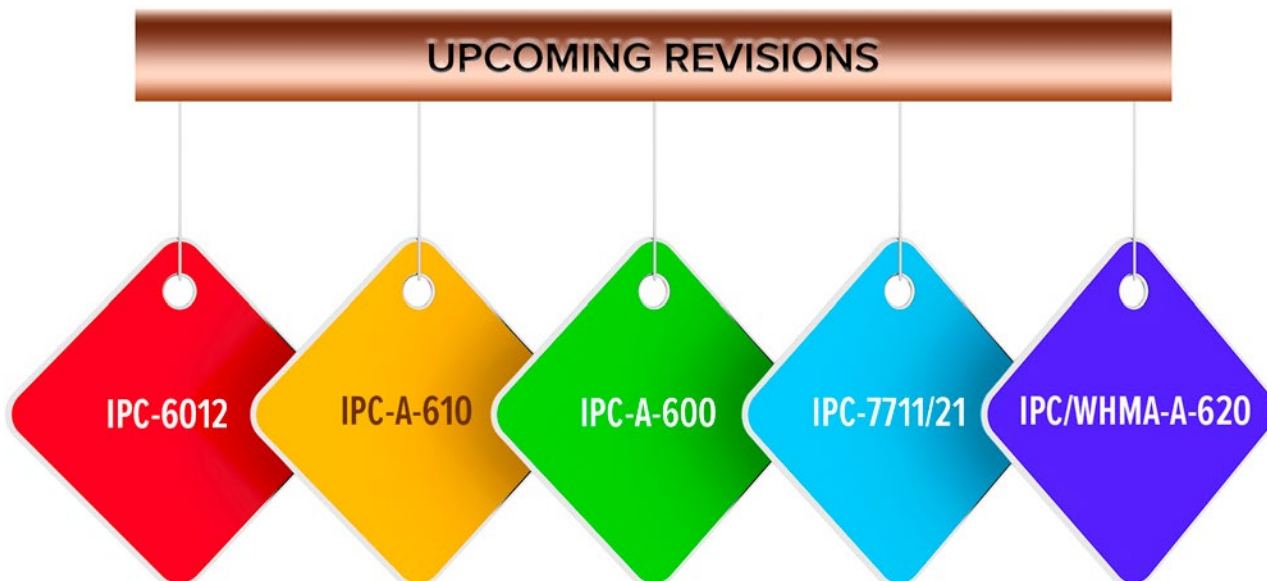
There are a few exciting activities for this year's training committee meetings.

Our first is the Training Programs Advisory Committee (TPAC) meeting on Monday, Jan. 23. At the beginning of each year, TPAC members review each training program commit-

tee's successes and challenges over the previous 12 months and discuss plans for the next 12 months. This will be followed by the election of new committee leaders. TPAC leaders serve two-year terms which expire in January at IPC APEX EXPO. Voting will take place during the meeting and the new leaders will be announced by the end of the meeting.

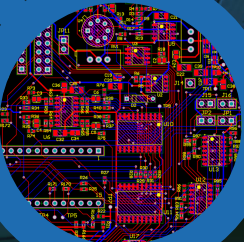
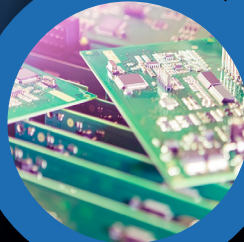
This year, four certification training committees will be revising CIT and CIS training materials to reflect the revisions to IPC/WHMA-A-620, IPC-7711/21, IPC-A-600, IPC-A-610, and IPC-6012:

**IPC/WHMA-A-620 (7-31FT) Certification Training Committee:** Members are currently reviewing revisions to the training materials for the 620E certification program. We are thrilled to be working on yet another revision of the program that not only incorporates the changes in the standard but also enhances the content and overall course design, making it both more attractive and effective to both



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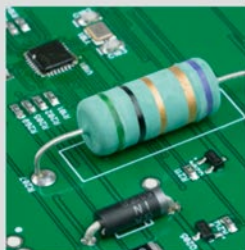
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2 Intro to PCA



3 Electronics Assembly & Soldering Processes



4 Safety



5 ESD & Product Handling

students and trainers. We are looking forward to publishing the 620E course in Spring 2023. The first full committee meeting is on Monday, Jan. 23.

**IPC-A-610 (7-31BT) Certification Training Committee:** Members meet on Tuesday, Jan. 24 to disposition user comments and follow up on open action items in preparation for the next revision of the IPC-610 standard in 2024.

**IPC-7711/21 (7-34T) Certification Training Committee:** Members are working on a major revamp of the program. This program has not been revised since 2017. The committee is evaluating the content as well as the relevance of the procedures for the course. The first full meeting of the year is on Wednesday, Jan. 25.

**IPC-A-600 (7-31AT) and IPC-6012 (D-33AT) Certification Training Committees:** This is a joint meeting at IPC APEX EXPO to discuss how they will collaborate on the revision of the IPC-600 and IPC-6012 training materials. The meeting is on Wednesday, Jan. 25.

**J-STD-001 Certification Training Committee (5-22BT):** Members are working on

improvements, comment resolutions, and action items. This committee will also disposition J-STD-001 Space Addendum user comments. The meeting will take place on Wednesday, Jan. 25.

## About the Committees

The TPAC committee advises and supports the IPC Education Team with the development, maintenance, and implementation of standards-based certification training programs. This committee also reviews proposals for new certification training programs and advises IPC on scope, feasibility, development, and implementation. TPAC members also advise and support IPC to ensure compliance with that IPC standards-based certification programs comply with national and international standards and relevant accreditation requirements.

If you would like to join an IPC standards-based certification training committee, please send an email to [zenaidavalianu@ipc.org](mailto:zenaidavalianu@ipc.org) for more information. SMT007



Zenaida Valianu is training manager at IPC.



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# Special Session Sneak Peek



**Feature Article by Julia Gumminger**

IPC INTERNATIONAL

The IPC APEX EXPO 2023 Technical Conference at the San Diego Convention Center will feature two hot topics—Advanced Packaging and e-Mobility/EV Automotive—in custom and curated Special Sessions on Thursday, Jan. 26. Please plan your travel accordingly to attend these exciting sessions.

## Advanced Packaging

Led by IPC's Chief Technologist, Matt Kelly, the Advanced Packaging special session will provide latest insights on IC substrate and packaging needs from industry experts.

The electronics industry is in the early stages of a new era, with unprecedented change already in motion. In this era of heterogeneous integration led by massive changes in semiconductor and advanced packaging sectors, the days of following Moore's Law are over. These fundamental changes in the semiconductor sector have significant impact throughout the rest of the electronics supply chain. As lines blur between IC substrate and HDI printed circuit board technologies and capabilities, the lines between OSAT and EMS manufacturers also blur. Please join us for this important Advanced Packaging Special Session focused on IC substrates and packaging assembly.

The session will be interactive with panelists providing top of mind priorities, followed by a panel discussion with interaction from attendees. HDI and ultra HDI PCB needs along with IC substrate and package assembly design, material, equipment, and process needs will be discussed.

## E-Mobility/EV Automotive

Climate change, government policy, and consumers are all driving us fast and furious toward an electrified future. As our century-old, mostly mechanical modes of powering transportation transition to using electric powertrains, and with the ever-increasing use of electronic systems in advanced driving assistance and autonomy systems, the PCBA industry plays an increasingly important role in making sure that electronic assemblies can work harder, longer, and at higher operating temperatures. This provides opportunities for many consumer PCBA manufacturers to participate in the automotive industry for the first time, but also creates challenges for the industry around navigating new technologies and supply chains.

Whether building an infotainment or driving assistance system with processors running over 200 watts, or a charging station's printed circuit boards running at 1,000 volts, the industry is being called upon to help with design, material selection, and test in an environment where



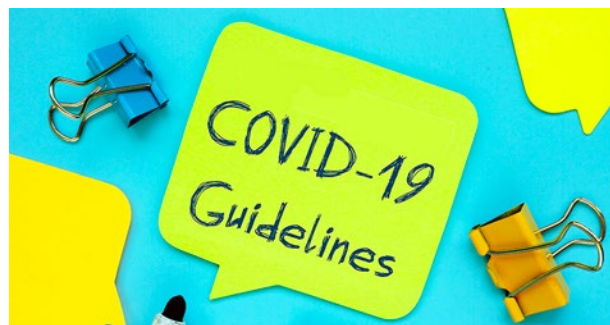
quality and reliability are challenged by requirements focusing on time to market. Meanwhile, specifications from design to test struggle to keep up. To further challenge the industry, EVs are part of a large rapidly developing ecosystem of charging stations that now require up to 97% uptime performance, and battery energy storage systems that require more than 20+ years of reliability, each with its own unique standards for design and test.

Co-chairs for the Technical Program Committee special sessions are Brian O’Leary, global head of e-mobility and infrastructure at Indium, and Jason Schwartz, business development manager at KYZEN. “The first part of the agenda will address the problems and challenges, with the second part addressing the solutions,” says O’Leary. “Our speakers will share a macro perspective about supply chain issues; a policy perspective about new government regulations and incentives; and a few technical perspectives from Tier 1, Tier 2, and OEMs.”

The e-Mobility session is supported by IPC’s e-Mobility Quality and Reliability Advisory Council and closely aligns with the council’s mission to help deliver e-Mobility quality, reliability, and safety while protecting the drive for innovation. IPC, in the first-of-its-kind event at IPC APEX EXPO’s e-Mobility/EV Automotive Special Session, will bring together stakeholders from OEMs, their supply chains, regulators, and policy and technology experts to discuss the many challenges as well as the collaborative-based solutions to those challenges.

The e-Mobility/EV Automotive session is a three-hour panel discussion with audience participation encouraged. Registration for this Jan. 26 session will be included in the “All Access” or “Full Technical Conference” packages, or it can also be added as a “Technical Conference Single Session Pass.” SMT007

**Julia Gumminger** is manager of professional development and events for IPC.



by IPC Staff

#### **Masks**

As of March 1, 2022, the state of California no longer requires masks, therefore masks will not be required while attending IPC APEX EXPO 2023.

#### **Proof of Vaccination or Negative COVID Test**

On April 1, 2022, the state of California lifted its requirement for vaccine verification or proof of negative test, therefore neither proof of vaccination status nor negative test will be required to attend IPC APEX EXPO 2023.

#### **For Those Traveling From Outside the U.S.**

##### **Negative COVID Test**

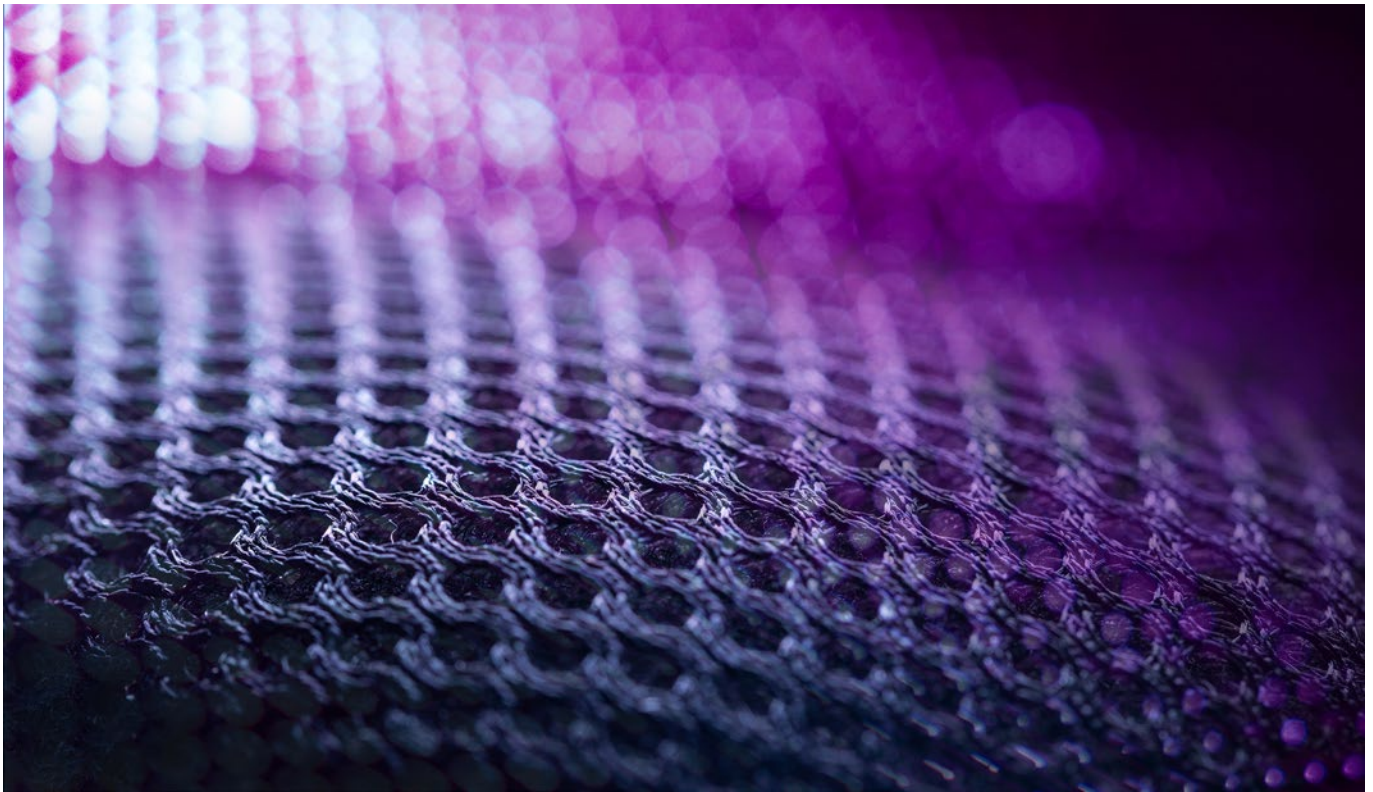
The CDC order requiring all persons to show a negative COVID-19 test result or documentation of recovery from COVID-19 before boarding a flight to the United States is rescinded, effective on June 12, 2022, at 12:01 a.m. ET. This means that starting at 12:01 a.m. ET on June 12, 2022, U.S. citizen air passengers and Lawful Permanent Residents (LPRs) will no longer need to get tested and show a negative COVID-19 test result, nor show documentation of recovery from COVID-19, prior to boarding a flight to the United States.

##### **Proof of Vaccination**

The CDC’s order requiring proof of vaccination for non-U.S. citizen non-immigrants to travel to the United States is still in effect. A booster dose is not needed to meet this requirement.

#### **Above Guidelines as of November 2022**

Please check the IPC APEX EXPO website at: [www.ipcapexexpo.org/covid-19-information](http://www.ipcapexexpo.org/covid-19-information) for the most current information or visit [wwwnc.cdc.gov/travel/](http://wwwnc.cdc.gov/travel/).



# Turn E-textiles Concepts Into Real-world Products

Feature Article by Julia Gumminger  
IPC INTERNATIONAL

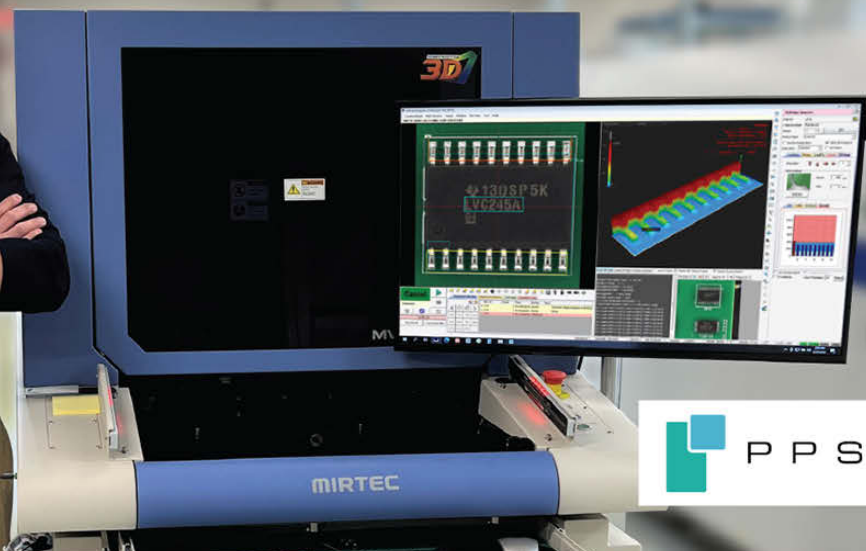
IPC E-Textiles 2023 is an international forum for materials suppliers, product designers, manufacturers, technical experts, and company executives from around the world to collaborate on all areas of the supply chain for e-textiles technologies in the fashion design, health and medical, sports and athletics, automotive, and military and aerospace sectors. It takes place Monday, Jan. 23, in conjunction with IPC APEX EXPO.

This year's event will feature informative and engaging presentations encompassing all areas of e-textiles, Q&A discussions with presenters, and a panel discussion on the economic and business aspects of e-textiles. Speakers have been invited to submit posters to accompany their presentations, which will be displayed during poster and exhibits networking breaks at IPC APEX EXPO 2023.

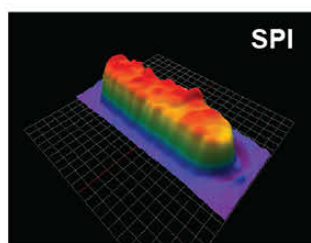
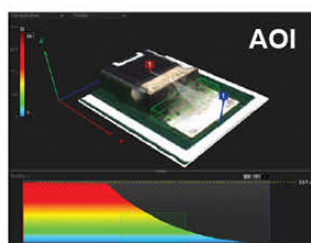
Presentation topics include:

- E-textiles product development, business, and economic impacts
- Enabling stretchable LED circuits for wearable applications through 3D geometry
- Textile-integrated liquid metal electrodes (TILEs) for electrophysiological monitoring
- Advanced fabric heating technologies for extreme cold weather environments
- Localized strain sensor vs. motion capture for joint angle tracking
- Re-positionable textile EMG electrodes for physiotherapy in mobile rehabilitation
- Ink-substrate compatibility for printed metasurfaces
- Reliability and performance criteria for wearable devices





"Located in rapidly growing Houston, Texas, PPSI Manufacturing has been a trusted Electronics Manufacturing Services (EMS) provider since 1986. PPSI is committed to providing high-quality electronics assemblies and world class service to a wide range of customers in high-reliability markets, such as energy, transportation, and industrial control. As part of our ongoing commitment to continuous quality improvement, PPSI has partnered with MIRTEC to incorporate their state-of-the-art 3D AOI technology into our SMT inspection processes. MIRTEC's MV-3 OMNI 3D AOI system is easy to program and delivers optimal defect detection as well as critical in-process feedback. With this capability, PPSI is able to meet the most stringent customer quality requirements in a consistent and cost-effective manner." — Jerry J. Huang, CEO



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- Scalable production of MXene dip-coated yarns and cords
- Mass production of e-textiles using embroidery technology
- Improvements in printed heating circuits for clothing garments
- Use-cases of e-textiles for automotive, robotics and beyond
- Architecture innovations to optimize e-textile performance in complex systems

“After two years of virtual conferences, we are excited to welcome the e-textiles industry to come together in person to learn, network, and collaborate,” said Vladan Koncar, PhD, professor, ENSAIT and IPC E-Textiles Program committee chair. “Holding the event alongside IPC APEX EXPO 2023 also provides our attendees the unique opportunity to participate in standards development meetings and view the latest technologies happening in the electronics industry by both visiting the exposition and the other events and education offered during IPC APEX EXPO 2023.”

The Professional Development course, “Electronic Textile Evaluation Methods for

Product Engineers and Designers,” taught by Madison Maxey of Loomia, will take place on Jan. 22. Maxey will cover how to engage with electronic textiles for new product development. Attendees will walk away with a clearer picture of when electronic textiles may be relevant to their engineering, which type of technology is ideal for their application, and how to thoroughly evaluate a technology when selected.

In addition to the conference, IPC e-textiles standards development committee meetings will take place. Committee meetings are open to anyone to attend, but attendees must select “Committee Meetings” as part of their registration package. There is no cost if participants register by Jan. 21. After that date, the registration fee is \$50.

---

## January 24

### D-72a Conductive Yarns for E-Textiles Task Group

10 a.m. to noon

### D-72b Woven, Knitted and Braided E-Textiles Standard Task Group

1:30 to 3 p.m.

### Embroidered E-Textiles Group

3:15 to 5 p.m.

---

## January 25

### D-75c E-Textiles Printed Electronics Reliability Standard Task Group

8 to 10 a.m.

### D-75a E-Textiles Wearables Standard Task Group

10:15 a.m. to noon

### D-75b E-Textiles Wearables Guideline Task Group

1:30 to 3 p.m.

For more information or to register for IPC E-Textiles 2023, visit:  
[www.ipc.org/events/ipc-e-textiles-2023](http://www.ipc.org/events/ipc-e-textiles-2023).



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# AIs Without Context Are Dumb

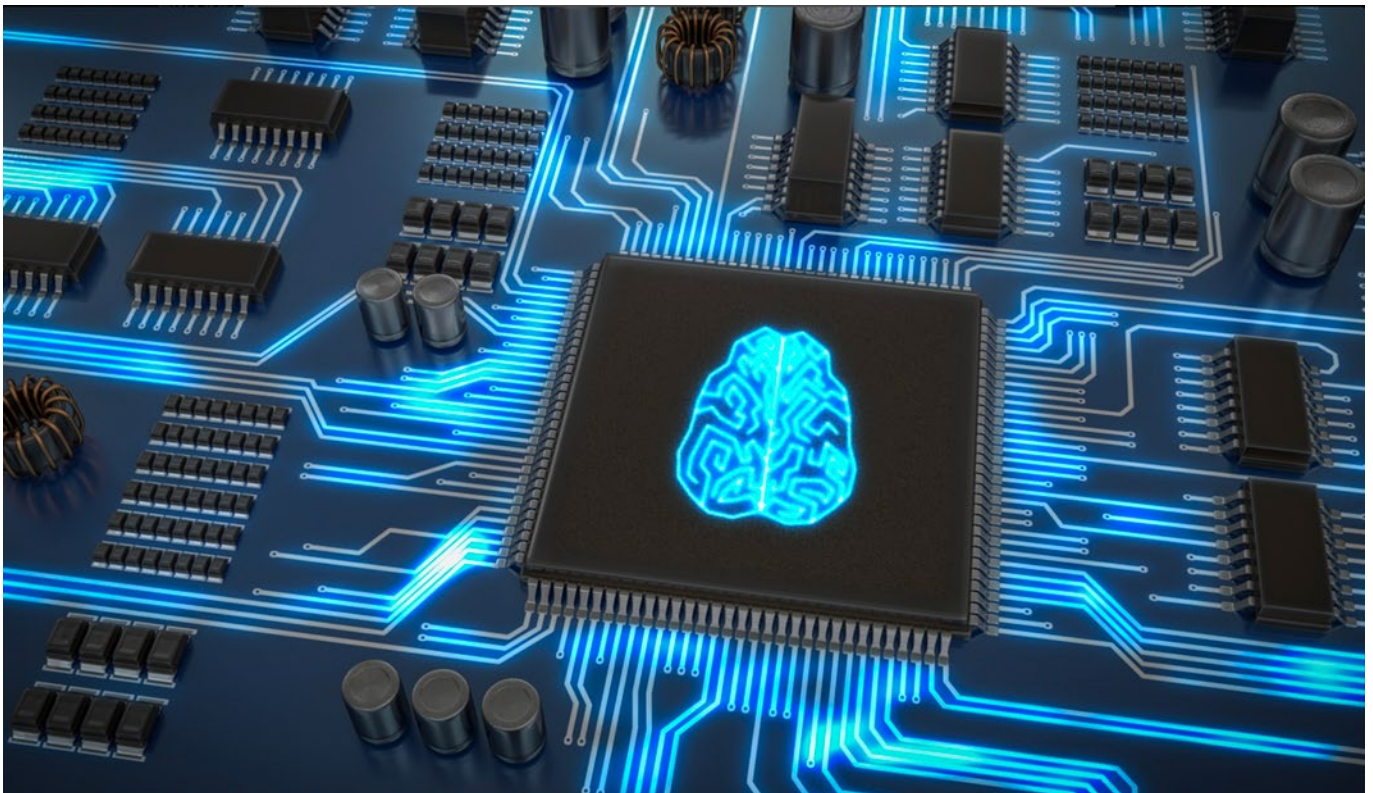
## Smart Factory Insights

by Michael Ford, AEGIS SOFTWARE

We often discuss the emergence of artificial intelligence in terms of how it will save us, or if movies are to be believed, how it might terminate us. The countless annoyances AIs inject into our daily lives can make us wonder: Do they already have a plan? We need to adequately consider context vs. privacy when deciding how to integrate AI technology into our lives, especially within our factories.

Picture this: After a quick search on the internet, I bought a pair of golfing gloves. Big mistake. Advertising AIs across the globe immediately inundated me with hundreds of golf-

related recommendations. Golf gloves, clubs, balls, socks, markers, books, weekend getaways—all a complete waste of not only data storage and energy, but also my time. I have no interest in golf whatsoever; the gloves were a present for a friend. The lesson here is that AIs often fail to work effectively because they lack adequate context. Marketing divisions pay good money to push billions of targeted ads each day, justifying the cost for that one-in-a-million hit. But all of us, along with the environment, are the ones who are really paying the price.







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In my case, the privacy restrictions I set on my data prevented AIs from accessing certain facts about my purchase—which I’m very happy about. Advertising companies who own these AIs will argue that more data leads to better value from their services, but is that worth the potential loss of our privacy?

This conundrum is a massive issue facing almost all digital transformation, Smart manufacturing, and Industry 4.0 projects. The situation is not so bad within a factory running, for example, a Smart MES solution. Data related to design, manufacturing capabilities and configurations, operations, measurements, etc., are all collected and stored in either a secure manufacturing environment or private cloud storage space. An MES can produce a variety of values by contextualizing the collected data, providing visibility, control, assurance, and optimization of manufacturing execution through material flows, operator assignments, and both machine and operator work instructions.

Well, at least that used to be the case. This open sharing vs. privacy issue can now be seen in Smart manufacturing, where external parties might request—even demand—access to private manufacturing information. Data relating to customer assurance, proof of product and material provenance, predictive maintenance, energy profiling, quality

analytics—everything is fair game. Honoring these requests means potentially exposing sensitive intellectual property details. Further, intelligence—whether artificial or human—can use this newly shared information for other purposes. How do we determine what data to share, who to share it with, and what purposes it can be used for? Once we decide these parameters, how do we enforce them?

The good news is that new digital technology standards, called Distributed IDs (DIDs) and Verifiable Credentials (VCs), have been developed by the World-Wide Web Consortium (W3C) to bring a simple resolution to this conundrum. These technologies use the blockchain to allow provable facts to be shared between authorized parties without the disclosure of the original private information. IPC has already begun work on new standards to determine how these technologies may be utilized within or around the IPC Digital Twin, traceability, cybersecurity, component-level assurance, Connected Factory Exchange (CFX), and IPC-2581 design data standards.

What might this look like in practice? A VC, for example, could help determine whether a product can carry a “Made in the USA” designation. This is by no means a simple question, as a certain percentage of assembly and material sourcing locations need to be considered before making the determination. All that data is recorded, with bits and pieces retained by the many manufacturing, assembly, and distribution companies involved in the supply network. The VC is a trusted algorithm that both calculates the proof of a claim and provides this claim as a small digital identity. Together with the proven identity (DID) of the source, this identity is stored openly (but securely) using blockchain technology so that companies can avoid sharing protected information while preventing any data tampering. Throughout the supply network, MES solutions associate materials with products at the point of assembly and thereby

create a hierarchy and inheritance of proofs based on consumed materials. For the completed product, the VA is a record that can be accessed by authorized parties to decisively answer the “Made in the USA” question without the need to divulge private data about materials or products.

This is a simple example, one of many now being considered as a solution for the industry, that enables Smart manufacturing and supply network data to provide that crucial contextual element to external parties without compromising privacy.

This is one of the many subjects that will be introduced and discussed at IPC APEX EXPO 2023 in a Professional Development Course named, “Application of IPC Smart and Secure Digital Transformation Standards,” scheduled from 8 to 11 a.m. Sunday, Jan. 22. The course will discuss how the new IPC Factory of the Future standards can work together to provide an interoperable, secure environment for the full lifecycle of Smart manufacturing. This is a unique opportunity to understand the context of the use and adoption of each IPC standard as they relate to each other in the creation of new digital best practices, which will be relevant to any holistic OEM, EMS, or solution-provider business.

Many key industry experts related to the development and driving adoption of each of these standards, have teamed up to present this course. While 8 a.m. may seem early, there’s no better time than early morning—as many birds can attest—to expand your horizons. Please consider joining us to learn more about these exciting new developments in the industry. **SMT007**



**Michael Ford** is the senior director of emerging industry strategy for Aegis Software. To read past columns, [click here](#).

# It's All in the App

by **Kim DiCianni**, IPC INTERNATIONAL

The IPC APEX EXPO mobile app provides everything attendees could possibly need for the event, including viewing exhibitors, sessions, speakers, and products. Need information on an exhibiting company? With the IPC APEX EXPO mobile app, you can look up exhibitors by company name and search by product category—it’s that simple.

When an attendee registers and answers the demographic questions, the information enters their agenda planner and provides suggestions on exhibitors and sessions that may be of interest to them, which they can then add to their planner. If an attendee adds an event they are not registered for, the app will take them back to registration so they can add it. The planner will also notify attendees if they have any scheduling conflicts when adding events to their planner.

When an attendee creates their schedule in the planner, they can sign into the app and their schedule will show under “My Schedule.” The app also has features including “What’s on Now,” which will show them any events taking place at the current time. App users can also see a list of other attendees (limited information) and can request connections with them.

The app also allows users to see all of IPC’s social media channels to keep on top of what IPC posts during the event.

Although the printed show directory is a great resource, we all know that program changes inevitably happen as soon as the directory goes to print; with an app, users are always able to see the most up-to-date information. Changes to meeting room locations, additions or cancellations, etc., will be reflected within the app. The app also allows IPC event staff to send out push notifications during the event in case of any last-minute changes.

Use this QR code (right) to download the IPC APEX EXPO Mobile App.



**Kim DiCianni**, CEM, is director of trade shows and events for IPC.



# Schedule at a Glance

Feature Article by Alicia Balonek, IPC INTERNATIONAL

## Saturday, Jan. 21

8 a.m. to 5 p.m. IPC Standards Development Committee Meetings

## Sunday, Jan. 22

8 a.m. to 5 p.m. IPC Standards Development Committee Meetings

## Monday, Jan. 23

8 a.m. to 5 p.m. IPC EMS Leadership Summit  
8 a.m. to 5 p.m. IPC E-Textiles (Advance/separate registration required)  
8 a.m. to 5 p.m. IPC Standards Development Committee Meetings  
9 a.m. to 12 p.m. Professional Development Courses  
12 to 1:30 p.m. Luncheon featuring a keynote by Shawn DuBravac, IPC Chief Economist (Advance/separate registration required if not included in registration package)  
1:30 to 4:30 p.m. Professional Development Courses  
5 to 6 p.m. Newcomers Welcome Reception\*

## Tuesday, Jan. 24

8:30 to 9:30 a.m. Keynote Session\*  
9:45 to 10 a.m. Ribbon Cutting Ceremony\*  
10 a.m. to 12 p.m. Technical Conference Sessions  
10 a.m. to 5 p.m. IPC Standards Development Committee Meetings  
10 a.m. to 6 p.m. Exhibits Open\*  
12 to 1:30 p.m. Luncheon | IPC Annual Meeting and Awards (Advance/separate registration required if not included in registration package)  
1:30 to 3 p.m. Technical Conference Sessions  
3:30 to 5 p.m. Technical Conference Sessions  
5 to 6 p.m. Show Floor Welcome Reception\*  
5 to 6 p.m. Network with Poster Presenters on the Show Floor\*  
6 to 7:30 p.m. Women in Electronics Reception\*

## Wednesday, Jan. 25

8 to 10 a.m. Technical Conference Sessions  
8 a.m. to 5 p.m. IPC Standards Development Committee Meetings  
8:30 a.m. to 2:30 p.m. STEM Outreach Event  
9 a.m. to 6 p.m. Exhibits Open\*  
10:30 a.m. to 12 p.m. Technical Conference Sessions  
12 to 1:30 p.m. Luncheon Featuring a Keynote by: Dr. John W. Mitchell, IPC president and CEO (Advance/separate registration required if not included in registration package)  
1:30 to 3 p.m. Technical Conference Sessions  
2:30 to 3:30 p.m. Network with Poster Presenters on the Show Floor\*  
2:30 to 3:30 p.m. Ice Cream Social on the Show Floor\*  
3:30 to 5 p.m. Technical Conference Sessions  
6 to 7:30 p.m. Career Connections Networking Event

## Thursday, Jan. 26

8 a.m. to 5 p.m. IPC Standards Development Committee Meetings  
8 a.m. to 5 p.m. PERM No. 53 (Advance/separate registration required)  
8 to 10 a.m. Advanced Packaging Special Conference Session  
8:30 a.m. to 2 p.m. STEM Outreach Event  
9 a.m. to 12 p.m. Exhibits Open\*  
10 a.m. to 1 p.m. e-Mobility/EV Automotive Technical Conference Special Session

## Friday, Jan. 27

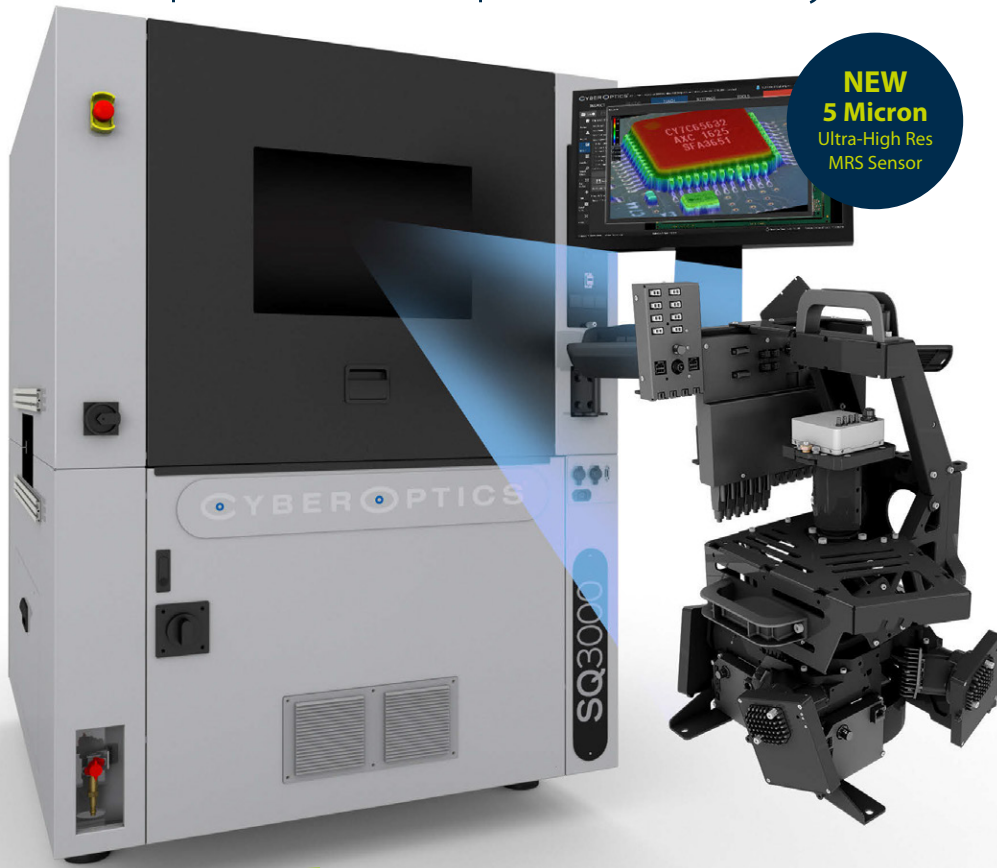
8 a.m. to 5 p.m. PERM No. 53 (advance/separate registration required)

\* = Event Essentials, included with registration.

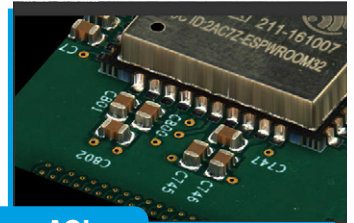
By now, you know that IPC APEX EXPO 2023 is no ordinary conference. As the largest event for electronics manufacturers in North America,

# Think Fast. See Small.

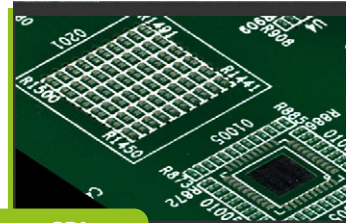
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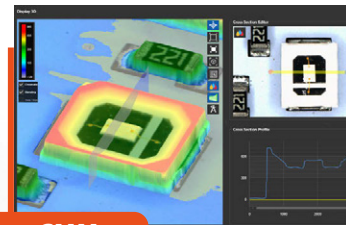
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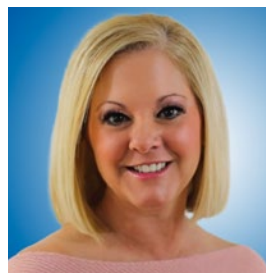
IPC APEX EXPO 2023 is the place to learn about the latest industry practices, gain insight into emerging technologies and industry strategies, connect with thought leaders in the field, and network with your peers. We understand it might be difficult to decide which package to register for and which has the best value, so we created this easy-to-read package comparison to help you decide which tier best meets your needs.

The Exhibit Hall Only (Event Essentials Pass) is free through online registration until Saturday, Jan. 21, 2023, and includes access to the Exhibit Hall and the following events:

- Tuesday's Show Floor Welcome Reception
- Opening Keynote Session; Poster Presentations
- Newcomers Networking Reception
- Women in Electronics Networking Reception
- Exhibitor Product Showcase Corridor
- Ice Cream Social on the Show Floor

For a complete list of registration options, including a la carte options, visit: [www.ipcapex-expo.org/2023-registration-options](http://www.ipcapex-expo.org/2023-registration-options).

Need help convincing your manager to approve your attendance for IPC APEX EXPO? We've got you covered. Take advantage of our complimentary justification tool kit, which both outlines the benefits of attending IPC APEX EXPO and includes a comprehensive budget form to help support the conversation with your manager. Visit <https://plan.ipc.org/> to download the kit today. **SMT007**



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





MEETINGS  
& COURSES Jan. 21-26

CONFERENCE  
& EXHIBITION Jan. 24-26

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# ADVANCE IN A NEW ERA

## IPC EMS Leadership Summit

Monday | January 23 | 8:00 AM-5:00 PM  
6:00 PM Networking Dinner at Osteria Panevino

### EMS Leaders of Today and Tomorrow Helping Each Other and the Industry to Prosper

The IPC EMS Leadership Summit brings together current and future industry leaders to solve problems, build business networks, and share insights to doing business better. Focused on high level topics which drive business growth and financial success, leaders gather insights from experts and discuss their own and potential new best practices.

This meeting of minds inspires action and builds resources for participants, future leaders, and the greater EMS industry.

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REGISTERED OUR TEAM WILL CONTACT YOU TO PROVIDE ACCESS TO THE COURSE.**

# Show Floor Highlights

Feature Article by Alicia Balonek,  
IPC INTERNATIONAL

IPC APEX EXPO 2023, recognized since 2001 by Trade Show News Network (TSNN) as one the largest of the 250 trade shows held in the United States, is also the largest event in North America for electronics manufacturing. Featuring leading equipment manufacturers, suppliers, and innovators from every step in the electronics manufacturing supply chain, IPC APEX EXPO has it all under one roof.

The Exhibitor Product Showcase Corridor will feature new, innovative, and compelling products that are leading our industry into another era. These graphic display panels located in Aisle 100 will provide an in-depth description of each product and you can see the product firsthand in the corresponding exhibitor's booth.

The Poster Presentations located in Aisle 100 will feature posters that describe significant results from research experiments, highlight new techniques or materials, and discuss cutting-edge trends and challenges facing the electronics manufacturing industry today.

Attendees can view the Poster Presentations anytime during the official exhibit hall hours and will have the opportunity to meet and network with these subject matter experts during the following times:

- Tuesday, Jan. 24, 5 to 6 p.m.  
(during the Show Floor Reception)
- Thursday, Jan. 26, 11 a.m. to noon

## Show Floor Reception

**Tuesday, Jan. 24, 5 to 6 p.m.**

The industry's largest networking event, the IPC APEX EXPO Show Floor Reception is your opportunity to network with industry colleagues and to connect with the industry's leading equipment manufacturers, suppliers, and innovators.

## Ice Cream Social

**Wednesday, Jan. 25, 2:30 to 3:30 p.m.**

Satisfy your sweet tooth while networking with industry colleagues, subject matter experts, and the industry's leading equipment manufacturers, suppliers, and innovators.

## 3D Printing Metal vs. Plastic

Stop by Booth #3151 for an interactive demonstration on the capabilities of a 3D metal printer vs. a 3D plastic printer and see parts printed in real time.

Sponsored by Kurtz ERSA, Inc., this special display area will also feature items that have been printed utilizing these printers, including items such as key chains, pens, a fully functional rotational planetary gear, an impel-





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## Need a New or Updated Professional Headshot?

No matter what your career level, having a good headshot is invaluable with today's use of social media platforms like LinkedIn, Instagram, and Facebook. It's always important for people to put their "best face forward" with an updated, professional-looking headshot. Stop by the Real Time with... IPC in Booth #2019 to get your complimentary professional headshot anytime during show hours.

Connect with IPC by visiting us in Booth #833 to learn how IPC standards, education and training, advocacy, and solutions can help you and your company build electronics better through:

- **Standards:** Our more than 300 IPC Standards, covering every step in the electronics manufacturing supply chain.
- **Education:** The variety of education we offer to deliver consistent and effective training across your organization.
- **Workforce training:** Electronics workforce training is available 24/7 on the IPC EDGE Learning Management System. IPC's courses include detailed illustrations, video presentations, interactive activities, and practice quizzes, all formulated to make complex topics easy to understand and master. Each topic is carefully selected to align with the skills and competencies vital to advancing an electronics career at any level.
- **Advocacy:** IPC is the leader in global advocacy, together with its members, and strives to engage in global government relations and environmental policy advocacy that are in line with IPC's mission to both further the competitive excellence and financial success of its members while

protecting the environment. Whether it's engaging with policymakers in Washington, D.C., in the European Union, or in China, IPC and its members proactively seek opportunities to educate, inform, and influence policymakers on policies that spur innovation, growth, and competition while protecting human health and the environment.

- **Solutions:** By collaborating with the electronics manufacturing industry, we can identify and launch new products and services that address important challenges and leverage new opportunities. IPC's Factory of the Future is a new "solutions" program to lead, assist, and guide the electronics manufacturing industry through the next industrial revolution by solving real business challenges.

## Show Floor Hours

- Tuesday, Jan. 24, 10 a.m. to 6 p.m.
- Wednesday, Jan. 25, 9 a.m. to 6 p.m.
- Thursday, Jan. 26, 9 a.m. to 12 p.m.

The Exhibit Hall Only (Event Essentials Pass) is free through online registration until Saturday, Jan. 21, 2023, and includes access to the Exhibit Hall and the following events:

- Tuesday's Show Floor Welcome Reception
- Opening Keynote Session
- Poster Presentations
- Newcomers Networking Reception
- Women in Electronics Networking Reception
- Exhibitor Product Showcase Corridor
- Ice Cream Social on the show floor

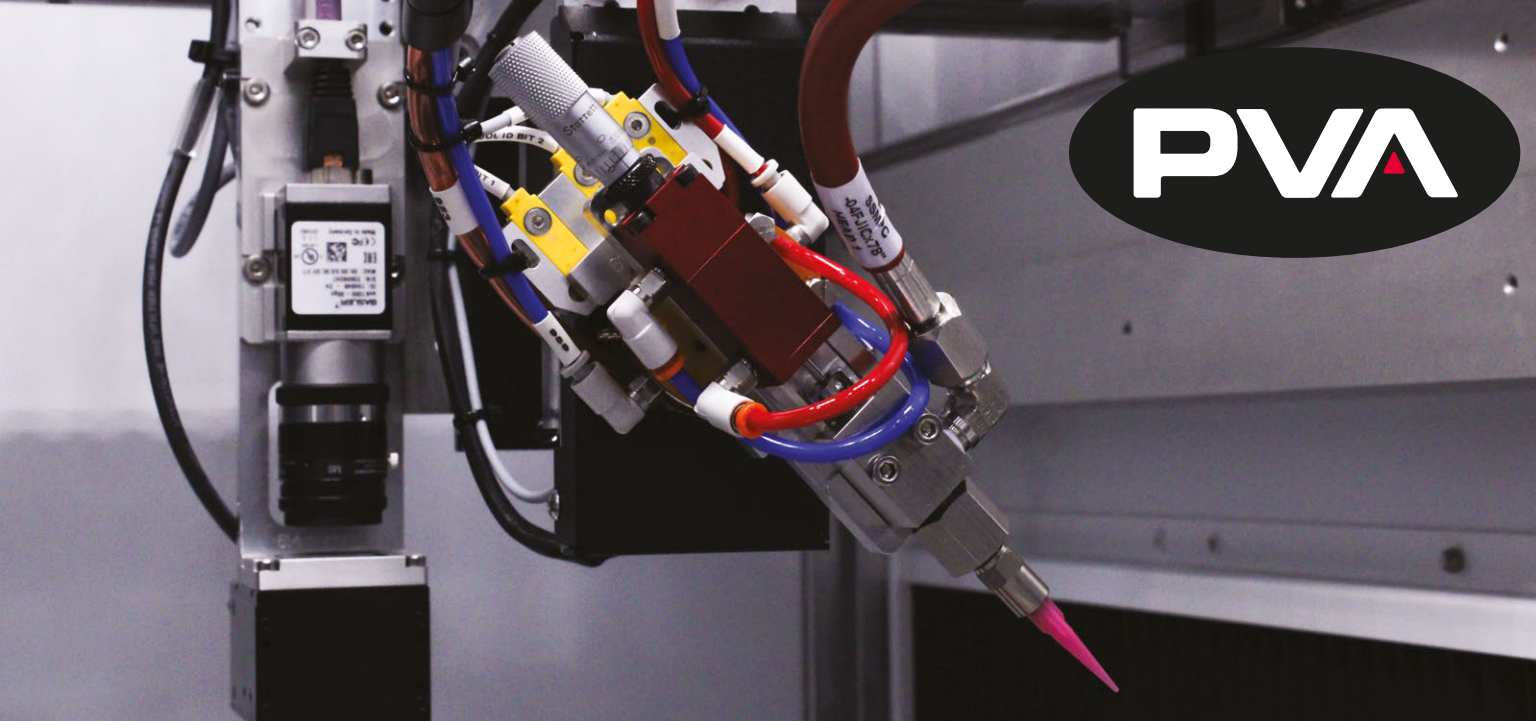
For a complete list of registration options and packages or to register today, visit [www.ipcapexexpo.org/2023-registration-options](http://www.ipcapexexpo.org/2023-registration-options).

SMT007

Alicia Balonek is senior director for trade shows and events at IPC.



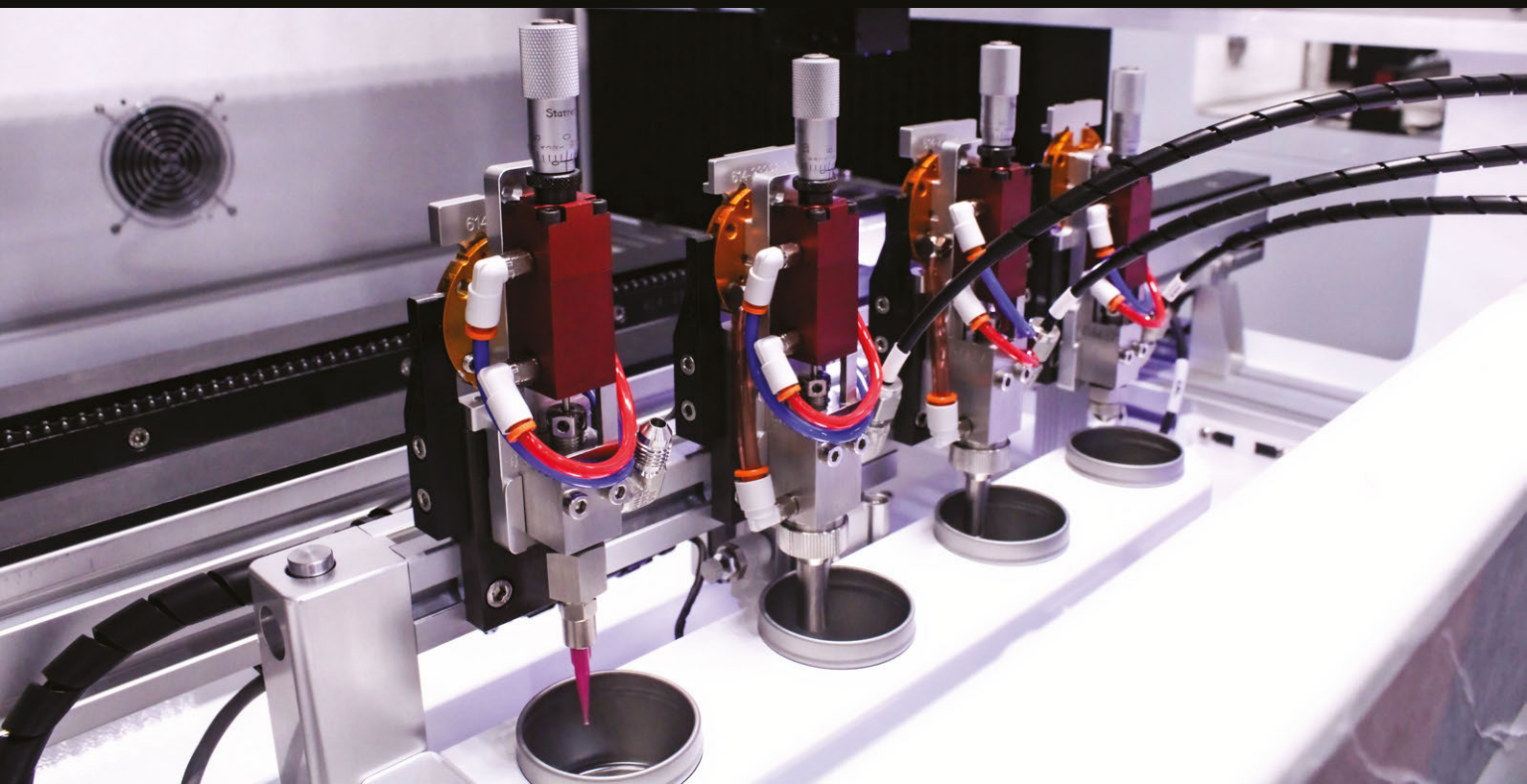
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# Five-Star Reflow Recipes

## Q&A With Rob Rowland

Interview by Andy Shaughnessy  
I-CONNECT007

Rob Rowland, director of engineering at Axiom Electronics, discusses his new IPC APEX EXPO Professional Development course on how to create a standardized methodology to accurately generate new reflow soldering profiles.



Rob Rowland

**A** This class will help you develop a systematic approach to creating reflow profiles by teaching you the physical and chemical properties that influence the reflow soldering process. This class will also help you fine tune this process and demonstrate how to troubleshoot various problems that occur during reflow soldering.

**Q** Rob, tell us a little about the Professional Development class you're going to be teaching at IPC APEX EXPO 2023.

**A** Many years ago, I became frustrated using the trial-and-error method to create reflow soldering profiles. I wanted a more scientific and systematic approach to help me simplify the process of creating good profiles, so I started to learn more about the science of soldering.

I discovered that there are basically five elements that influence all soldering profiles: flux, solder, heat, materials, and surfaces. I studied each one of these topics in-depth to understand how they influence reflow soldering profiles. A better understanding of these topics enabled me to develop a standardized methodology for calculating conveyor speeds and determining reflow oven zone temperature settings for various board sizes.

In this class, I'll explain how I approached this work to help others develop similar methodologies for creating their own reflow soldering profiles. My presentation also includes the basic reflow profile recipes I have been using for the past 20 years.

**Q** Why should someone attend your class?

**Q** What are the biggest challenges in getting an accurate reflow profile?

**A** Conveyor speed and zone temperature settings are the adjustable parameters of a reflow profile. Figuring out how to calculate conveyor speed and determine zone temperature settings is challenging if the basic elements of soldering (flux, solder, etc.) are not well understood. For example, flux depletion during reflow soldering can be a big problem if flux chemistry behavior is not accurately anticipated. Flux depletion is directly related to conveyor speed.

**Q** What is the most important piece of advice you would give your attendees?

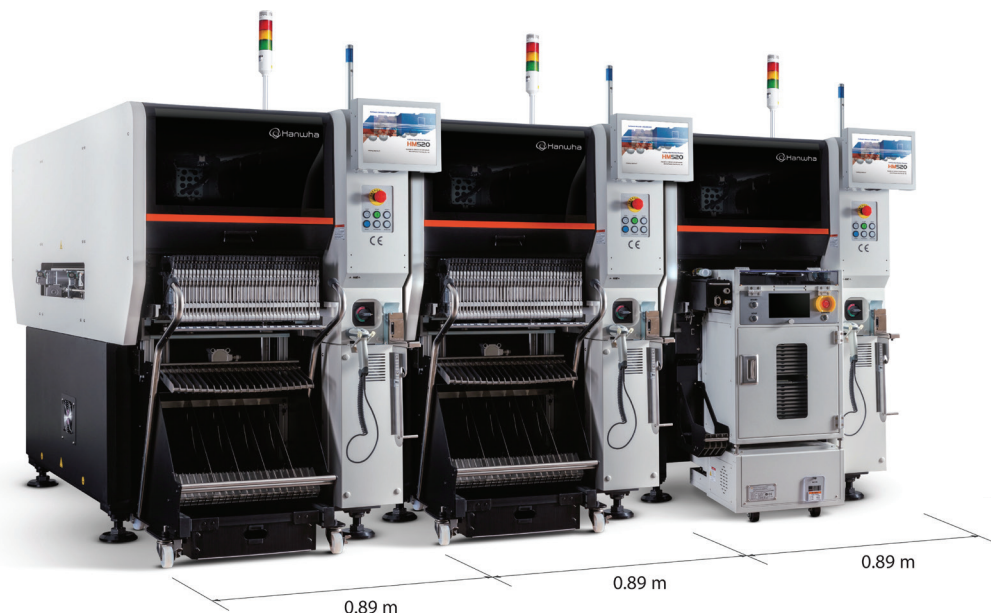
**A** Soldering profiles should be based on the physical and chemical properties that influence the soldering process, not developed by trial and error.

**Q** Is there anything else you'd like to add?

**A** I enjoy teaching because I always learn something new, so I'm looking forward to presenting this class at IPC APEX EXPO. **SMT007**



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# Charting the Path to Improvement

## Maggie Benson's Journey

by Dr. Ronald C. Lasky, INDIUM CORPORATION

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

Let's look in on Andy Connors and Sue March as they continue their flight to Mexico to inspect Castellanos Electronics, a factory that Maggie and John are interested in buying.

Andy was tickled to finally discover a math problem that he knew how to solve but Sue didn't.

"So, to solve for  $7^{1000}$  you have to use logarithms," Andy said. "If you take the log to the base 10 of 7 you get 0.84509804. So that means that 7 is equal to  $10^{0.84509804}$ ."

But Sue, realizing the solution, got so excited that she interrupted Andy before he could finish.

"I see, you take 7 expressed as a power of 10, so  $7^{1000} = (10^{0.84509804})^{1000} = 10^{845.09804} = (10^{0.09804})^{*10^{845}}$ ," Sue said, getting out her calculator and determining that  $10^{0.09804}$  was 1.2533. "The answer is  $1.2533 \times 10^{845}$ ."

Andy just had to chuckle; it was hard to top Sue.

Their flight landed on time, and after a short cab ride, they arrived at the factory. The factory owner, José Castellanos, gave them a brief tour before suggesting that they all go to dinner. Chuck Tower, who was accompanying Andy and Sue on their trip, had trouble following the conversation as José spoke very little English. Chuck had to rely on Andy or Sue







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to translate whenever José switched to speaking in Spanish.

After the tour, they left for the restaurant in José's auto with Sue and Andy in the back seat.

"Wow, I feel better about my Spanish than I thought I would," Sue whispered in Andy's ear.

"You're doing great," Andy responded quietly. Then in a hushed whisper, he said, "José seems really nice. I'm relieved." Sue nodded her head in agreement as both remembered how bad it had been working under a tyrant like Ned Price before Maggie bought Ivy-Benson Electronics.

As they sat down at the restaurant, the server came over and asked, "¿A alguien le gustaría una bebida, aparte del agua?" ("Would anyone care for a beverage other than water?")

Chuck responded, "Quisiera una copa de vino tinto, un Cabernet por favor." ("I would like some red wine, a Cabernet please.")

Sue and Andy's mouths dropped open. Had Chuck just ordered in Spanish? "I thought one of the reasons we came with you was because you didn't speak Spanish," Sue said to Chuck.

"That's about the extent of my Spanish ability," Chuck said, chuckling.

They continued to have a delightful conversation in both English and Spanish, with Sue and Andy translating both ways. Chuck, Sue, and Andy were impressed with José.

After dinner, they said goodbye to José and went to their hotel to get settled into their rooms. Sue was old-fashioned and chose to stay in her own room rather than share a room with Andy. They got up bright and early the next morning and had a light breakfast before heading back out to the factory.

José gave the trio a more thorough tour of the three assembly lines and the factory in general.

"Their assembly equipment looks quite good," Sue commented to Andy and Chuck.

"I agree," Chuck said. "It's refurbished, but it looks to be in good condition."

Sue talked to one of the technicians, Carlos, who was a portly man in his early 40s; he had a

kind face and appeared thrilled to be chatting with Sue.

"Hello, my name is Sue March," she said, and Carlos replied: "Mucho gusto."

"Do you collect quality data here?" Sue asked. His reply: "Sí, señorita."

"What do you do with the data?" Sue asked.

"I put it in a filing cabinet," responded Carlos.

"And then?" But Carlos had no reply.

Sue saw that he was embarrassed that he did nothing else with the data. She took the opportunity to explain to Carlos what a Pareto Chart was and how it should be used to develop a continuous improvement plan.

Sue turned to Andy and Chuck and said to all three, "I have an idea. Why don't we take the quality data and try making a Pareto Chart together? Then we can share it with José."

Carlos's face lit up. He went to retrieve the datasheets that contained the number of defects vs. time. Meanwhile, Andy and Chuck were interviewing some of the operators and technicians.

"Hello," said Andy to a petite young woman with black hair and sparkling brown eyes named María. She seemed a little shy, but Andy charged ahead. "How do you like working here?" he asked.

"Oh, Mr. Andy, this is a wonderful place to work. Mr. José pays a little more than the other factories and he provides a free lunch. We even get a Christmas and Easter bonus. He encourages us to learn, but I have to admit I'm not much of a student," María explained.

Chuck asked José to explain their process from order receipt through shipment to the customer.

These activities kept Chuck, Sue, and Andy busy for the entire day. They all ate lunch in the company cafeteria and agreed to chat with some of the workers as they ate. They agreed to meet later for dinner to discuss their findings.

At dinner, Sue was the first to speak. "Well, they collect data, but they don't do anything

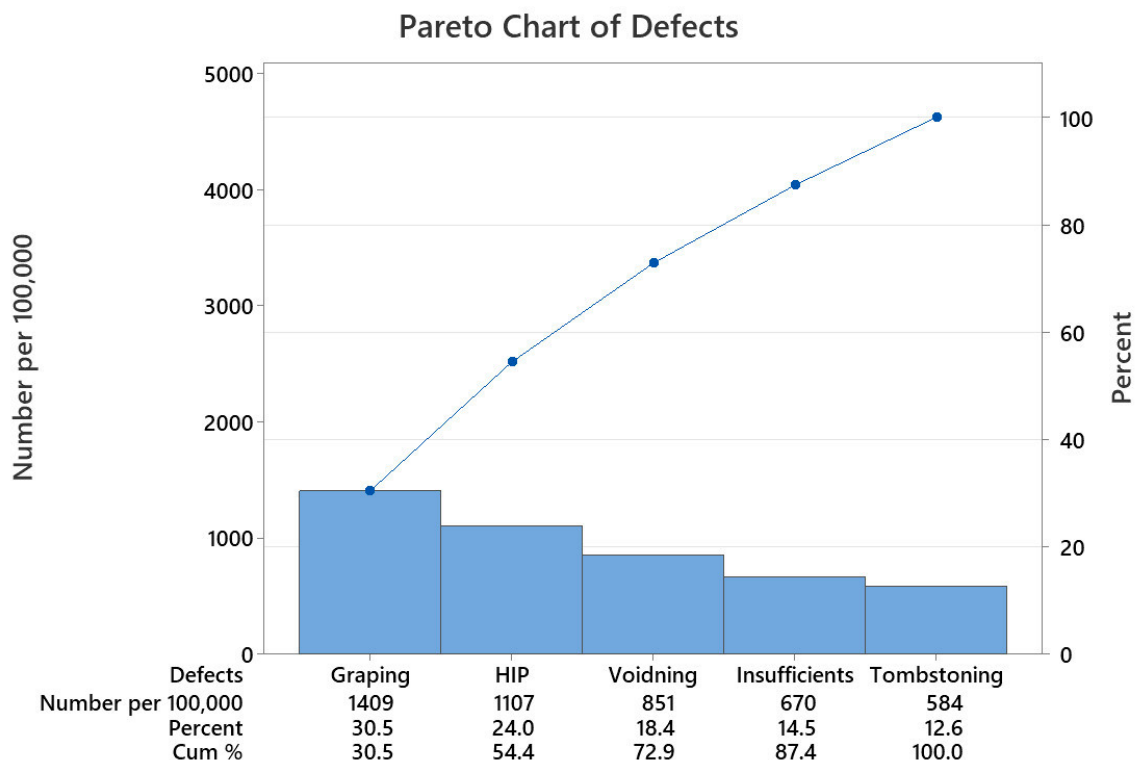


Figure 1: The Pareto Chart of Defects at Castellanos Electronics.

with it,” she groaned. “I took some time to teach Carlos how to make a Pareto Chart and he seemed grateful and enthusiastic. José really needs to appoint someone to help Carlos develop a continuous improvement plan now that we’ve identified the defects in priority order. Here’s the chart, by the way.”

“Wait a minute, this doesn’t look like it follows the 80/20 rule,” Chuck said.

“I thought the same thing,” Sue said. “I asked around and a few operators confessed that they fix some of the defects and don’t record them.”

“Besides those issues, what did you both think about the facility, the equipment and the people overall?” Chuck asked.

“Maybe I’m easy to impress, but I have to admit that everything looked much better than I thought it would,” Andy said, and then Chuck asked him to elaborate.

Before Andy could answer, Sue jumped in: “Worker morale was terrific. Everyone was grateful to be working at Castellanos Electronics; they all seem to like and respect José. The

free lunches and bonuses help them feel seen and supported. The facilities are also clean and inviting.”

Andy nodded and added, “The lines were set up well, but the placement machines were not time balanced, and uptime could be improved. In addition, their solder paste has poor response-to-pause, so we could increase uptime with a better solder paste.”

“José wants to sell because he can never go on vacation,” Chuck said. “No one else in the facility can set up the assembly lines when a new product or changeover is required.”

“Wow, what a bummer that must be,” Sue said.

“That reminds me—here’s a funny story for you,” Andy said. “I watched an operator use a pencil to correct the alignment of a passive component that the chip shooter had placed incorrectly. I asked him why he didn’t just reprogram the machine to place the passive squarely and he said, ‘Only Mr. José knows how to program the chip shooter, and I don’t want to bother him.’”



**Table 1:** A game plan for Castellanos Electronics

Strengths	Opportunities for Improvement (OFIs)
Employee morale	Training for operators and technicians
Strong customer base	Addressing defects in the Pareto Chart
Good facilities	Developing a few leaders so the facility can run without José
Owner (José) is respected and admired by the employees	Improving uptime

After dinner, they reconvened in one of the factory’s offices to make a game plan. “Let’s see if we can summarize, at a high level, what things Castellanos Electronics is doing well and what might help them improve,” Chuck suggested.

Chuck went to a white board to write down the conclusions. He drew two columns, titling the first “Strengths,” and the second “Opportunities for Improvement (OFIs).” After some discussion, the trio produced Table 1.

After completing the Strengths/OFI table, Sue commented, “We forgot to give the quiz to the operators and technicians and it’s close to closing time.”

“Well, I think we know what the results would be,” Chuck said.

As they prepared to leave the facility, there were a few workers near the front door. They were holding notepads and pens. Chuck and Andy were confused, but Sue figured out what the workers were waiting for.

“They want our autographs,” Sue said.

Sure enough, as they approached the door, several workers approached them. One said, “Gracias por venir aquí para ayudarnos a mejorar la calidad de nuestro trabajo.” (“Thank you for coming here to help us improve the quality of our work.”) There were tears in the woman’s eyes as she said these words...

**Epilogue:**

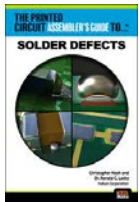
With the good report from Chuck, Andy, and Sue, Maggie and John decided to buy Castellanos Electronics. Since Sue and Andy had a few months’ time until classes started in the fall at Ivy University, Maggie and John asked if they would stay in Mexico to help José and his team initiate the improvement plan. Sue and Andy focused on improving uptime, addressing the defects plotted in the Pareto Chart, starting a training program, and working with José to identify a few future leaders. José agreed to stay on for at least six months to help with the transition. Stay tuned to hear about their progress. **SMT007**

*Dr. Ron notes: The events in the episode represent a compilation of experiences that I have had touring factories.*



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

Download *The Printed Circuit Assembler’s Guide to... Solder Defects* by Christopher Nash and Dr. Ronald C. Lasky. You can also view other titles in [our full I-007eBooks library](#).





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## SMT Tooling, PSA: 'Perfect Marriage of Innovation and Product'

Jeffrey Pulaski describes the recent partnership between SMT Tooling and PSA, which brings SMT Tooling's innovation and PSA's manufacturing capabilities together.

## Salary Budgets Rise Sharply in 2022, Says New IPC Wage Rate and Salary Study

A sharp increase in salary budgets and use of flexible hours programs for North American electronics

assembly companies are among the findings of a new study published by IPC this week, the 2022 Wage Rate and Salary Study for the North American Electronics Assembly Industry.



## ICAPE USA's Jeremy Griner Talks Market Conditions

ICAPE USA Managing Director Jeremy Griner discusses current market conditions for PCB

fabrication and shares the ICAPE perspective on which industries are experiencing growth. Griner also outlines how ICAPE is navigating current shipping and logistics challenges while continuing to grow sales during these dynamic times.



## Advanced Packaging Gets an Additive Upgrade

The recent approval of the CHIPS Act has reignited the U.S. semiconductor industry and shone a spotlight on the intricacies involved in chip manufacturing. As new technological innovations—such as 5G, IoT, AI, automotive and high-performance computing—come to market, they're pushing chip manufacturing and integration capabilities.





## Real Time with... SMTAI 2022: Essemtec Claiming Its Place in the Automated Factory



Bryce Timms, managing director, gives Nolan Johnson a tutorial on Essemtec's

position in the market, how Essemtec (as a division of Nano Dimension) fits not only into the additive manufacturing space but also in the more traditional EMS market.

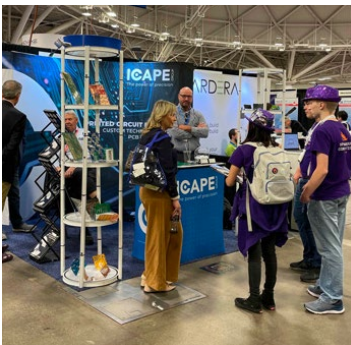
## New Growth Opportunities Worldwide for BTU

It's not just automotive and medical devices for which capital equipment manu-



facturers like BTU International are finding a market. It's also not just domestic. The company has seen an uptick in sales after the pandemic into more "purpose-built" equipment with sophisticated requirements and very tight process control.

## SMTAI 2022: Like a Tesla in a Drag Race



If you've ever experienced an electric car launching from a dead stop, felt the torque and acceleration that a motor made of magnets and copper coils can deliver over a combustion engine, then you'll have a sense for how this year's SMTAI took off—both literally and figuratively.

## North American EMS Industry Up 15.5% in September

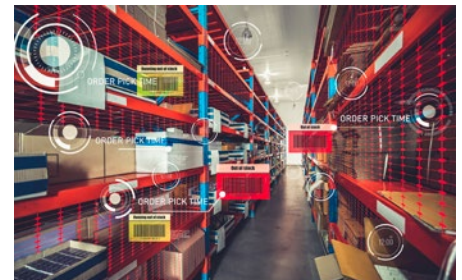
IPC announced the September 2022 findings from its North American Electronics Manufacturing Services (EMS) Statistical Program. The book-to-bill ratio stands at 1.29.

## Indium Celebrates Grand Opening of New Manufacturing Facility in Malaysia

Indium Corporation, a U.S.-based global materials supplier to the electronics assembly and semiconductor packaging industries, organised a grand opening for its new 37,500-square-foot manufacturing facility with a special ceremony in Penang.

## Modern Inventory Management Secrets

Inventory management should be simple; after all, it is how many of us learned to count. ERP solutions have become complex yet cannot solve our immediate supply-chain and manufacturing challenges unaided. It's time to unfold the root-causes behind key issues and reveal the secrets for success in modern inventory management which have a significant impact on any manufacturing business.



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

# Career Opportunities



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- **Senior PCB Designer**—You will perform PCB layout and documentation of complex printed circuit assembly products as part of a project team including procurement, electrical & mechanical engineering, PCB fabrication, Assembly and Test engineering stakeholders.

To learn more and apply for any of these openings please visit [keytronic.com/join-us](http://keytronic.com/join-us) or email your resume to: [llitsheim@keytronic.com](mailto:llitsheim@keytronic.com).

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We are an established distributor that represents manufacturing equipment and specialty consumables for the PCB manufacturing industry as well as other markets. All4-PCB represents products from suppliers in both Asia and Europe.

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A generous commission structure is available on top of solid base salary.

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- Manage operation of accounts through responding to customers, forecasting, inventory management
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- Attend trade shows and relevant conferences
- Supporting sales network in North America. Travel is required.

### Qualifications

- A technical background in chemistry or engineering is beneficial. Min. 2-year degree.
- Proficient in Microsoft Office
- Strong organizational, communication and analytical skills
- Strong understanding of full sales process
- Experience utilizing customer relationship management software
- US citizenship or green card is needed and a valid driver's license

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# Career Opportunities



## Application Engineer

Flexible Circuit Technologies (FCT) is a global supplier providing design, prototyping and production of flexible circuits, rigid flex circuits, flexible heaters and full assembly services.

### Responsibilities

- Gain understanding for customer/specific project requirements
- Review customer files, analyze - application, design, stack up, materials, mechanical requirements; develop cost-effective design to meet requirements
- Quote and follow-up to secure business
- Work with CAD: finalize files, attain customer approval prior to build
- Track timeline/provide customers with updates
- Follow up on prototype, assist with design changes (if needed), and push forward to production
- Work as the lead technician/program manager or as part of FCT team working with an assigned application engineer
- Help customer understand FCT's assembly, testing, and box build services
- Understand manufacturing and build process for flexible and rigid-flex circuits

### Qualifications

- Demonstrated experience: flex circuit/rigid-flex design including design rules, IPC; flex heater design +
- Ability to work in fast-paced environment, broad range of projects, maintain sense of urgency
- Ability to work as a team player
- Excellent written and verbal communication skills
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## Electrical Engineer

Located in State College, Pennsylvania, Chemcut, a world leader in wet processing equipment for the manufacture of printed circuit boards and chemical etching of various metals, is seeking an electrical engineer.

### Objectives:

The electrical/controls engineer will not only work with other engineers, but interface with all departments (manufacturing, sales, service, process, and purchasing). The engineer will design customer systems, creating electrical and control packages, while focusing on customer requirements.

### Responsibilities:

- Process customer orders (create schematics, BOMs, PLC programs, relay logic controls, etc.)
- Startup and debug customer equipment on production floor
- Interface with engineering colleagues and other departments, providing input & direction
- Provide electrical/control support to customer service
- May require occasional travel and overtime

### Qualifications:

- Bachelor's degree in electrical engineering or an EMET degree
- Machine control design experience a plus
- Good communication skills working in a team environment
- Strong ability to work independently with minimal supervision
- PLC and HMI experience a plus (ex. Studio 5000 Logix Designer, Factory Talk)
- Experience with AutoCAD, Microsoft Word, and Excel

Chemcut benefits include: Medical, dental and vision Insurance, life and disability insurance, paid vacation and holidays, sick leave accrual, and 401K with company match.

To apply, please submit a cover letter and resume to [hr@chemcut.net](mailto:hr@chemcut.net).

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# Career Opportunities



## Technical Marketing Engineer

EMA Design Automation, a leader in product development solutions, is in search of a detail-oriented individual who can apply their knowledge of electrical design and CAD software to assist marketing in the creation of videos, training materials, blog posts, and more. This Technical Marketing Engineer role is ideal for analytical problem-solvers who enjoy educating and teaching others.

### Requirements:

- Bachelor's degree in electrical engineering or related field with a basic understanding of engineering theories and terminology required
- Basic knowledge of schematic design, PCB design, and simulation with experience in OrCAD or Allegro preferred
- Candidates must possess excellent writing skills with an understanding of sentence structure and grammar
- Basic knowledge of video editing and experience using Camtasia or Adobe Premiere Pro is preferred but not required
- Must be able to collaborate well with others and have excellent written and verbal communication skills for this remote position

EMA Design Automation is a small, family-owned company that fosters a flexible, collaborative environment and promotes professional growth.

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## Field Service Technician

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### PRIMARY FUNCTION:

The Field Service Technician is responsible for troubleshooting and providing technical services on Taiyo Circuit Automation's mechanical and electro-mechanical products and systems.

### ESSENTIAL DUTIES:

1. Identify mechanical issues and implement process control solutions for process improvement and new projects
2. Consult with maintenance, operations, engineering, and management concerning process control and instrumentation
3. Specify, install, configure, calibrate, and maintain instrumentation, control system and electrical protection equipment

### QUALIFICATIONS/SKILLS:

1. 3 years of experience with equipment, preferably in PCB or related electronics industry
2. 3 years of experience in similar process industries with hands-on experience in operations, maintenance and project implementation—OMRON, Koyo, Allen Bradley experience preferred
3. Experience in installation and calibration of process control elements and electrical measurement devices
4. The ability to read and understand electrical, pneumatic diagrams and control systems

### REQUIRED EDUCATION/EXPERIENCE:

1. High school graduate
2. Associate degree in Industrial Engineering Technology, Mechanical or Electrical Engineering, preferred.
3. PLC experience

Email: [BobW@Taiyo-america.com](mailto:BobW@Taiyo-america.com) (Subject: "Application for Field Service Technician for TCA")

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# Career Opportunities

## **Altium®**

### **DevOps Engineer**

Altium is a publicly traded global company responsible for the most widely used PCB design software in the industry. Altium 365® is our cloud-based design and collaboration platform; it gives more power to every contributor in the electronics product chain, from the PCB designers to manufacturing. Our R&D teams are the driving force behind Altium 365 and all our technological accomplishments.

- The primary role of the DevOps Engineer is to help continue our transition to a cloud-based SaaS model as part of the production engineering team
- The team's top priorities are product reliability, security, feature delivery, and automation
- DevOps is responsible for the CI/CD process, streamlining automation for provisioning and deployment, scalable infrastructure, uninterrupted service, other DevOps activities

#### **Required Skills and Experience:**

- Analysis, troubleshooting
- 4+ years' DevOps/SRE/ Linux/Windows
- AWS (EC2, RDS, S3, Storage, Route53, and network appliances)
- Architecting and securing cloud networking

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### **Supplier Quality Manager** **Headquarters, New Hartford, NY**

#### **JOB SUMMARY:**

The Supplier Quality Manager is responsible for maintaining and improving the quality of Indium Corporation's supplier base as well as compliance with identified quality standards and risk mitigation. This position will work cross-functionally with Supply Chain, Operations, and our suppliers. The role will ensure that the quality levels of all Indium Corporation suppliers and products meet customer requirements while supporting the company's growth, vision, and values.

#### **REQUIREMENTS:**

- Bachelor's degree in business, supply chain or a science-based discipline
- Minimum 3 years in a supply chain role supporting or leading supplier quality
- Obtain and/or maintain International Automotive Task Force (IATF) auditor certification within first 3 months of employment
- Able to work independently or lead a team, as needed, to meet goals
- Excellent oral and written communication skills
- Knowledge of quality standards
- Proficiency in MS Office

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# Career Opportunities



## Technical Service & Applications Engineer

### Full-Time — Midwest (WI, IL, MI)

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 is expanding the team with an Applications Engineer to provide helpdesk support by delivering guidance on operation, maintenance, and programming remotely or on-site.

#### Responsibilities

- Provide support, preventive and corrective maintenance, process audits, and related services
- 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
- 75% domestic and international travel (valid U.S. or Canadian passport, required)
- Able to work effectively and independently with minimal supervision
- Able to readily understand and interpret detailed documents, drawings, and specifications

#### Benefits

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

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## Regional Manager

### Midwest Region

**General Summary:** Manages sales of the company's products and services, Electronics and Industrial, within the States of KS, MO, NE, and AR. 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](mailto:fernando_rueda@kyzen.com)

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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.**

[apply now](#)



## SMT Field Technician Hatboro, PA

Manncorp, a leader in the electronics assembly industry, is looking for an additional SMT Field Technician to join our existing East Coast team and install and support our wide array of SMT equipment.

### Duties and Responsibilities:

- Manage on-site equipment installation and customer training
- Provide post-installation service and support, including troubleshooting and diagnosing technical problems by phone, email, or on-site visit
- Assist with demonstrations of equipment to potential customers
- Build and maintain positive relationships with customers
- Participate in the ongoing development and improvement of both our machines and the customer experience we offer

### Requirements and Qualifications:

- Prior experience with SMT equipment, or equivalent technical degree
- Proven strong mechanical and electrical troubleshooting skills
- Proficiency in reading and verifying electrical, pneumatic, and mechanical schematics/drawings
- Travel and overnight stays
- Ability to arrange and schedule service trips

### We Offer:

- Health and dental insurance
- Retirement fund matching
- Continuing training as the industry develops

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# Career Opportunities



**ventec**  
INTERNATIONAL GROUP  
騰輝電子

## European Product Manager Taiyo Inks, Germany

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

### Duties include:

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

### Skills and abilities required:

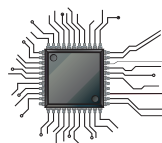
- Extensive sales, product management, product application experience
- European citizenship (or authorization to work in Europe/Germany)
- Fluency in English language (spoken & written)
- Good written & verbal communications skills
- Printed circuit board industry experience an advantage
- Ability to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

### What's on offer:

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

This is a fantastic opportunity to become part of a successful brand and leading team with excellent benefits. Please forward your resume to [jobs@ventec-europe.com](mailto:jobs@ventec-europe.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](mailto:N.Hogan@MivaTek.Global) for consideration.

### More About Us

MivaTek Global is a distributor of Miva Technologies' imaging systems. We currently have 55 installations in the Americas and have machine installations in China, Singapore, Korea, and India.

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# Career Opportunities



## 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](mailto:careers@ttci.com). Please, no phone calls.

We proudly serve customers nationwide and around the world.

TTCI is an ITAR registered and JCP DD2345 certified company that is NIST 800-171 compliant.

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# Career Opportunities



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

- Engineering
- Quality
- Various Manufacturing

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

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

Our facility employs state of the art production equipment engineered to provide cost-effective and flexible manufacturing capacity allowing us to respond quickly to customer requirements while meeting the most stringent quality and tolerance demands. Our manufacturing site is ISO 9001: 2015 registered, and through rigorous quality control practices and commitment to continual improvement, we are dedicated to meeting and exceeding our customers' requirements.

For additional information please visit our website at [www.arlonemd.com](http://www.arlonemd.com)

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## Are You Our Next Superstar?!

Insulectro, the largest national distributor of printed circuit board materials, is looking to add superstars to our dynamic technical and sales teams. We are always looking for good talent to enhance our service level to our customers and drive our purpose to enable our customers to build better boards faster. Our nationwide network provides many opportunities for a rewarding career within our company.

We are looking for talent with solid background in the PCB or PE industry and proven sales experience with a drive and attitude that match our company culture. This is a great opportunity to join an industry leader in the PCB and PE world and work with a terrific team driven to be vital in the design and manufacture of future circuits.

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# Career Opportunities



## Sales Representatives

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

### Reasons you should work with Prototron:

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

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

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TRAIN. WORK SMARTER. SUCCEED.

## Become a Certified IPC Master Instructor

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

### Qualifications and skills

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

### Benefits

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

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# Career Opportunities



## IPC Instructor

Longmont, CO; Phoenix, AZ;  
U.S.-based remote

*Independent contractor,  
possible full-time employment*

### Job Description

This position is responsible for delivering effective electronics manufacturing training, including IPC Certification, to students from the electronics manufacturing industry. IPC instructors primarily train and certify operators, inspectors, engineers, and other trainers to one of six IPC Certification Programs: IPC-A-600, IPC-A-610, IPC/WHMA-A-620, IPC J-STD-001, IPC 7711/7721, and IPC-6012.

IPC instructors will conduct training at one of our public training centers or will travel directly to the customer's facility. A candidate's close proximity to Longmont, CO, or Phoenix, AZ, is a plus. Several IPC Certification Courses can be taught remotely and require no travel.

### Qualifications

Candidates must have a minimum of five years of electronics manufacturing experience. This experience can include printed circuit board fabrication, circuit board assembly, and/or wire and cable harness assembly. Soldering experience of through-hole and/or surface-mount components is highly preferred.

Candidate must have IPC training experience, either currently or in the past. A current and valid certified IPC trainer certificate holder is highly preferred.

Applicants must have the ability to work with little to no supervision and make appropriate and professional decisions.

Send resumes to Sharon Montana-Beard at  
[sharonm@blackfox.com](mailto:sharonm@blackfox.com).

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American Standard Circuits

Creative Innovations In Flex, Digital & Microwave Circuits

## CAD/CAM Engineer

### Summary of Functions

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

### Essential Duties and Responsibilities

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

### Organizational Relationship

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

### Qualifications

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

### Physical Demands

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

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# Career Opportunities



**U.S. CIRCUIT**

## Plating Supervisor

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

Competitive benefits package.

Pay will be commensurate with experience.

Mail to:  
mfariba@uscircuit.com

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**APCT**  
Passion | Commitment | Trust

## APCT, Printed Circuit Board Solutions: Opportunities Await

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

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

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

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

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# Get to market faster.

## THE ELECTRONICS INDUSTRY'S GUIDE TO...™

### THE EVOLVING PCB NPI PROCESS



Mark Laing and Jeremy Schitter  
Siemens Digital Industries Software

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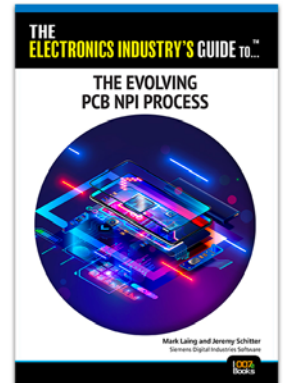




# *The Electronics Industry's Guide to... The Evolving PCB NPI Process*

by Mark Laing and Jeremy Schitter, Siemens Digital Industries Software

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



I-007e  
Books

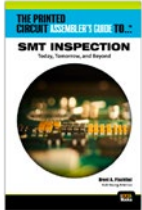
## The Printed Circuit Assembler's Guide to...



### **Solder Defects**

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

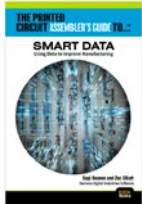
This book is specifically dedicated to educating the printed circuit board assembly sector and serves as a valuable resource for people seeking the most relevant information available.



### **SMT Inspection: Today, Tomorrow, and Beyond**

by Brent Fischthal, Koh Young America

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



### **Smart Data: Using Data to Improve Manufacturing**

by Sagi Reuven and Zac Elliott, Siemens Digital Industries Software

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



### **Process Validation**

by Graham K. Naisbitt, Gen3

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



### **Advanced Manufacturing in the Digital Age**

by Oren Manor, Siemens Digital Industries Software

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

**Our library is open 24/7/365. Visit us at: [I-007eBooks.com](http://I-007eBooks.com)**

**PUBLISHER: BARRY MATTIES**

barry@iconnect007.com

**MANAGING EDITOR: NOLAN JOHNSON**

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

**ASSOCIATE EDITOR: MICHELLE TE**

michelle@iconnect007.com

**TECHNICAL EDITOR: PETE STARKEY**

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

**TECHNICAL EDITOR: PATTY GOLDMAN**

**CONTRIBUTING TECHNICAL EDITOR: HAPPY HOLDEN**

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

**CONTRIBUTING TECHNICAL EDITOR: DAN FEINBERG**

baer@iconnect007.com

**SALES MANAGER: BARB HOCKADAY**

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

**MARKETING SERVICES: TOBEY MARSICOVETERE**

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

**PRODUCTION MANAGER: SHELLY STEIN**

shelly@iconnect007.com

**MAGAZINE LAYOUT: RON MEOGROSSI**

**AD DESIGN: SHELLY STEIN, MIKE RADOGNA,**

**TOBEY MARSICOVETERE**

**CREATIVE TECHNOLOGIST: BRYSON MATTIES**

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