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GOOD FOR THE INDUSTRY

# REALTIME with...

IPC APEX EXPO 2019 EXCLUSIVE EVENT COVERAGE

# SHOW & TELL

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**APEX  
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IPC 2019



18

- 6** Welcome to Real Time with...  
IPC APEX EXPO 2019 Show & Tell  
by Nolan Johnson
- 10** IPC APEX EXPO 2019 Photo Gallery
- 14** Electronics Industry Comes Together  
at IPC APEX EXPO 2019  
by John Mitchell
- 18** Real Time with... IPC APEX EXPO 2019  
Video Showcase and Library
- 26** Thank You, I-Connect007  
Interviewers!  
by Barry Matties
- 30** Happy's Highlights  
by Happy Holden
- 34** Leo Lambert, IPC's 2019  
Hall of Fame Inductee  
by Patty Goldman
- 38** Inspiring the Next Generation of  
Leaders: IPC STEM Student  
Outreach Program  
by Patty Goldman





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**42** A STEM Student on FIRST Robotics and Career Opportunities  
by Barry Matties

**46** Best Technical Paper and Honorable Mentions

**48** An Emerging Computer Scientist on IPC and STEM Opportunities  
by Patty Goldman

**54** Congratulations to the Three Recipients of the Dieter Bergman IPC Fellowship Award  
by Patty Goldman

**70** Two Full CFX Demo Lines at IPC APEX EXPO 2019  
by Dan Feinberg

**78** What Does CFX Mean to You?  
by Nolan Johnson

**82** Keynote Presentation: Accelerating and Disrupting Innovation—The Tesla Story  
by Pete Starkey





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EXPO<sup>®</sup>**  
IPC 2019



93

**88** Best Technical Paper Award  
by Happy Holden

**93** Student Photo Contest Winners

**98** IPC APEX EXPO 2019:  
Perhaps the Best One Yet  
by Dan Feinberg



102

**102** Perfect Score: Hand Soldering  
at IPC APEX EXPO 2019  
by Nolan Johnson

**106** Making Connections at  
IPC APEX EXPO 2019  
by Tara Dunn

**110** Five IPC APEX EXPO Exhibitors  
Earn 2019 Innovation Awards



112

**112** IPC APEX EXPO 2019:  
Another Year Here and Done  
by Patty Goldman

**116** Executive Forum on Advancing  
Automotive Electronics  
by the I-Connect007 Editorial Team



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**120** 2019 IPC EMS Management Meeting  
Wrap-up  
by Tracy Riggan

**124** IPC APEX EXPO 2019 Observations  
by Steve Williams

**128** Attendees Speak!  
by Kelly Dack

**131** IPC APEX EXPO 2019  
by the Numbers

**132** Impressions From the Show Floor  
by Dan Beaulieu

**136** And the Award Goes to...

**144** Seven Takeaways from  
IPC APEX EXPO 2019  
by Chris Mitchell

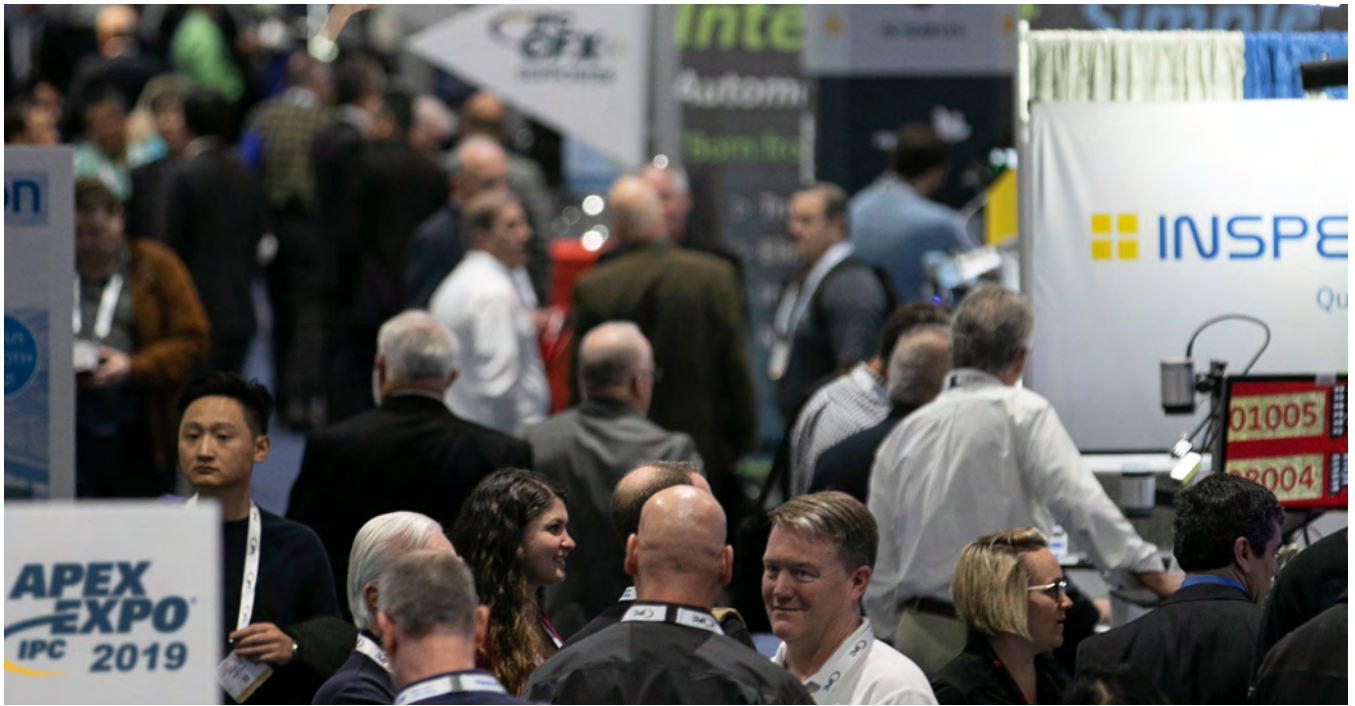
**148** Volunteers Honored for Contributions  
to IPC and the Electronics Industry

**150** IPC Issues Call for Participation for  
IPC APEX EXPO 2020

**153** Advertiser Index and Masthead







# Welcome to Real Time with... IPC APEX EXPO 2019 **Show & Tell**

by Nolan Johnson  
I-CONNECT007

Welcome to the second annual *Real Time with... IPC APEX EXPO 2019 Show & Tell Magazine*. This special publication is a supplement to our other monthly magazines and brings you exclusive, in-depth coverage of the recent event.

These pages are packed with tons of great content including event photos, video interviews, attendees' thoughts, reviews from our guest contributors and I-Connect007 editors, interviews with award winners and other industry experts, and coverage of the successful IPC STEM Student Outreach program. If that's not enough, you will also enjoy our coverage of the Hand Soldering and Rework World Championship, the two executive forums, and all of the excitement around CFX.

As far as my view of the event, there was a clear celebratory tone. Everyone in attendance

was in high spirits as IPC President and CEO Dr. John Mitchell kicked off the event with the aptly chosen theme of "Where Technology's Future Comes Together."

In the CFX working meeting on Monday, much of the conversation centered around what happens next. During my time sitting in on the meeting, with Michael Ford from Aegis Software serving as the speaker and moderator, the discussion focused on how to turn the information into added value on the manufacturing floor.

In the Executive Forum on Advancing Automotive Electronics, everyone's attention was focused on technologies, techniques, and methods to achieve the levels of production volume and device reliability that vehicles on the road will require.

If all of these conversations are barometers for what's happening on the shop floors around the industry, then the revolution is imminent. Now, it's about preparation, which is the foun-



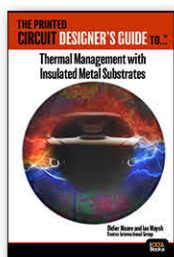
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bonding materials*



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dation for the change. Another theme for the show could have been “Industry Evolution Accelerated.” So, as you go through these pages, here is a preview of what you will find.

Dr. John Mitchell’s column is slotted first, and his takeaways set the stage for our coverage.

Next, our *Real Time with... IPC APEX EXPO 2019* video showcase and library take you right to the show floor with news, interviews, and insider commentary from industry leaders. Of course, we cannot deliver this amount of detailed coverage without the help of I-Connect007 interviewers. This is our turn to say, “Thank you.”

Happy Holden gives his impressions of the show in “Happy’s Highlights.” Happy followed factory automation news and many of the other conference and exhibition proceedings. Then, we go to full coverage of Leo Lambert, the 2019 IPC Hall of Fame inductee.

The next piece, “Inspiring The Next Generation of Industry Leaders,” focuses on the success of the IPC STEM Student Outreach program from Colette Buscemi’s perspective, IPC’s senior director for education programs.

We follow this with two interviews: one with Marcos McGalliard, a high school STEM student we met at the show, and Scott O’Hair, a college student who started his own company with a business partner while in school.

Adding to the awards coverage, Managing Editor Patty Goldman brings us the recipients of the Dieter Bergman Fellowship Awards.

Dan Feinberg, I-Connect007 technical editor, sits down with David Bergman to discuss the



roots, reasons, and ramifications of the CFX standard.

Also, during the week, I spoke to a number of CFX supporter companies about the importance of CFX to their products. In this article, we share those perspectives.

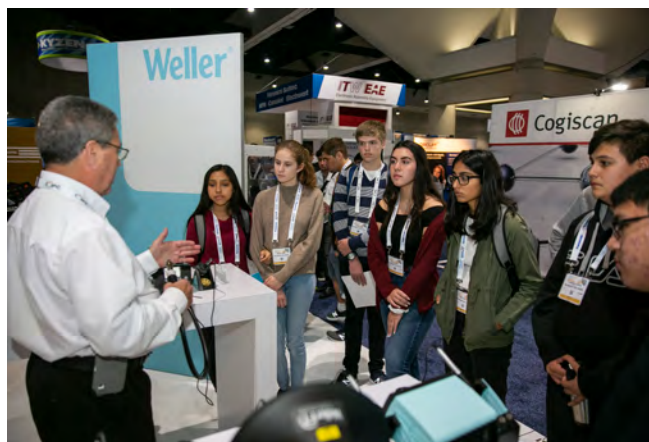
I-Connect007 Technical Editor Pete Starkey adds to his reputation as a stellar reporter of conferences and speakers by filing this report on the IPC APEX EXPO 2019 keynote speech delivered by Tesla CTO and Co-founder JB Straubel. Straubel’s talk was on “Accelerating and Disrupting Innovation—The Tesla Story.” Let Pete’s account take you into the room with him.

The recipient of the Best Technical Paper Award, Dr. Chen Xu from Nokia, agreed to an interview with Technical Editor Happy Holden. There is, perhaps, no one better than Happy to provide an understanding of the big picture around a technical topic.

Further, this year saw the return of the I-Connect007 Student Photo Contest. Three local college students brought a unique and artistic perspective to our coverage of the show. Meet them, find out who won, and view their showcased work.

In “IPC APEX EXPO: Perhaps the Best One Yet,” Dan Feinberg makes a case for his claim, and Dan should know. He’s not only an IPC Hall of Famer and an I-Connect007 technical editor and interviewer, but he’s also one of the founders of the show. See why Dan thinks this show was the best.

Get a great report on the IPC APEX EXPO 2019 Hand Soldering and Rework World Cham-





pionships, and find out who won with a perfect score.

Next, Tara Dunn files a report on “Making Connections at IPC APEX EXPO 2019.” She touches on technology making connections, and people as well. Then, Patty Goldman gives us her take on the show.

The two IPC Executive Forums were considered to be key events at this year’s show, and we covered both. In “Executive Forum on Advancing Automotive Electronics,” the I-Connect007 editorial team provides details of the day’s events, and IPC’s Senior Director for Member Support Tracy Riggan covers the EMS Forum in her article, “2019 IPC EMS Management Meeting Wrap-up.”

Steve Williams provides his observations, ranging from how the show has changed over the years to topics discussed during his Real Time with... interviews. Always good with the “man on the street” perspective, I-Connect007 Guest Editor Kelly Dack took to the show floor to gather real-time show reactions from attendees.

Dan Beaulieu also shares his impressions from the show floor. His salesman’s eye picked up some details that are worth a read.

Patty Goldman also brings us full coverage of additional awards at IPC APEX EXPO 2019.

IPC VP of Global Government Relations Chris Mitchell shares his seven takeaways from the show, which also chart a likely course for what we will see in the upcoming year.


To wrap up our issue, we showcase all the volunteers honored for contributions to IPC and the electronics industry. Volunteers are the source of the passion and commitment in this industry, and again, we thank you.

If you weren’t at the show, you can find out what you missed, and if you were, you might learn something new. Enjoy, and see you next year! **\$€T**



**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](#).

**Pete Starkey**  
The European Angle



Industry experience: **30+ years**

Areas of expertise:

- Process development
- Technical service
- Technical sales


Hometown: **Coventry, England**

College major: **Applied chemistry**

Sage advice: **The only thing better than a pint...is another pint!**


Star Trek or Star Wars? **Easy Rider**

**PCB007**  
2019 EDITION



**Pete Starkey**  
I-Connect007 Technical Editor

**Jan Pedersen**  
PCB Norsemen



Industry experience: **41 years**

Area of expertise: **Printed circuit boards**

Day job: **Senior technical advisor Elmatica**

Sage advice: **Never admit that a PCB design is impossible to manufacture. There is always a solution!**

Achievements/awards: **IPC Rising Star Award, IPC Committee Leadership Award**

**DESIGN007**  
2019 EDITION



**Jan Pedersen**  
I-Connect007 Columnist

**Mehul J. Davé**  
“Can Do” in CAM Outsourcing



Industry experience: **30+ years**

Area of expertise: **Software and services**

Day job: **CEO, Entelechy Global**

Awards: **Ernst & Young Entrepreneur of the Year**

Star Wars or Star Trek? **Star Trek**

Who inspires you? **My dad**

**PCB007**  
2019 EDITION



**Mehul Davé**  
I-Connect007 Columnist

**Joe Fjelstad**  
Flexible Thinking



Industry experience: **48 years**

Areas of expertise:

- Flexible circuits
- IC packaging
- Thinking differently

Day job: **Founder and CEO, Verdant Electronics**

Achievements/awards: **187 patents IPC President's Award**

Favorite quote: **“If you ain’t busy growing, you’re busy dying.” –Bob Dylan**

**FLEX007**  
2019 EDITION

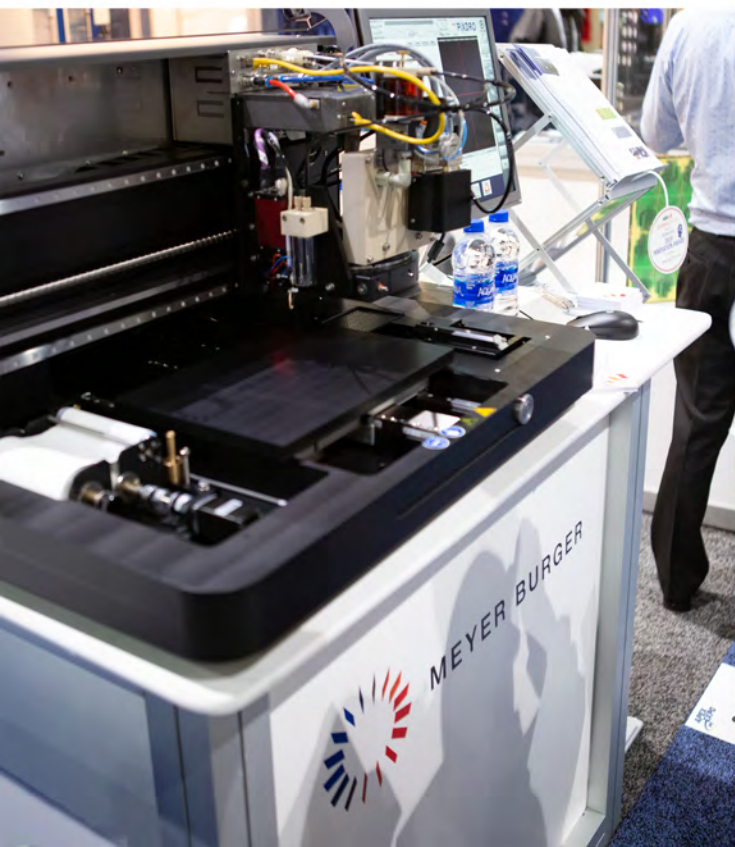


**Joe Fjelstad**  
I-Connect007 Columnist





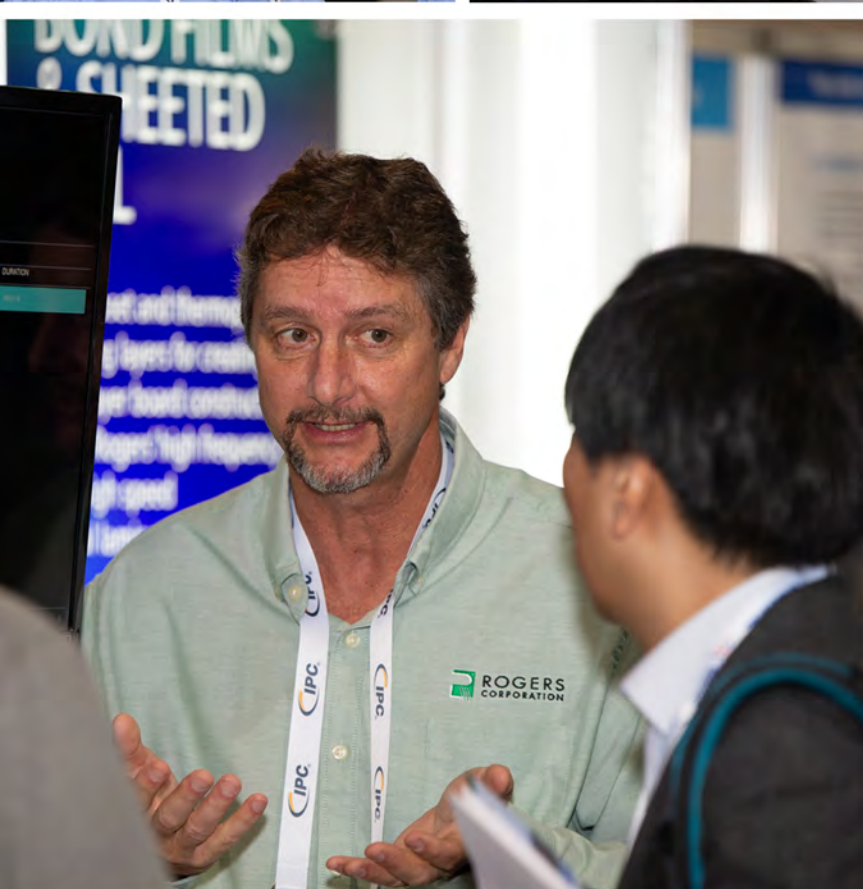
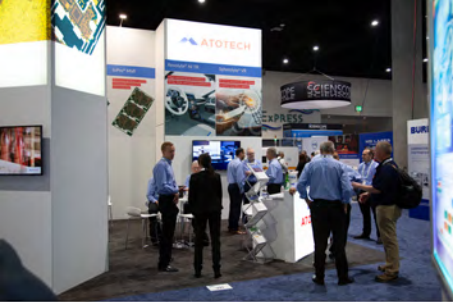
















# Electronics Industry Comes **Together** at IPC APEX EXPO 2019

by John Mitchell

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

From revolutionary advancements displayed to expert insights, the months of planning proved IPC APEX EXPO 2019 to be a success. IPC APEX EXPO provided educational and networking opportunities fostered in the technical conference, buzz sessions, and professional development courses that helped **5,292** attendees from **56** countries prepare for the future. The **440** exhibitors welcomed a busy three days of business development and generating qualified sales leads on nearly **150,400** net square feet of show floor space. IPC APEX EXPO 2019 attracted **9,796** total visitors including attendees and exhibitor personnel.

With a focus on developing important standards, IPC committee members joined to discuss, revise, and improve documents that will be used to create quality products. Their hard work is vital to furthering our industry. As they are volunteers, I appreciate the executive leaders of their organizations for allowing them to engage in standards development and participate in this year's event.

IPC CFX took center stage this year with two live production lines where visitors experienced achievements made in digital standards development over the past year. The first line

featured both the HERMES standard (IPC-9852) and IPC's Connected Factory Exchange (CFX) IoT messaging standard (IPC-2591), which worked seamlessly together to deliver SMT automation value. The second line featured the wider application of IPC CFX across multiple technologies of assembly production including manual processes. Both lines featured machines from different vendors all speaking the same language, demonstrating value from machine-to-machine communication, and creating a practical, smart, easily operable, and fully connected manufacturing environment. Both standards received ballot approval and are expected to be released by the end of February.

Education is also an important factor in furthering the success of the electronics industry. IPC APEX EXPO 2019 provided the industry's largest breadth of learning opportunities from the technical conference to hot topics covered in the buzz sessions and professional development courses.

In keeping with the event's theme, "Technology's Future Comes Together," IPC APEX EXPO 2019 featured nearly 75 technical papers detailing original research and innovations from industry experts around the world. Our programs are grounded in and driven by real-world application happening right now. Attend-





ees had access to new research on materials and processes and opportunities to learn more about trending materials, applications, and processes such as printed electronics, Industry 4.0, smart manufacturing, product miniaturization, and e-textiles.

IPC APEX EXPO's full- and half-day professional development courses blended traditional electronics industry topics with new developments delivered by corporate technologists, consultants, training center staff, and university faculty. Attendees chose from an array of leading topics such as PCB fabrication, SMT and through-hole defect analysis, electronics reliability, DFM best practices, soldering challenges, and more.

During IPC's annual STEM Student Outreach program, IPC introduced the new IPC Education Foundation—a 501(c)3 organization that will help students and the emerging workforce acquire the knowledge and skills necessary to succeed in the electronics industry. The IPC Education Foundation focuses on strengthening and shaping the next generation of workers by preparing the talent pipeline, engaging the emerging workforce, improving the perception of the industry, and offering scholarships to deserving students.

Our mission is to introduce students to careers in our industry and prepare them with

skills that will give them a boost as they enter the job market. We have begun our fundraising efforts and are actively seeking IPC members to take a lead role. Our goal is to award tens of thousands of dollars in scholarships in 2019 and provide students with an understanding of the sophistication of today's smart manufacturing environments and opportunities available for an emerging workforce with the proper skills.

On Thursday, January 31, the IPC Education Foundation hosted approximately 100 students for a day-long event including a panel session of industry leaders who provided detailed information on the electronics industry as well as a tour of the show floor, focusing on the high-tech aspects of the IPC CFX showcase and working production lines. For the first time, students were able to experience hands-on soldering at world championship solder stations with the support of IPC trainers teaching them the purpose, design, and fundamentals of a PCB. Local San Diego area schools attending the event included Morse, Mission Hills, Otay Ranch, San Marcos, e3 Civic, and North County Trade Tech High Schools.

The goal of the program was to provide an opportunity for students to see, feel, touch, and experience what this industry has to offer. There was no better way to do that than put-



ting tools in their hands, so they could experience up close how the equipment works. Staff from program-sponsoring companies provided live demonstrations of the working equipment in their booths during the tour of the show floor and participated in panel discussions. It was truly a community of people coming together to make this happen.

Another part of the experience and fun of attending IPC APEX EXPO is learning from individuals who are influential in the industry. This year's opening keynote speaker, JB Straubel, CTO and co-founder of Tesla Inc., drew on his extensive technical knowledge and experience. He also shared the history of Tesla, informing the standing-room-only crowd that innovation wasn't simply an add-on to Tesla's operations, but it was interwoven into every element of its business. Straubel also covered the perennial question, "How can my organization re-engineer itself to create products that address 21<sup>st</sup>-century needs?"

Further, 2019 saw the return of the IPC Hand Soldering World Championship to IPC APEX EXPO. With a perfect score of 634, Ryo-suke Matsunami from PWB Corporation of Japan earned first place and the title of IPC Hand Soldering World Champion. Second place went to Wenji Zhang, Jiangsu Jin-

ling Mechanism Manufacture Factory, China; and third place was claimed by Le Van Linh, Spartronics Vietnam Co. Ltd., Vietnam. Additional competitors representing Britain, France, Germany, India, Indonesia, South Korea, and Thailand also participated in the event.

When I spoke with exhibitors and attendees at this year's show, feedback was positive. Attendees said that networking and educational events and activities helped them find new ways to solve challenges. And the exhibition provided them with the opportunity to meet suppliers that could help them save time and money, and foster new business connections. Every year, IPC APEX EXPO provides me with unique ways of learning things that help me stay on top of current industry issues and concerns.

Overall, I am proud of everything we accomplished in San Diego, and I am equally as invigorated with everything we will do in the rest of the year. We are already working on putting together next year's show, which will take place February 1–6, 2020. I look forward to our industry's continued support in making IPC APEX EXPO 2020 a success. **\$6T**

Photos from IPC APEX EXPO 2019 are available at [www.ipc.org/IPCAPEXEXPO2019Photos](http://www.ipc.org/IPCAPEXEXPO2019Photos).

**Dr. John Mitchell** is president and CEO of IPC—Association Connecting Electronics Industries. To read past columns or contact Mitchell, [click here](#).







# LAMINATION SYSTEMS FOR PRINTED CIRCUIT BOARDS

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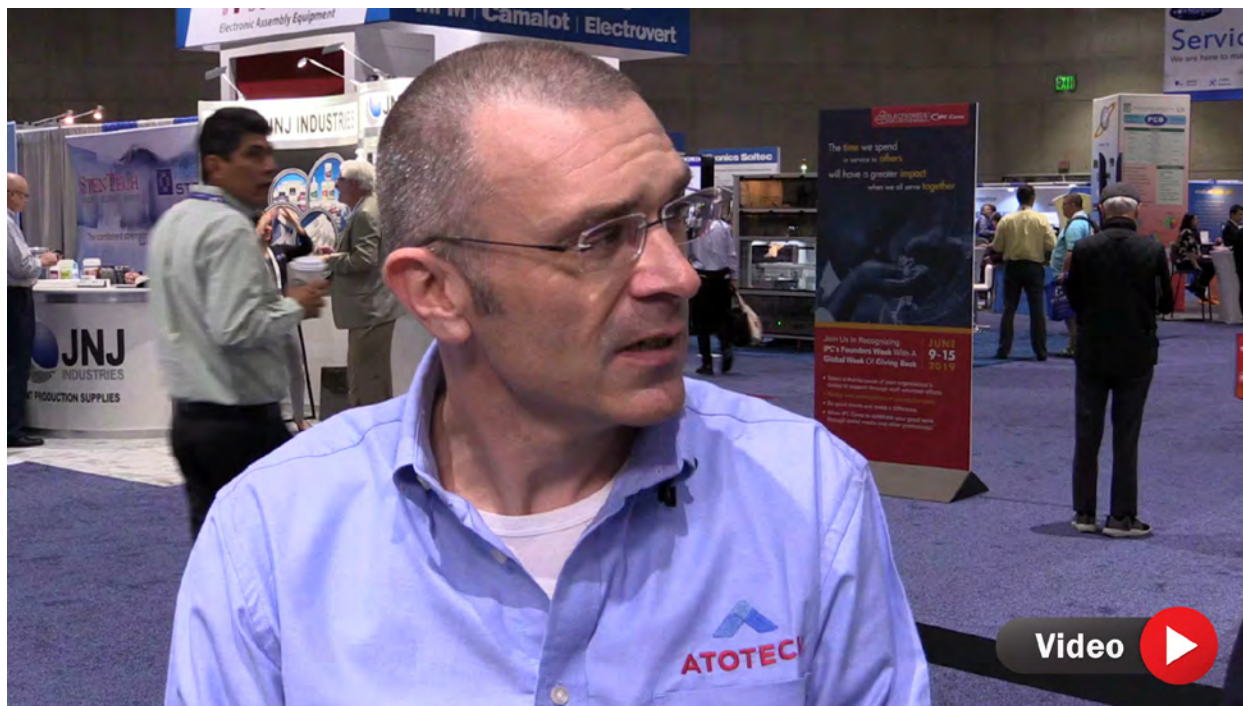
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Contact:  
**Kurt Palmer**  
**714-379-5090**





**Atotech, Roger Massey**

## Developments in Metalization Chemistries

As tracks and gaps trend below 30 microns, traditional metallization chemistries need to be reviewed and revised to address issues of palladium-related shorts. And as microvia geometries decrease, it becomes increasingly difficult to uniformly deposit electroless copper. Roger Massy discusses the latest developments.



**Arlon Electronic Materials, Brad Foster**

## Investments & the Important Role of a Niche Supplier

Arlon Electronic Materials President Brad Foster sits down to discuss capital investments the company is making in business expansions and upgrades, and the North American quick-turn electronics market.



**Comet Group, Ken Burden & Craig Arcuri**

## Comet Group's Successful Customer Center

Joe Fjelstad speaks with Ken Burden, senior director of North American field service, and Craig Arcuri, business development, about Comet Group's customer center, which focuses on all aspects of the business.

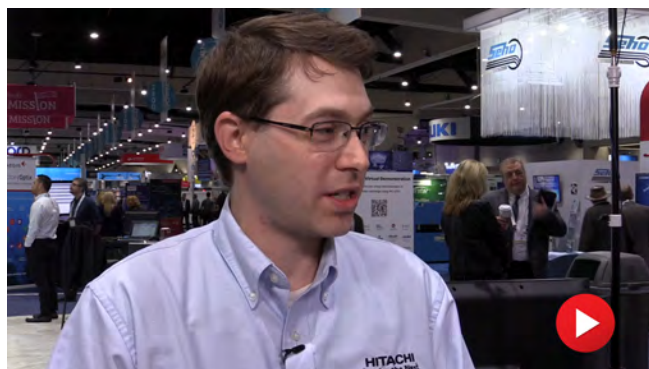




**Blackfox, Joel Sainz (en Español)**

## IPC Standards Instruction & Certification

Joel Sainz, Mexico general manager, tells Osvaldo Targon about Blackfox activities regarding instruction and certification in accordance with IPC standards.



**Hitachi High-Tech, Matt Kreiner**

## XRF in Elemental Analysis

Matt Kreiner, product business development manager, describes Hitachi High-Tech's elemental analysis products using X-ray fluorescence (XRF) to analyze small, thin metallic coatings on PCBs and component attributes.

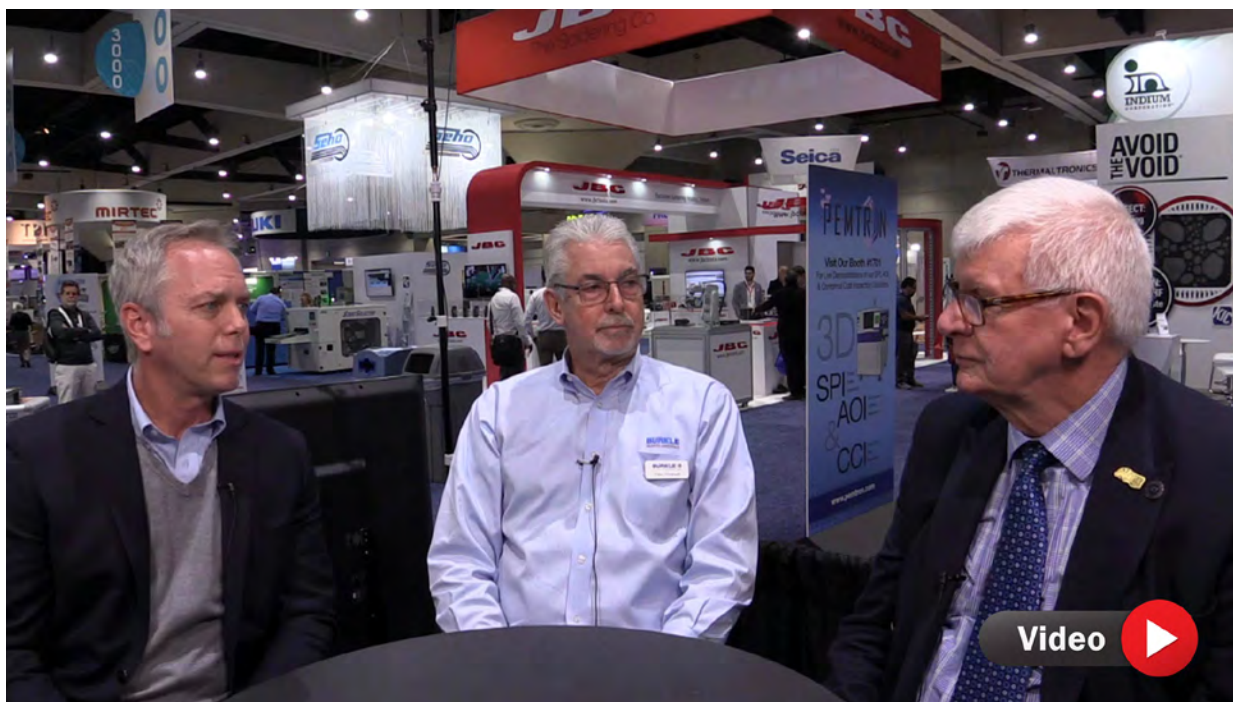


**Rogers Corporation, Anthony Mattingly**

## Impacts of 5G on Laminate Development

Tony Mattingly, senior product manager at Rogers Corporation, explains how 5G infrastructure requirements are driving the development of specialty laminates for high-frequency applications.

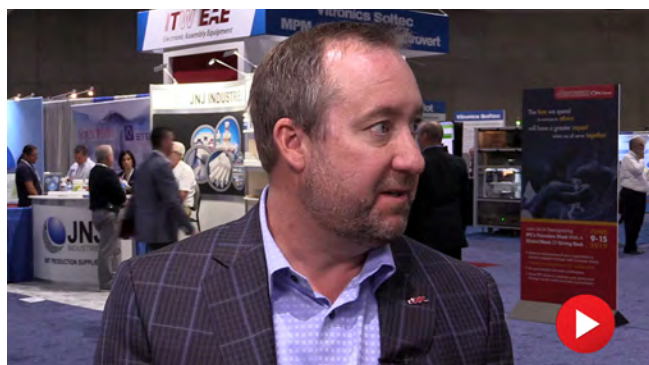




## Burkle North America, Kurt Palmer & David Howard

### David Howard's Upcoming Retirement & Successor Kurt Palmer

Burkle North America's David Howard has chosen to take a well-earned retirement. In this interview, he introduces Pete Starkey to his worthy successor, Kurt Palmer.



## Insulectro, Tim Redfern & Kevin M. Miller

### Growth & Opportunities in Printed Electronics

Judy Warner speaks with Tim Redfern, Insulectro president, and Kevin M. Miller, VP of sales, about growth in the printed electronics market, the direction Insulectro is going, and opportunities for North American PCB suppliers.



## IPC, Dr. John Mitchell

### New IPC Initiatives & Programs for 2019

Dr. John Mitchell, IPC president and CEO, and Dan Feinberg discuss IPC's new initiatives and programs for 2019 including the IPC Workforce Champions program, IPC EDGE 2.0, transportation initiative, and more.





## Super Dry Totech, Richard Heimsch

### Storage Options to Manage Intermetallic Growth

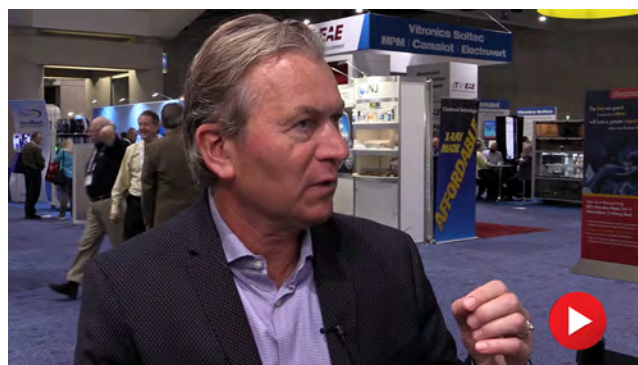
Guest Editor Kelly Dack speaks with Richard Heimsch, director of Super Dry, about some of the differences between storing components and other materials for assembly floor storage versus long-term storage, and how Super Dry can help combat intermetallic growth.



## IPC, Randy Cherry

### IPC Validation Services: New Programs & Updates

Director of IPC Validation Services Randy Cherry gives Judy Warner an overview of a new IPC-1791 QML program focused on prime contractors and OEMs, and updates us on existing programs.



## KIC, Bjorn Dahle

### Machine-to-machine Communication Standards & Traceability

KIC President Bjorn Dahle discusses standards for machine-to-machine communication, comments on the importance of traceability, and explains how cooperation with solder paste manufacturers can achieve reductions in voiding.





**Taiyo America, Donald Monn**

## New Solder Mask & Photoimageables

Donald Monn, Midwest regional sales manager for Taiyo America, turns the tables on Pete Starkey and quizzes him about his knowledge of Taiyo's new crack-resistant white solder mask for automotive, and the company's standard photoimageables re-formulated for LDI that avoid the need for UL requalification.



**Lenthor Engineering, Rich Clemente**

## Facility & Equipment Expansion

Dan Feinberg and Lenthor Engineering's General Manager Rich Clemente discuss the company's expansion and new facility and equipment at IPC APEX EXPO 2019.



**MacDermid Alpha Electronics Solutions, Joseph D'Ambrisi**

## Recent Company Rebranding

Senior VP Joseph D'Ambrisi from MacDermid Alpha Electronics Solutions speaks with Steve Williams about the recent rebranding of the business, and the benefits to their customers.





**Ventec International Group, Mark Goodwin**

## North American & Global Technology Directions

Mark Goodwin, Ventec International Group CEO EMEA and USA, comments on technology directions globally and in the North American market. He also explains how Ventec's quality accreditations, technical expertise, and flexible manufacturing capacity continue to strengthen their leading position.



**Meyer Burger, Annegret Lewak**

## Advanced Inkjet Solder Mask Printing Equipment

Meyer Burger Head of Sales Annegret Lewak speaks with Steve Williams about rolling out their inkjet solder mask printing equipment, which offers advanced accuracy and resolution imaging.



**iNEMI, Grace O'Malley**

## iNEMI on Next-generation Soldering

Grace O'Malley, VP of technical operations, and Nolan Johnson discuss the next-generation soldering buzz session workshop hosted by iNEMI and the upcoming bi-annual technology roadmap that will be released this spring.



## A.C.T. (USA) Int'l, Arturo Santillana

U.S. Distributor's POV on LED Lighting & Servicing Customers

## Aculon, Edward Hughes

Technologies, Developments, & Partnership With Henkel

## Aegis Software, Michael Ford

MES & IPC CFX

## Altium, Judy Warner

Engaging Industry Stakeholders & AltiumLive Events

## Altix North America Inc., Sylvain Dromaint

Direct Imaging Equipment Updates

## Arlon Electronic Materials, Brad Foster

Investments & the Role of a Niche Supplier

## Artnet Pro Inc., Meir Polack

Company Updates

## ASM & Technica, Jeffery L. Timms & Frank Medina

EbySIPLACE & EbyDEK Product Updates

## Atotech, Roger Massey

Developments in Metalization Chemistries

## Averatek, Mike Vinson

Very High-density Interconnect (HDI), SAP, & Mina

## Blackfox, Joel Sainz (en Español)

IPC Standards Instruction & Certification

## BTU International Inc., Bob Bouchard

New Solder Flux Reclamation Solutions

## Burkle North America, Kurt Palmer & David Howard

Howard's Upcoming Retirement & Successor Palmer

## CBT & Technica, David J. Clark & Najib Khan

Working Relationship, Roadmap, & Equipment

## Comet Group, Ken Burden & Craig Arcuri

Successful Customer Center

## DIS, Jesse Ziomek

The Circle Is Complete

## Downstream Technologies, Joe Clark

New Tool Capabilities & IPC-2581 Consortium Updates

## Electra, Shaun Tibbals

Man With a Mask

## Electrolube, Phil Kinner

Overcoming Secondary Cure Issues

## Elmatica, Didrik Bech

Data, Transparency, and Award-winning CircuitData

## Fineline-USA Inc., Eran Navick

Significant Company Growth

## Gardien, Niraj Patel

Quality Assurance & Benefits of Shortening the Supply Chain

## HDP User Group International, Dr. Bev Christian

Objectives and Projects

## Hitachi High-Tech, Matt Kreiner

XRF in Elemental Analysis

## I-Connect007

A Drone's-eye View of the Show Floor

## I-Connect007

IPC APEX EXPO 2019 Time-lapse

## I-Connect007

Taiyo America Booth Drone Flyby

## Indium Corporation, Chris Nash

Reducing Voiding in Reflow Soldering

## iNEMI, Grace O'Malley

iNEMI on Next-generation Soldering

## Insulectro, Tim Redfern & Kevin M. Miller

Growth & Opportunities in Printed Electronics

## IPC, Brook Sandy-Smith

New IPC Technical Education Program Manager

## IPC, Chris Mitchell

IPC Global Government Relations Initiatives & Updates

## IPC, David Hernandez

New Entry-level Technical Training Programs

## IPC, Dr. John Mitchell

New IPC Initiatives & Programs for 2019

## IPC, Dr. John Mitchell

IPC Hand Soldering World Championship Award Ceremony

## IPC, Dr. John Mitchell

IPC Education Foundation, IPC Education Day, & Student Chapters

## IPC, Dr. John Mitchell

IPC APEX EXPO 2019 Opening Ceremony

## IPC, Randy Cherry

IPC Validation Services: New Programs & Updates

## IPC, Sanjay Huprikar

New Solutions Group With a Holistic View

## JS-001, David D. Hillman & Teresa M. Row

Five-year Standard Committee Collaboration on JS-001



**KIC, Bjorn Dahle**

Machine-to-machine Communication Standards & Traceability

**KYZEN, Thomas M. Forsythe**

New Aquanox Aqueous Cleaner

**Laserssel, Denis Barbini**

Joining Materials With Laser Energy

**Lenthor Engineering, Rich Clemente**

Facility & Equipment Expansion

**Limata, Lino Sousa**

Exciting Developments in Laser Direct Imaging

**LPKF, Stephan Schmidt**

Laser Depaneling Equipment & Benefits

**LPKF, Stephan Schmidt**

Laser Processing Equipment & Glass Drilling Capabilities

**MacDermid Alpha Electronics Solutions, John Swanson**

Merger, Products, & Opportunities

**MacDermid Alpha Electronics Solutions, John Swanson**

Affinity for ENIG

**MacDermid Alpha Electronics Solutions, Joseph D'Ambrisi**

Recent Company Rebranding

**MacDermid Alpha Electronics Solutions, Paul Salerno**

Solutions to Combat Voids in Solder

**MacDermid Alpha Electronics Solutions, Traian Cucu**

New Materials to Improve Void Issues

**Macon, Emiliano Herrero (en Español)**

The Argentinian Market Situation

**Manncorp Inc., Ed Stone**

Custom SMT Lines

**Mentor, a Siemens Business, Oren Manor**

Introducing the Camstar Software Suite

**Meyer Burger, Annegret Lewak**

Advanced Inkjet Solder Mask Printing Equipment

**Miraco, Jason Michaud**

Flexible Circuit Products & Offerings

**MIRTEC, Brian D'Amico**

Automation Equipment, CFX, & Sales Success

**Mission Hills High School, Sara Huffman**

STEM Student on FIRST Robotics & Mentorship

**MivaTek Global, Brendan F. Hogan & Chris Hrusovsky**

Flatbed LED Direct Imaging Systems, Record Sales, & New Introductions

**MivaTek, Brenden F. Hogan**

MivaTek Customer Advocacy & Sales Awards

**Nordson MARCH, Roberta Foster-Smith**

Business Overview & Plasma Offerings

**OK International, Bryan Gass**

Updated Hand Soldering Stations

**Oracle, Karl Sauter**

Two Technical Papers on HDPUg's Projects

**Orbotech West, Sharon Cohen**

Supporting Customer Needs

**P. Kay Metal, Rodolfo Camberos (en Español)**

Eliminating Contaminants from the Solder Bath

**Panasonic, Sean M. Murray**

New Products & IPC STEM Student Outreach Program

**Pluritec, Lino Sousa**

Partnerships: Information Systems, ECOSPRAY, & OCCLEPPO

**Ray Prasad Consultancy Group, Ray Prasad**

Standards Updates: IPC-7093 and IPC-7530

**Rogers Corporation, Anthony Mattingly**

Impacts of 5G on Laminate Development

**Saki, Norihiro Koike**

Accurate, Industry-leading AOI & 3D Equipment

**San Marcos High School, Marcos McGalliard**

STEM Student on Speaking With Industry Professionals

**Siemens, Fram Akiki**

Siemens on the New Camstar Software Suite

**Super PCB, Jessica Zhang**

Providing High-end PCB Procurement Services

**TAGARNO, Ole Lind Terkelsen**

State-of-the-art Digital Microscopy

**Taiyo America, Donald Monn**

Inkjet Solder Mask: Proven Product Offering

**Taiyo America, Donald Monn**

New Solder Mask & Photoimageables

**Thermaltronics, Michael Gouldsmith**

Robust Soldering Unit

**Ucamco, Karel Tavernier**

Evolutionary Bare Board Manufacturing Software

**Uyemura, Richard DePoto**

Successful Heavy Gold Deposition Process

**Ventec International Group, Jack Pattie**

Core Solutions

**Ventec International Group, Mark Goodwin**

North American & Global Technology Directions

**Vi Technology MYCRONIC, Olivier Pirou**

Advanced 3D Inspection Technology for Solder Paste

**VJ Electronix, Don Naugler**

Making Components Count

**Zentech, John Vaughan**

The Fourth Pillar of DoD Acquisitions & NIST



# Thank You, I-Connect007 Interviewers!

by Barry Matties  
I-CONNECT007

As we all know, the quality of an output is only as good as the input, and our [Real Time with... IPC APEX EXPO 2019](#) video coverage is no exception. Our team of I-Connect007 interviewers has done an exceptional job this year—as they have in the past—from columnists to guest contributors, technical editors, and even high school students.

With more than 80 video interviews already online (our media team had them online minutes after the interviews were complete), our interviewers did a phenomenal job. The entire team at I-Connect007 thanks each one for their commitment and dedication to sharing the stories of our industry.

A special thanks to the two young journalism students from a local San Diego high school who conducted fantastic interviews with two visiting STEM students. From a coverage point of view, I think it's important for the future of our industry to hear from these voices.

The following is a list of this year's contributors. Again, thank you very much.

## Columnists

### Dan Beaulieu

Dan Beaulieu has over 35 years of experience in the PCB industry. He is considered one of the industry's top marketing and sales experts, as well as perhaps the strongest and most focused strategist in the industry. His main focus is helping companies achieve their fullest potential. Dan is also a well-known industry writer and has published over 645 of his popular "It's Only Common



Sense" weekly columns. He has contributed numerous interviews with some of the industry's most renowned leaders. Since co-founding D.B. Management Group, he has also worked personally with over 100 companies. To read past columns or contact Dan, [click here](#).

### Tara Dunn

Tara Dunn is a seasoned professional with more than 20 years in the electronics industry exclusively focused on the PCB sector. Her experience spans roles from manufacturing to sales and marketing. Tara is now president of Omni PCB, a manufacturers' rep firm uniquely focused on the PCB market, offering sales and engineering support with technology ranging from standard technology to high-end HDI products. Specialties include flex, rigid-flex, RF microwave designs, and microelectronics. She is also a founder of Geek-a-Palooza, is on the board of her local SMTA association, and regularly volunteers for IPC. Her website ([www.pcbadvisor.com](http://www.pcbadvisor.com)) shares technical information related to all segments of the PCB industry. To read past columns or contact Tara, [click here](#).



### Joseph (Joe) Fjelstad

Joe Fjelstad, founder of Verdant Electronics, is an international authority and innovator in the field of electronic interconnection and packaging technologies with almost five decades of experience and more than 185 U.S. patents issued. He is the author of *Flexible Circuit Technology*, and author, co-author, or editor of several other books including









*Chip Scale Packaging for Modern Electronics*. He has also authored numerous technical papers and articles. Over the last 35 years, Joe has presented numerous seminars on PCB, flex circuit, and chip-scale packaging technologies at industry conferences. To read past “Flexible Thinking” columns or contact Joe, [click here](#).

## Steve Williams

Steve Williams is a 40-year veteran in the electronics industry, having gained prominence and recognition as an authority on manufacturing, quality and management. He is the president of The Right Approach Consulting and the former long-time global sourcing manager for Plexus Corporation. Steve has authored five books on quality, Lean, and leadership; published more than 150 business articles and whitepapers; and is a columnist for *PCB007 Magazine* at I-Connect007. He is also an accomplished public speaker as a certified John Maxwell Team coach, teacher, and speaker on leadership. To read past columns or contact Steve, [click here](#).



## Guest Contributors

### Kelly Dack

Kelly Dack, CID+, is an experienced PCB designer with a demonstrated history of working in the electronics manufacturing industry. He understands that PCB design involves a lot more than getting electrons to flow through a circuit on a PCB. Further, he has dedicated his career to demonstrating that it also includes how well a designer can lay out a PCB to flow efficiently through the manufacturing process lines for fabrication and assembly. Kelly’s holistic experience in the PCB industry is underlined by proven design capability serving a wide array of segments including aerospace, medical, telecommunications, and gaming. Currently, Kelly provides DFX-centered PCB design layout and manufacturing engineering services for a dynamic EMS provider in the Pacific Northwest. Additionally, he serves on



the executive staff of the IPC Designers Council and is a CID instructor.

## Osvaldo Targon

At the age of 18, Osvaldo Targon started working as an electronic designer at Philips in Argentina. In 1962, he started a personal venture with activities related to designing and manufacturing printed circuits and has also added component assembly since then. Osvaldo has served as president of the electronic chamber in Buenos Aires (CADIEL), and is currently associated with IPC. He is also part of ALAINEE (Latin American Association of the Electrical and Electronic Industry), which is a private nonprofit entity of international character. Further, his company is building a new factory, and he is advising the director on the construction based on the Industry 4.0 smart factory technology. Osvaldo has 60 years of industry experience.



## Judy Warner

Judy Warner has been in the electronics industry for over 25 years in sales and marketing for PCB manufacturing and EMS companies. She also worked for the I-Connect007 team and has been a writer and blogger for other publications. Judy now serves as the director of marketing, community engagement for Altium where she helps provides resources and advocates for PCB design professionals as well as hosts the OnTrack PCB design podcast.



## Technical Editors

### Dan Feinberg

Dan Feinberg is president of Fein-Line Associates, a business services and market research consulting firm. He was formerly president of Morton Electronic Materials (Dynachem)—a \$240-million division of





Morton International Inc.—and was group VP of the parent company until its acquisition (it is now part of DOW/Dupont). He is a 50-year veteran of IPC and was founding chair of the suppliers council, resulting in the founding of IPC APEX EXPO. Dan was also chairman of IPC's government relations committee and honored with various awards including being inducted into the IPC Hall of Fame. He has spoken at numerous industry events and published hundreds of articles, columns, and webcasts. Dan also teaches computer technology for the Cyber Café and for S.C.O.R.E. His experience in international marketing, mergers and acquisitions, and technology-based business makes him uniquely suited to assist companies in today's highly competitive global environment.

## Happy Holden

Happy Holden is the retired director of electronics and innovations for GEN-TEX Corporation. Formerly, he was the chief technical officer for the world's largest PCB fabricator—Hon Hai Precision Industries (Foxconn). Before Foxconn, Happy was the senior PCB technologist for Mentor Graphics and advanced technology manager at Nan Ya/Westwood Associates and Merix. He previously worked at Hewlett-Packard for over 28 years as director of PCB R&D and manufacturing engineering manager. Happy has been involved in advanced PCB technologies for over 50 years.



## Pete Starkey

Pete Starkey has over 45 years of experience in the PCB industry. An honours graduate in applied chemistry with a research background in materials science, he worked in the development of proprietary metal finishing processes and progressed through technical service and sales with multinational supply houses. As the hands-on technical and managing director of a leading UK



PCB fabricator, he was recognised as a trend-setter and innovator. In his retirement, Pete has become a respected technical writer. He is a Fellow and council member of the Institute of Circuit Technology, an Honorary Fellow of the European Institute for the PCB Community, and a member of the European technical committee of the SMTA.

## Nolan Johnson

Nolan Johnson's experience includes a 30-year career focused almost entirely on electronics design and manufacturing. Nolan started his career as a software engineer at Mentor Graphics where he managed some of their initial OEM IC verification products. Later, Nolan managed and developed a series of technical training centers for ESI, Tektronix, and Synetics Solutions. In addition, Nolan has also held a variety of marketing and leadership positions at Clarity Visual Systems, General Electric, Rumblefish, Planar Systems, and Sunstone Circuits. A graduate of Oregon State University with a degree in computer science, a close inspection of Nolan's college transcript reveals that most of his elective courses were English, literature, film, and writing courses—the result of a lifelong love of history and storytelling.



## High School Students

### Salma Ramirez and Jocelynn Beltran

Salma Ramirez, a junior, and Jocelynn Beltran, a senior, are journalism students from Mission Hills High School in San Diego, California, who participated in the IPC STEM Student Outreach program. **S&T**



Salma Ramirez



Jocelynn Beltran



# Happy's Highlights

**by Happy Holden**  
I-CONNECT007

It's IPC APEX EXPO time again! This is one of my most favorite events. I get to see old friends again, listen to technical talks, and see what the industry has created. But, alas, I spent most of my time in committee meetings or doing I-Connect007 activities. I'm not complaining. Attending the Executive Forum on Advancing Automotive Electronics was very informative, and the keynote speaker was sensational. I also got to interview the Best Technical Paper awardee. All the while, I was missing record cold weather (the Polar Vortex) at home in Michigan.

Activities started on Sunday with CES training, committee meetings, and professional development courses. This is the one place to get necessary training on PCB fabrication, assembly, materials, and reliability, and it is a bargain! The best technologists in our industry

come here to help us all. The only problem was that the premier design conference, DesignCon, was the same week up in Santa Clara, California. I'm sure this created a lot of conflicts for many IPC members. Other conflicts were that the CES show in Las Vegas had just ended and the North American International Auto Show in Detroit started on January 30.

Monday was the executive forum along with more committee meetings and professional development courses. There were eight speakers at the automotive forum starting with Alex Stepinski as the keynote speaker, VP and officer of GreenSource Fabrication. GreenSource's automated PCB fabrication has been the subject of substantial coverage by I-Connect007 in the last two years and was a great way to get all of us to start thinking about smart factories and CFX (you can find more about this and more within this magazine).

Tuesday started us off with an inspiring keynote by JB Straubel, CTO and co-founder of







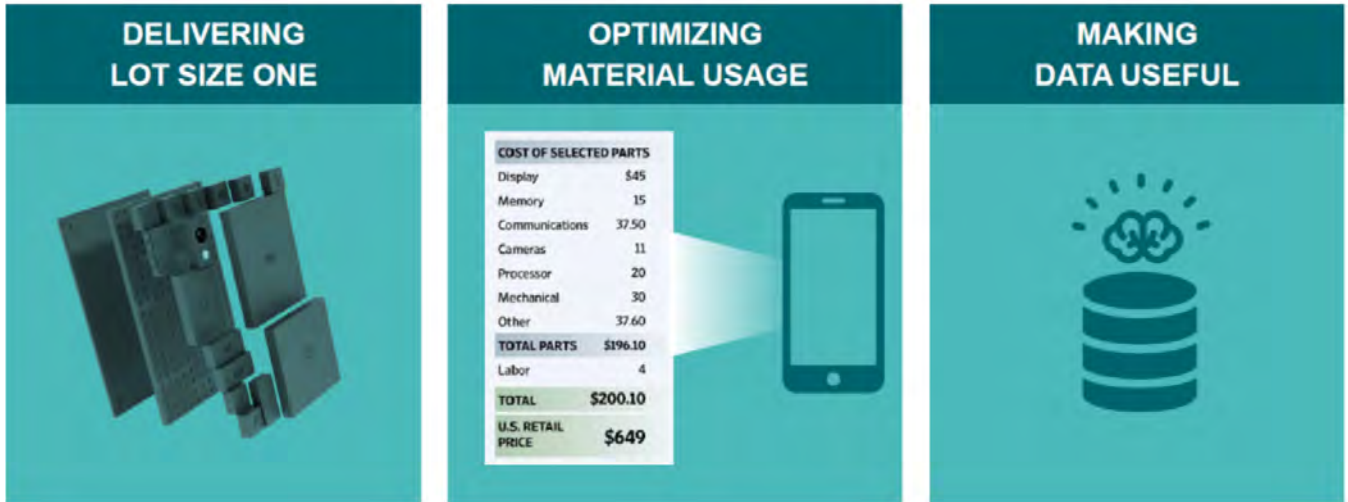


Figure 1: Lot-size-of-one concepts.

Tesla Automotive. Before the keynote, John Mitchell, IPC president and CEO, announced the Best Technical Paper winner, “Reducing Dust Deposition on Electronic Equipment by Optimizing Cooling Air Flow Patterns” by Chen Xu of Nokia, and the five IPC APEX EXPO 2019 Innovation Awards for exhibitors—GreenSource being one of them.

The exhibits were larger than last year—the largest in a long while. Business is strong and it showed in the attendance for all three days. See the [video](#) of the show floor as well as the [time-lapse](#) from our booth in our [Real Time with... IPC APEX EXPO 2019](#) series. What was also really outstanding was the emphasis on smart factories with the IPC’s Connected Factory Exchange (CFX) initiative and IPC-3581 data format. CFX demos and equipment were

everywhere outlined by a special flag and booth border. There was no missing CFX at the show.

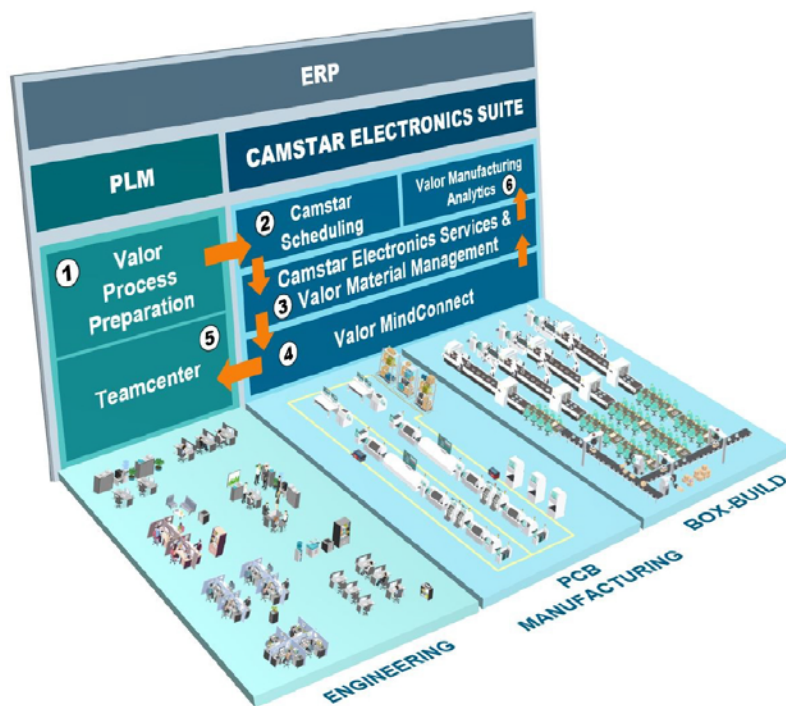
On Tuesday evening, I attended a press briefing by Siemens with *SMT007* and *PCB007* Managing Editor Nolan Johnson on their new initiative called “smart manufacturing for electronics.” This is a new effort by Mentor, a Siemens Company, and the Valor Division to combine their knowledge and put together a series of new products that will lead to the smart factory for electronics products from IC design to finished, tested products.

The first group of products includes the Camstar Electronics Suite. Siemens is one of the world’s largest industrial products company, and their reputation and expertise in automation are renowned. Figure 1 shows an overview with Fram Akiki explaining their “lot-size-of-one” concepts and Figure 2 demonstrates the Camstar Electronics Suite. You can hear more about Camstar by watching two interviews with Oren Manor and Fram Akiki. *I-Connect007* will also cover smart factories and manufacturing in future publications.

Wednesday included more activities like Tuesday, but I spent most of my time working on a special industry problem the IPC has tackled—weak microvia interface failures. For the past year, a small IPC committee of experts has been addressing the failure and root-cause analysis of a new HDI failure that is escaping our testing and ending up in the field. There







## CAMSTAR Electronics Suite

1. Streamlined NPI processes and change management
2. Optimized production plans and schedules
3. Flexible configuration, out-of-the-box production enforcement, end-to-end traceability and real-time material management
4. Direct shop-floor connectivity, real-time data acquisition and performance analysis
5. Closed-loop manufacturing for efficient and continuous improvement
6. Big data analytics and intuitive enterprise manufacturing intelligence

**For both... PCB and Box-build**

Figure 2: Camstar Suite.

was an open forum on Wednesday morning to explain it and update everyone on the progress. We expected 60 to show up, but when over 120+ attended, we had to get more chairs because there was no place to stand.


You can catch up by getting our first publication titled IPC-WP-023, "IPC Technology Solutions White Paper on Performance-Based Printed Board OEM Acceptance: Via Chain Continuity Reflow Test—The Hidden Reliability Threat." The afternoon was spent in a closed working meeting by dividing into subgroups to work on our FMEAs, test vehicles, and data collection. The group will meet again at the IPC High Reliability Conference in the spring in Baltimore, Maryland. If you're interested in joining this group, [contact](#) Chris Jorgensen, director of technical transfer at IPC.

Thursday was the final day of the exhibition. The only sad note was that there were fewer PCB fabrication supplier booths. There is so much consolidation that what was once

four booths for MacDermid, Enthone, OMG, and Alpha is now one booth for the newly combined MacDermid Alpha Electronics Solutions. The same is true for past equipment and materials exhibitors now represented by larger marketing firms. However, the SMT side is larger and growing.

Next year, we meet in San Diego again during the first week in February. I hope to see you there! **S&T**

**Happy Holden**  
Happy's Essential Skills



Industry experience:  
**47+ years**

Areas of expertise:

- **Advanced printed circuit board design**
- **Technical educator in electronics packaging design and engineering**

Hometown:  
**Zeeland, Michigan**

Alma mater:  
**Oregon State University**

Things that bring happiness:  
**After more than 47 years in the industry, Happy continues to write and teach.**

**PCB007**  
2019 EDITION

Welcome to  
Autumn 2019 Sun

**Happy's**  
**HAPPY HOUR**  
and Book Signing  
Bay Terrace

**Happy Holden**  
I-Connect007 Technical Editor



# Leo Lambert, IPC's 2019 Hall of Fame Inductee

by **Patty Goldman**  
I-CONNECT007

According to IPC's website, the IPC Raymond E. Pritchard Hall of Fame Award is given to individuals in recognition of the highest level of achievement, extraordinary contributions, and distinguished service to IPC and in the advancement of industry including the creation of a spirit of mutual esteem, respect, and recognition among members consistent with the goals and mission of IPC on a long-term basis.

This is the highest level of recognition that IPC can give to an individual and is based on exceptional merit.

Leo Lambert, VP and technical director at EPTAC Corporation, is IPC's 2019 Hall of Fame inductee. I caught up with Leo in his office to learn more about his time at IPC and in our industry.

**Patty Goldman:** Leo, congratulations on receiving what is the most prestigious award and highest honor bestowed on volunteers at IPC. Please start by telling us a bit about your background and how you got into the electronics industry.

**Leo Lambert:** I guess the best place to start is with my first IPC meeting, which was a long time ago back in '76. My boss went to an IPC meeting, and said he was never going back; he said, "You go." I have been going ever since. The other piece of it was getting involved with the various specifications and committees. At that time, I worked for Digital Equipment for 20 years, and then got caught in a company reconfiguration and was laid off. I came to work for EPTAC, which is a training consulting company, and continued attending the meetings, participating in the committees. The next thing I knew, I became the chair for vari-



ous task groups and committees, and finally became the chair of TAEC, and so forth. That's how I got involved.

I've been involved with soldering my whole life from the time I graduated in as an ME from UMass-Lowell (Lowell Tech at the time). I was involved with cleaning and soldering, fabricating, and board assembly process so as can be seen I've been involved in electronic manufacturing assembly my whole life. When I came to EPTAC, we wanted to expand our business, and my focus was the consulting side and getting involved with the specifications, making sure all of our instructors knew them, etc. That's how I got into it, and I guess the opportunity is never say no to the question, "Do you want to do this?" I'm always the guy that said, "Sure, I'll do that." That's how I got started, and how it has been over the years.

**Goldman:** Well, let's say you were already started (laughs).

**Lambert:** Yeah. You get involved with these things, and it's just a matter of do you want to do this or not? And of course, you see the need

for it in the marketplace, which has changed so drastically over the last 20–40 years from basically just electronics in computers to all the electronic products that are on the market today. It's just crazy. We get a lot more customers, requests, and questions, and a lot more use of the IPC specifications and things like that. So, you start thinking about the value that it brings to the marketplace; I think that's the big piece. I like seeing the value of the work, and then because you have that opportunity to work in this kind of business and industry and give back, which was big for me.

**Goldman:** I know you've been heavily involved in the soldering specification arena at IPC and have been on a number of committees and subcommittees always in the assembly area. Any memorable moments or times that particularly stand out?

**Lambert:** Oh, there are all kinds of them. Perhaps the most memorable was when I started going to the meetings, the heads of the assembly and joining process were Paul Bud from Electrovert and John DeVore of General Elec-



tric who were my mentors. Working with those guys and seeing what they were doing was impactful.

When I think about memorable moments, I also think about the mentoring that occurred when I was a kid and the evolution of that and how it continues through your life. Then, of course, there is the usage of the specifications and seeing the specifications you helped developed being used in various industries including automotive, telecommunications, etc. However, the computer people are all gone. We don't deal with them anymore because they're so big and they have their own people, but I guess that's the way it is.

Of course, seeing the growth of the industry is pretty memorable in itself as well as the shrinkage of the product. When you used to look at a computer, it filled a room. Now, it's on a phone. There have been a lot of changes in the industry related to that sort of thing.

**Goldman:** We sure have seen a lot of changes over the years.

**Lambert:** It has been crazy and amazing. You sit back and think, "The technology is still the same to fabricators; they just shrunk it." At home, I think, "What does that mean? What do I have to work with now?" Before, we were dealing with big components, but we're now dealing with stuff that's the size of a speck of pepper.

**Goldman:** That's true. What advice would you give to people, especially first-timers, at a meeting? I always say, "Get involved."

**Lambert:** Getting involved is one thing. There's also a part related to getting permission to go to

the meetings. I know when I was working for Digital, you had to write a letter and memo to justify your reason for going to every meeting. When I came to work at EPTAC, I didn't need a reason for going; you'd need a reason for not going. You have to go because you're involved. I think getting involved and having companies committed to sending people is important, and we're trying to start new mentor programs. There are a few young people that have started coming to the meetings, which is good.

The days of working at the same company and job for 20 years are a thing of the past. "Where do you want to be in five years?" was a typical question we were used to hearing. Today, young people are different. They're not going to take a job for 20 years. They want to move on. They have to develop a love for it, which is tough to do. What about their job is interesting enough that it's going to keep them coming back and contributing? You can mentor somebody for three or four years, but they're going to get an opportunity to move on. I've seen it with my own kids, too.

So, getting involved with the people and asking them to participate is one thing, but giving them responsibility is another thing entirely. When they take on a responsibility, they become more committed. You have to find something that tickles your fancy and stick with it. I think that's the answer. You have to make sure people get that flavor, you can't make it painful for them; they must develop a liking or a love for whatever it might be.

Find something that you're dedicated to and piques your interest every day. What is in it today that's going to be different from yesterday? Soldering is soldering, but there is always new equipment, materials, and people. And





how do those things work? I think that's what you have to do with people coming on board.

**Goldman:** Over the years, we have always joked that you get sucked into this industry and can't get out again.

**Lambert:** That's true; you do get hooked. One of the expressions we used to use was, "Be careful who you tee off because you're going to be working for them." It's a small fraternity and sorority of people who are in this business. The more contacts you make, the better off you're going to be, but we're all in the same business. What the product does is up to you, but the way you put it together, that involves a fraternity or sorority of people that just go at it. That's how you have to look at IPC.

**Goldman:** That's right, we are a close-knit industry. How many friendships have you developed that go beyond a business association?

**Lambert:** Absolutely. You see these people all the time. The meetings are twice a year plus the interim meetings. You spend a lot of time with them—sometimes days at a time—and really get to know them. Real friendships develop. And now, you get onto social media and are conversing with them about family, kids, and so on. You develop friends all over the place.

**Goldman:** Do you have any other thoughts or bits of wisdom you would like to pass along to our readers?

**Lambert:** I think one that intrigues me is the direction and growth of IPC. Sometimes, we feel they're going in directions that are leaving us behind because of all that is going on as they're trying to globalize. In the process of globalization, so many things are changing. Change is an interesting word; you have to be able to take the change that comes, adapt to it, and make it work because if you don't, you're stuck. You won't go anywhere.

There have certainly been a lot of changes in IPC in the last 10 years. It's just amazing the things that the organization has done, where



they're going, and their introduction of new programs. How do we implement those programs and get the people involved?

**Goldman:** It's hard to keep up.

**Lambert:** Exactly. We need to be able to take change, understand it, and sometimes it's the explanation of the change that's a big deal. Who's in charge of this, and can they answer all the questions? For me, the changes that have happened over the past few years have been good, but they've been painful in certain cases. How do you work through the pain to make it a lasting effect? You must get used to changes in people, the industry, funding, etc. If you're not used to that, you're not going to want to participate, and that's what happens with the new people. They're thinking, "Are you guys crazy? We spent 45 minutes discussing whether we should use the word 'shall' or 'should.'" I think change is the big deal.

**Goldman:** But it's all good. Thanks so much for your time, Leo, and congratulations again.

**Lambert:** Thank you. **SET**



# Inspiring the Next Generation of Industry Leaders: **IPC STEM Student Outreach Program**

by **Patty Goldman**  
I-CONNECT007

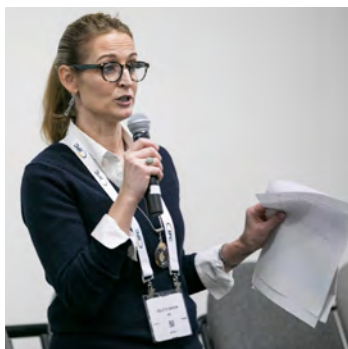
At IPC APEX EXPO 2019, I spoke with Colette Buscemi, IPC's senior director for education programs, about the success and expansion of the IPC STEM Student Outreach Program, activities and scholarship opportunities for students through sponsor support—including I-Connect007—and feedback she received on the event. She further addresses other educational opportunities aimed at inspiring the next generation of industry leaders in both high schools and colleges, and the announcement of the new IPC Education Foundation and IPC Education Day on January 31.

**Patty Goldman:** Colette, let's start with a little bit about you. You're new with IPC. Can you tell us about that first?

**Colette Buscemi:** Absolutely. Thank you for speaking with me. I joined IPC in January of 2018 as the senior director for education programs focused on developing education programs for pre-college and post-secondary students with the fundamental goal

of helping address the skills gap and workforce issues facing the electronics industry. Before I joined IPC, I was with the Digital Manufacturing Design Innovation Institute (DMDII), which is part of the National Network for Manufacturing Innovation (NNMI). And before that, I worked for the British government, overseeing the U.K.'s international trade office in the Midwest. I got my start working with a manufacturing trade association based in Chicago, supporting small- to mid-sized manufacturers to improve processes, expand into new markets, and access funding, so in some ways, this opportunity has brought me full circle.

**Goldman:** We had a very nice program with high school students today here at IPC APEX EXPO 2019. Can you tell me about it?



Colette Buscemi speaks with STEM students at IPC's STEM Student Outreach program.

**Buscemi:** We just finished this year's IPC APEX EXPO STEM Student Outreach program, and it was a big success. We had six schools participate from the San Diego region including 100 students and their teachers and instructors. The point of this experience was to expose students to all things electronics within this industry—careers,





technologies, and professional development—and to get them to see firsthand that there are a wide range of career opportunities for them to consider and pursue. We had two career panel discussions with representatives from both large- and medium-sized industry leaders including Panasonic, Weller Apex Tools, Calumet, Nordson, and Mycronic as well as IPC’s emerging engineers speak about their experiences and what it took for them to get to where they are today.

The emerging workforce lacks essential industry skills. Over 66% of IPC members have difficulty hiring operators, and 64% of IPC members have difficulty hiring engineers. There is an urgency to collaboratively solve this industry-wide problem that is predicted to grow worse in the decades ahead. IPC and the IPC Education Foundation are uniquely positioned to be part of the solution.

I’m a believer in the “see, think, do” model, and that’s really what this opportunity offers students. The students go through a soldering training experience with industry experts. In addition, they walked the trade show floor with hundreds of exhibitors where they toured IPC member booths. Then, they saw the Connected Factory Exchange (CFX) line, which demonstrates the intersection between digital technology and manufacturing. Each school was also given a \$1,000 scholarship. The opportunity to bring these students here was just incredible.

In addition, John Mitchell, president and CEO of IPC, offi-

cially announced the launch of the IPC Education Foundation. Further, this day [January 31] has been proclaimed IPC Education Day by Representative Scott Peters from the 52<sup>nd</sup> congressional district of California, which covers the coastal and central portions of the city of San Diego as well as the suburbs of Poway and Coronado. Cesar Solis from the Congressman’s district office also attended the morning breakfast and welcome session.

There are a lot of great things happening. We are very excited about the progress we’ve made and the direction we are headed including working with high school districts across the country to integrate IPC’s training materials and resources and industry credentials into high school curricula. While here, we met with several career technical education (CTE) instructors to discuss a pilot program later this year.

**Goldman:** Where are the teachers from?

**Buscemi:** They’re from San Diego high schools.

**Goldman:** Okay. And are you also working on this program with colleges?







**Buscemi:** For college students, we will be setting up chapters that will give students dual membership in the IPC Education Foundation and IPC. A \$40 annual student membership allows students to access resources and content including two free standards per year. In addition, every chapter will have the opportunity for a student member to apply for a \$1,000 scholarship per year. We're building out regional "ecosystems" within markets where there is a heavy concentration of IPC industry members. The goal is to get our industry members involved so they host events, offer company tours for students, and networking, mentoring, and job shadowing opportunities. Again, the whole idea is "to see it and be it." The earn-and-learn model such as apprenticeships and internships will be a key feature of

our education programs as we grow and further enlist the support and involvement of industry members.

**Goldman:** That's great. What feedback have you received from students and teachers today?

**Buscemi:** We've received amazing feedback. Students and teachers have been effusive about the program. One of the schools that attended called me last week and said, "You have no idea what this means for our students. They do not get to see this." When they came in today, they were amazing. There were 20 of the brightest and most professional students dressed in suits and ties, wide-eyed and ready to go. We know that we're making a difference with this type of programming. When you can get the students out into the world, it is the best teaching you can ever do.

**Goldman:** The sad part is it's only here in San Diego, since this is where our show is, and we don't know how to get beyond that as far as the show part.

**Buscemi:** We have plans to grow and scale the program; it's meant to be flexible and adaptable. Given IPC's strong national and global footprint of industry members, there's no reason we can't replicate what we did here in other markets. We'll be looking at replicating this program in other markets through various partners and industry members including the proliferation of IPC Student Chapters.



IPC's education team. From L to R: Colette Buscemi, senior director, education programs; Charlene Gunter du Plessis, director, strategic partnerships and programs; Aaron Birney, manager, education programs; and Brook Sandy-Smith, technical education program manager.





**Goldman:** Are you planning to do an event this summer?

**Buscemi:** We will be in Raleigh in early June, and there is absolutely the potential to replicate this.

**Goldman:** The kids might be out of school then, though.

**Buscemi:** Well, maybe they will be looking for something to do. There's an opportunity with summer programming too.

**Goldman:** It could work. That would be great.

**Buscemi:** There is strong interest from teachers to integrate industry-recognized credentials and training materials into their curriculum to ensure that students are gaining the right level of skills to go to the next level, whether that's to become immediately employed or further their education at a community college or university. It's not about everyone going to a four-year school anymore; it's about how we can get young people on a pathway to a career that is going to give them real opportunities.

**Goldman:** That's so true. Do you have any other thoughts?

**Buscemi:** I'll close out with saying we need support. We are actively fundraising and going out to our IPC industry members from large OEMs and EMS companies to the mom-and-

pop manufacturing shops. Everyone has an opportunity to contribute. We've already seen that here today with the great support from many of our industry members.

**Goldman:** I noticed that all of the students received a backpack with a t-shirt and soldering iron.

**Buscemi:** Yes, thanks to the generous donation of several of our industry partners including Panasonic who donated the backpacks to Weller Apex Tools who donated a soldering kit to each school.

**Goldman:** Were any of the schools here today also represented last year?

**Buscemi:** No, all of the schools here this year are new. Our goal is to reach as many new schools and students as possible. Three schools attended last year.

**Goldman:** Interesting. So, we reached six more schools.

**Buscemi:** Yes, six new schools.

**Goldman:** That's great news. I hope everything works out so you can reach more people throughout the year. Let's keep the ball rolling. I'll be interested in learning more as it goes along.

**Buscemi:** Absolutely. Thank you very much.

**Goldman:** Thank you. **S&T**

# A STEM Student on FIRST Robotics and Career Opportunities

by Barry Matties  
I-CONNECT007

I-Connect007 was proud to help sponsor IPC's STEM Student Outreach program at this year's APEX EXPO, which brought students from six local high schools to experience first-hand the electronics manufacturing industry. Barry Matties spoke with Marcos McGalliard, a STEM student and robotics team member from San Marcos High School, about his experience at the show and the benefits of participating in STEM-related events.

As the room began to fill with high school students at the IPC's STEM Outreach program, one student, in particular, caught my attention. He approached a table of eight or so industry experts and said with confidence and intent, "Good morning, I am Marcos McGalliard from San Marcos High School, and I would like to..." I can't quote his exact words, but he went on to introduce his robotics team and their need for sponsors. He held the attention of all of the adults and concluded with a thank you and how he hoped to hear from them. As he turned to walk back to his classmates, the adults at the table were very impressed; it worked. I heard one later offering support. Well done, Marcos.



Marcos McGalliard

I had a chance to catch up with Marcos and talk to him later in the afternoon. Below is my interview with this young leader.

**Barry Matties:** First, can you tell us what school you attend?

**Marcos McGalliard:** I'm currently a junior at San Marcos High School in San Marcos, California.

**Matties:** Great, and you are also representing a special group as well. Tell us about that.

**McGalliard:** Yes. I am a member of the Alphanites robotics team (#6695), and we compete through FIRST Robotics. What our group does is during the robotics season, which is currently going on, we have a certain task that is given to us via what's called a "kickoff,"





which is a global event that takes place in New Haven, Connecticut, where FIRST was founded. The announcement usually airs on a Twitch.tv stream, and everyone watches it. Dean Kamen and Woodie Flowers are the two founders of FIRST. Their mission is to push gracious professionalism through competition and cooperation and teams working together even though they're in a competitive environment.

**Matties:** How long have you been involved with FIRST?

**McGalliard:** I've been involved for three years since I'm a junior. I started as I was a freshman, and I'm actually one of the founding members of our team. My team basically started with just about 10 people. We rushed through to the registration process because our teacher explained how we had to register right away before the deadline. We registered in time and started without having much of an understanding of what we were doing, but we built our first robot.

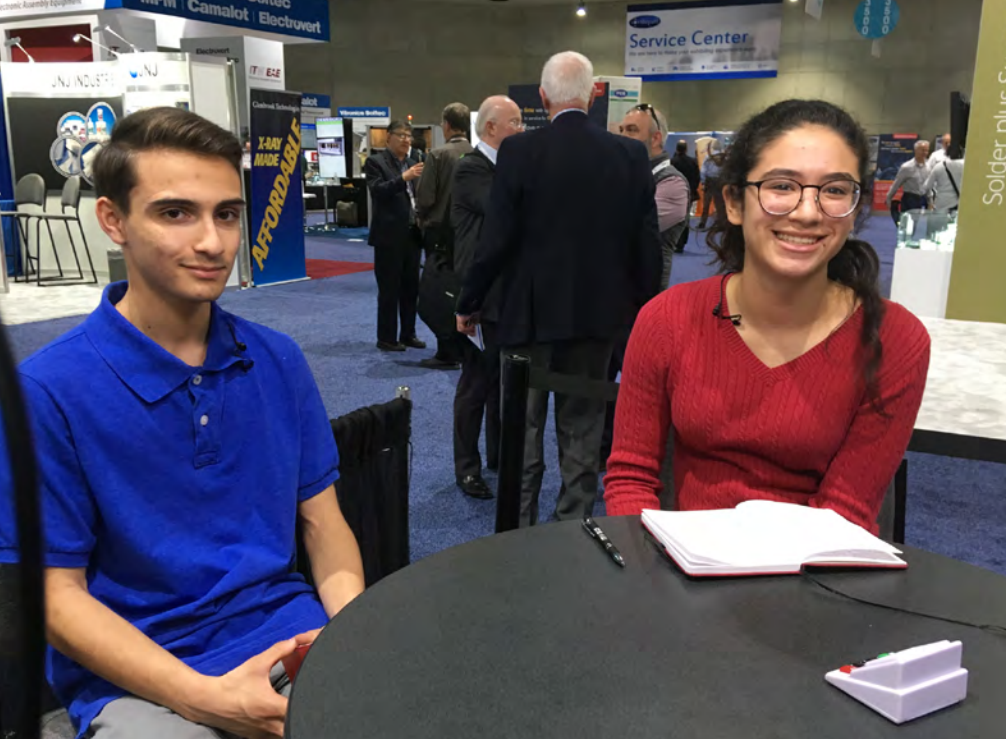
The competition that we did the first year

was called FIRST STEAMworks. Basically, we had to build our robot within six weeks to be able to launch little whiffle balls into this thing called "the boiler." It was a six-foot apparatus with a hole on the top, and you had to be able to launch balls in it to give you points. We also had to be able to carry and deposit gears to what they called "an airship." There was a system where a human operator could pull up the gears, grab them, and put them into a system where they would eventually fill up with gears, and you would rotate them, which would get your "rotor" going.

**Matties:** In the three years that you've been involved, what has inspired you the most or what have you learned the most from this?

**McGalliard:** What I've learned the most from is not just the perseverance on the engineering side but also how to write a grant and how to present myself well in front of other people as the business head. I've had that experience before, but being able to do that in a truly professional environment inspired me since we need sponsorships and grants—things you





Marcos being interviewed by Jocelynn Beltran, a journalism student from Mission Hills High School, for *Real Time with... IPC APEX EXPO 2019*.

To view the video [click here](#).

would never usually think about when you're just a student doing a regular program of some sort such as football or some other athletic program.

**Matties:** How successful have you been in finding sponsors?

**McGalliard:** We have been pretty successful. Our two biggest sponsors this year are Hunter Industries and the Nordson Corporation. We also have grants from Qualcomm, Superior Case Coding Inc., and a smaller company where one of the parents of a former team member works called Matter.

**Matties:** As you move through school and start your senior year next year, what's next for you?

**McGalliard:** FIRST gives you a lot of huge opportunities. They have many scholarships available for college-bound FIRST alumni. If you were an alumnus of FIRST, you can apply for different types of scholarships that will range from a few hundred dollars to up to many hundreds of thousands of dollars. It just depends

on what you qualify for and what you have done as far as FIRST goes. The more invested you are in FIRST\*, the more opportunities you will have.

**Matties:** You've taken on leadership roles in your activities. What do you think it takes to be a great leader?

**McGalliard:** The most important thing leadership involves is communication. I'm an Eagle Scout, and have taken leadership courses and participated in National Youth Leadership Training through the Boy Scouts of America. The training helps

to bring people through a certain stage of development that you don't really get through many programs. Another important thing that I was taught during that time was to listen to those that you are leading. Leadership can be about talking a lot of the times, but people forget to listen to what your people that you are managing have to say. A good leader listens, maintains their composure, and even when something goes wrong, they know how to be a good friend.

**Matties:** Who inspires you?

**McGalliard:** My dad definitely inspires me. He's a nurse, but also spent 24 years in the military in both the army and navy. He is an inspiration to me because he goes out every day to do his best to provide for my family and make a difference in the world. I also think that my teachers, especially my mentor for robotics, are very big influences for me. My mentor has shown me a lot of guidance and given me direction on what I should do with my life.

**Matties:** You're here at the IPC APEX EXPO 2019 with the STEM Student Outreach pro-





gram, of which we're a proud sponsor. Thank you for being here to do this interview.

**McGalliard:** Of course.

**Matties:** You started with a morning welcome and panel session led by Dr. John Mitchell, president and CEO of IPC. Then, you've done some soldering and took a tour of the show floor. What's your takeaway from all of this today?

**McGalliard:** My takeaway is it's all about opportunities. I see what they do here, and it gives me a perspective into the industry itself and what I can do. I was also able to interface with people from Nordson or ITW, get a taste of what they do, and see if there's anything that I can do as far as job opportunities or scholarships if they apply.

**Matties:** You've been through leadership training, and you're obviously thoughtful in your answers. What advice would you give other young people?

**McGalliard:** Definitely practice. Whenever you have any type of presentation that you want to give, just practice in front of a mirror and be confident in yourself. I talk to myself all the time, which I know people might think I'm crazy, but it also helps me to get a feel for what I'm supposed to say even in a spontaneous situation. I can go into a place and comfortably give an interview or give a presentation. And also, the way that you carry yourself is very important—the way that you dress and talk. The way that you come across to other people can really help you in your life when it comes to a certain profession or position.

**Matties:** You mentioned to me earlier that you had considered wearing a tie today. What happened?

**McGalliard:** I was going to wear a tie today, but as I walked downstairs for my mom to drive me to school so the bus could pick me up, she said, "You're going to be soldering. You probably shouldn't wear a tie." I said, "It's also a networking event," and she said, "Go put on a

polo shirt,” so I did. You have to listen to your parents.

**Matties:** Good. Well, I certainly appreciate that you had a tie on. It shows that you’re taking a serious approach to your day and life.

**McGalliard:** It’s okay to be serious. People may call me staunch or uptight, but it doesn’t matter what they say when it comes to how I dress for school. Every Friday, I wear dress pants, a buttoned-down shirt, and a tie to school. That helps me present myself well to my teachers. It’s not really a case of what my peers think. For me, it’s more important that those who I am trying to impress are impressed rather than those who are my peers and I am working alongside.

**Matties:** In reality, it’s really what you think about yourself that’s the most important and not others.

**McGalliard:** I absolutely agree.

**Matties:** I appreciate you taking the time to meet and do this interview. Do you have any thoughts that you’d like to share that we haven’t discussed?

**McGalliard:** Anyone that is considering getting into a STEM profession should definitely do it because they’re very much in demand. For anyone that is on the fence, you can find something that will suit your interests. Even if there are people that are more interested in the arts, for example, there are ways to incorporate art and technology. It’s all about what you want to do and what your interests are. Go and find something that can accommodate for that; that’s my biggest piece of advice.

**Matties:** Marcos, thank you so much for taking the time to speak with me today. I really appreciate it.

**McGalliard:** You are very welcome. **SET**

*\*For more on the FIRST program, click here to read my interview with Dean Kamen, Segway Inventor and Founder of FIRST.*

## Best Technical Paper and Honorable Mentions

The best technical conference papers of IPC APEX EXPO 2019 were voted on through a ballot process by members of the IPC APEX EXPO Technical Program Committee.

As previously mentioned, Chen Xu from Nokia and Jason Stafford, his co-author from Imperial College London, took top honors with the winning paper “Reducing Dust Deposition on Electronic Equipment by Optimizing Cooling Air Flow Patterns.” The authors received their awards during the opening keynote session on January 29, 2019.

This year, two papers were selected in the honorable mention category. Honorable mention went to “Head-on-Pillow Defect Detection: X-ray Inspection Limitations” by Lars Bruno, Ericsson AB. His co-author was Benny Gustafson, Ericsson AB.

Honorable mention also went to “Analyzing a Printed Circuit Board with Oxide Residue Contamination” by Wade Goldman, The Charles Stark Draper Laboratory Inc. His co-authors included Andrew Dineen, Hailey Jordan, Curtis Leonard from The Charles Stark Draper Laboratory Inc.; and Edward Arthur, Raytheon Company, Space and Airborne Systems.

The papers were evaluated on their technical content, originality, test procedures, data used to deduce conclusions, quality of illustrations, and the clarity and professionalism of writing as well as value to the industry.

### WINNING PAPER

#### “Reducing Dust Deposition on Electronic Equipment by Optimizing Cooling Air Flow Patterns”



Chen Xu



Jason Stafford





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# An Emerging Computer Scientist on IPC and STEM Opportunities

by **Patty Goldman**  
I-CONNECT007

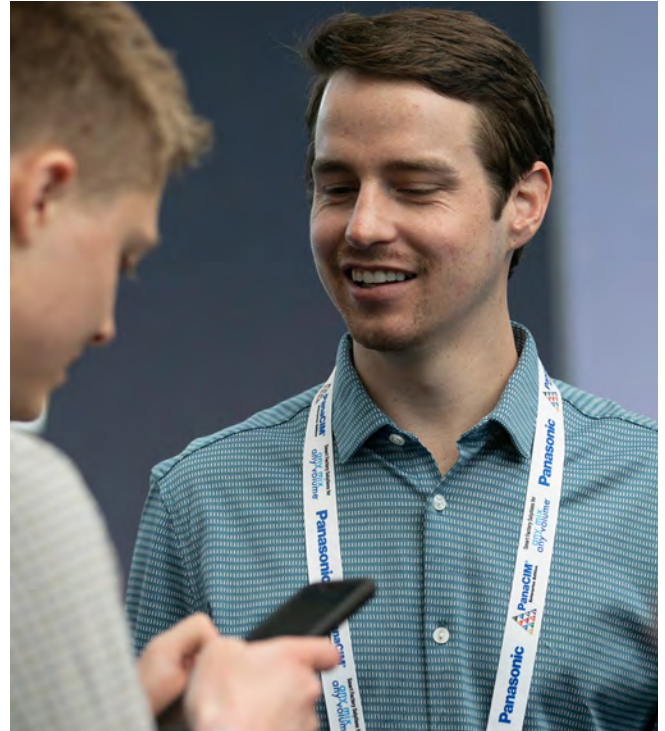
Scott O'Hair, a computer science student at Sacramento State University nearing graduation, discusses his participation in the IPC STEM Student Outreach program and panel, the new IPC Student Chapter, and plans for the company he started with a business partner—Irijule—through their Kickstarter project turned product—TheoryBoard.

**Patty Goldman:** Scott, it's nice to meet you. Can you start by telling me a little bit about yourself and your background?

**Scott O'Hair:** I'm a computer science student at Sacramento State University, and if anyone's thinking about a computer science degree, I recommend it. It was actually recommended to me, which is how I ended up there, and I really like it. I graduate in the spring of 2019, so in a couple of months, I'll be done with school. I also have a side project, which is actually more of a main project since I work on it daily until around midnight, which is the TheoryBoard. It's a music controller that allows people to play music without knowing the rules of music theory. It maps out all of the chords and melodies of a scale onto buttons, and then people can freely play as if they knew what they were doing. My business partner, Evan Swanson, and I launched it on Kickstarter last year, we did \$250,000 in sales and became a company.

**Goldman:** Just like that?

**O'Hair:** Pretty much just like that. We were thrown into it. So, in the past year, we've been ramping up production, and now we've actually done all of our tooling. We finalized all of



Scott O'Hair

our designs and are moving into production. Right now, we're waiting on shipping.

**Goldman:** You're doing all of this while you're going to school?

**O'Hair:** I'm like a workaholic, and I'm having fun. I have my laptop with me, and I'm doing both at the same time.

**Goldman:** That's great. So, you're here at IPC APEX EXPO 2019 with the group of high school STEM students. How did you get connected with the IPC STEM Student Outreach program?

**O'Hair:** How I got into this is weird. Part of being a student at a university and having a separate business venture, if I have a question, I will wander the halls and look for a professor who







might know how to answer it. It's the engineering building, so you can go from floor to floor and pretty much see any type of industry that you want. One day, I was trying to bother a professor, but he didn't show up. By chance, another professor felt bad for me and let me come and sit in his office, and it turned out to be Professor Heedley at Sacramento State who does IC design. We started talking, and I told him I like PCB design, so he connected me with Professor Moyer who is very active in the IPC. So, I got connected by randomly trying to bug a professor, and Professor Moyer introduced me to all of this.

**Goldman:** That's great. Are you walking around with the students today?

**O'Hair:** I'm not, but I was on the panel this morning. As far as I know, I think I can do what I want (laughs). Hand soldering sounds the most fun, so I think I'm going to hang out at the soldering station.

**Goldman:** Still, that was an interesting story of how you came to be here today.

**O'Hair:** It was a long-winded story, but yes, that's what happened. I don't know if any of your readers are students, but my advice is to bug professors. They like when people are motivated and want to learn, and they're not as annoyed as you think they are. Sometimes they might be, but you have to read them.

**Goldman:** If somebody says no, you don't run and hide and never talk to anybody again.

**O'Hair:** Right. I've probably knocked on 100 doors, and that has maybe only happened once.

**Goldman:** And I take it that you learn something from every door you've knocked on and every person you've talked to?

**O'Hair:** Yes. You learn and become friends with them. It's a really good way to meet people.

**Goldman:** So, it serves as networking.

**O'Hair:** It was very uncomfortable for me at first, and I did it out of necessity, but now, I do it for fun. Just to talk to people and pick their brains; it gets easier.

**Goldman:** So, you're going to be graduating this year, and then you're going to work on your company. What is it called?

**O'Hair:** Irijule.

**Goldman:** So, you're making one product right now. What's your next product going to be?

**O'Hair:** We have other things in the pipeline.

**Goldman:** What are you thinking about?

**O'Hair:** We developed a good stack of intellectual property, and now we're asked, "Where can we make a different version of this controller?" by which I mean essentially write little to no software. We have one where I have the board layout almost done, so we'll start prototyping it soon.





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**Eric Camden**  
Quest for Reliability



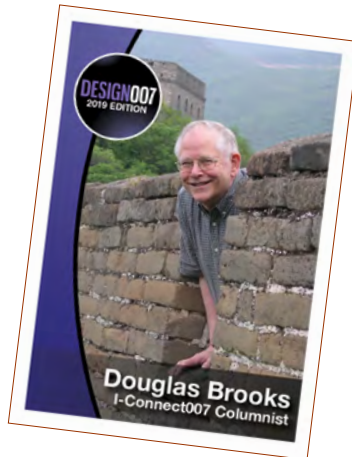
Industry experience:  
**19 years**

Areas of expertise:  
**Assembly process and related failure modes**


Day job:  
**Lead Investigator, Foresite Inc.**

Beer or wine?  
**Beer**

Sage advice:  
**Life is uncertain, always eat dessert first**



**Douglas Brooks**  
Brooks' Bits



Industry experience:  
**50+ years**

Areas of expertise:  
• **Signal Integrity**  
• **Trace current/temperature relationships**

Sage advice:  
**Your integrity is the most important asset you have**

Favorite quote:  
**If you can't stand the answer, don't ask the question**

Favorite musician:  
**Dave Brubeck**



**Jennie Hwang**  
SMT Perspectives & Prospects



Industry experience:  
**40+ years**

Areas of expertise:  
• **Innovation, strategy, & growth**  
• **Electronic packaging/SMT manufacturing & reliability**

Day job:  
**CEO of H-Technologies Group**

Favorite quote:  
**"It is no use saying, 'We are doing our best.' You have got to succeed in doing what is necessary." -Sir Winston Churchill**

Achievements/awards:  
**Women In Technology International Hall of Fame**



**Tim Haag**  
Tim's Takeaways



Industry experience:  
**38 years**

Areas of expertise:  
• **PCB design**  
• **PCB design tools support & training**

Day job:  
**PCB design consultant**

Who inspires you?  
**Those who will put the needs of others before themselves.**

Favorite movie:  
**"A Beautiful Mind" or "Star Trek II: The Wrath of Khan" (mood dependent)**

We're hoping to release two additional products this year. One is an accessory to our current product, and the other one is a standalone product. The TheoryBoard is a great-looking device. I also have some background in artsy videography and graphic designing from when I was younger, so it's a very aesthetically pleasing device. We went into it with product design as a huge priority. We wanted to make it look good.

**Goldman:** Would you prefer that STEM be called STEAM (science, technology, engineering, arts, and math)?

**O'Hair:** No, I wouldn't. I think it should be left out, but even if you're involved in STEM, you should have an artistic side. You should be well rounded. I think it should just be a part of the territory of being creative.

**Goldman:** Changing subjects a bit, I understand there's a new IPC Student Chapter at your school.

**O'Hair:** Yes, I think we're number one on the entire list.

**Goldman:** How did that come about? Was it through your connection with Professor Moyer?

**O'Hair:** Yes, it was 100% through him. I think he spoke with people at IPC, and they said, "You're a professor. Let's start something."

**Goldman:** And it all connected.

**O'Hair:** Yeah. And he's very motivated to get it going, so that's definitely the driving force.

**Goldman:** I believe John Mitchell's announcement today means it has officially started. Do you have anyone in your chapter?

**O'Hair:** Yes, we recruited people. The way this all came about was we were in a circuit board design class with Professor Moyer, and he recruited from there. I said, "Sure, I'll be a part of it." We started talking more for 10 minutes



after every class. Then, we started and elected officers. I have a couple of classmates who are in it, and I have a lot of people on my hit list that I'm going to recruit.

**Goldman:** Great. In fact, I believe you are the president of that chapter. So, what is this chapter going to be doing?

**O'Hair:** We're working that out now, but a lot of it is getting people to understand what IPC does. Also, IPC has massive connections with industry, and college students don't have any connections with industry. I think a big thing that we can hopefully get going with the trajectory of the IPC Student Chapter at Sacramento State University is connecting student engineers with industry professionals.

**Goldman:** So, you're hoping to get some mentoring, internship, and career opportunities?

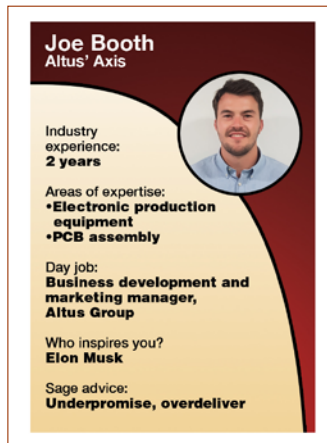
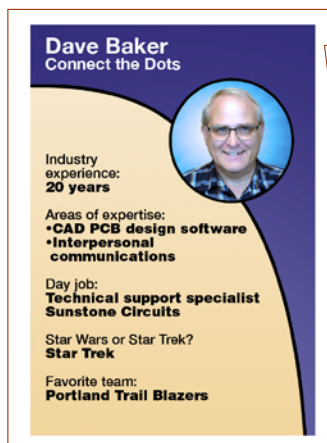
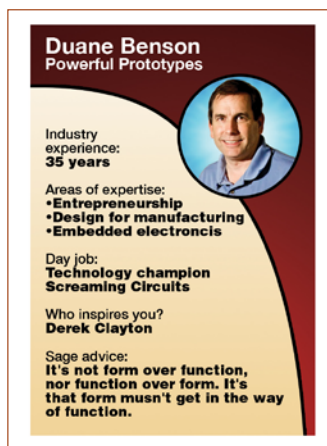
**O'Hair:** Yes, but even just exposure like going to a factory or job shadowing at a site to see what the company culture is like. Those are big things when you don't know any of that, which I would say most students don't. Most probably work in customer service or as a restaurant server.

**Goldman:** Right. And you don't see the inside of factories when you're driving around, so you don't know what goes on behind the scenes there. There is a whole world out there in every industry.

**O'Hair:** Absolutely. Exposure is huge. That's probably the main thing that I want to start is opportunities by partnering with businesses and industry professionals to give students exposure. I also think we're planning on entering some electronics or robotics competitions.

**Goldman:** That all sounds good! Thanks so much for your time, Scott.

**O'Hair:** You're welcome. **\$ET**



# Congratulations to the Three Recipients of the Dieter Bergman IPC Fellowship Award



by Patty Goldman  
I-CONNECT007

The Dieter Bergman IPC Fellowship Award is given to individuals who have fostered a collaborative spirit, made significant contributions to standards development, and have consistently demonstrated a commitment to global standardization efforts and the electronics industry. Each recipient will be eligible to bestow the Dieter Bergman Memorial Scholarship upon the university or college of his/her choice.

This year, there were three recipients: Lionel Fullwood, WKK Distribution Ltd.; Constantino Gonzalez, ACME Training and Consulting; and Cao Xi, Huawei Technologies Co., Ltd. In conversations with them we learn their interests in the industry and what drives them to contribute above and beyond.



Lionel Fullwood



Constantino Gonzalez



Cao Xi





## Lionel Fullwood, Long-time IPC Member and Contributor

Lionel Fullwood is a technical director at WKK Distribution Ltd. in Hong Kong and is responsible for research and development of new products and processes and technical problem resolution for clients. He has presented numerous technical papers and is involved with more than a dozen IPC standards development committees including chairing the Design Committee and D-31 Rigid Printed Board Design Subcommittee. In 2003, Fullwood was presented with an IPC President's Award, and in 2013, an IPC Hall of Fame Award for his contributions to IPC and the electronics industry. He holds a B.S. degree in chemistry from Brigham Young University in Provo, Utah, and a master's degree in molecular biology and polymer chemistry from the University of California, Irvine.

**Patty Goldman:** First of all, Lionel, congratulations on receiving the Dieter Bergman Fellowship Award. First, could you give us a little background about yourself?

**Lionel Fullwood:** Well, here's the short version (laughs). I was born in Liverpool, England, during the bombings of World War II, shipped up to Scotland, and spent the first few years of my life there. Then, I went back to Liverpool until I was 18, and came to America for school. I got involved with PCBs in the military in 1963 with Autonetics in Anaheim, California—a division of North American Aviation—and we made the guidance systems for minutemen—two and three Polaris and Poseidon submarines. I just fell in love with the technology. Finished my undergraduate work at Brigham Young University in Provo, Utah, in chemistry, I did my graduate work at the University of California—Irvine in biochemistry, organic chemistry, and ended up in chemical engineering. Since '63, I've been in PCBs, and from 1982 until 2017, I was in Asia.

**Goldman:** Since '82. Wow, that's 35 years in Asia.

**Fullwood:** The last 19 years I was the technical director for WKK—the technical marketing arm of the Wong’s company in Hong Kong.

**Goldman:** So, just over half of your time in Asia was with WKK. What other companies did you work with?

**Fullwood:** I started with Wong’s PTH, and took them from single-sided through double-sided and multilayers. I went from there to Singapore and was responsible for building the Data General facility—129,000 square feet. I took a slight sabbatical in Portugal to build a PCB factory for the Portuguese government. Let’s just say that they didn’t like Englishmen and Americans, so I went back to Asia in the Philippines. There was a double-sided and multilayer facility in the Philippines—79,000 square feet. From there, I finally ended up back with WKK.

**Goldman:** Now, how about your involvement with IPC?

**Fullwood:** That started in either ‘63 or ‘64; I can’t remember exactly. I think it was ‘64 where I started going to meetings every year while in the U.S. When I was in Asia—the period until coming back to WKK, which was in the early ‘90s—I didn’t have time for it. There was too much involvement, but since then, I’ve been actively involved in IPC. Even when I retired,

I did a fair amount until personal things took priority.

**Goldman:** What areas in IPC and what sort of committees and subcommittees were you involved with?

**Fullwood:** All the way from placing technology to photoresist; photoresist was a real key with me. As technology progressed into HDI, I chaired and published the initial handbook on HDI technology in the ‘90s. I would say that was my critical interest because my graduate work ended up basically being polymer chemistry and engineering, so a lot of my work has been involved in that. Over the years, I have authored 37 technical papers or publications, and I have four patents. So, it has been a fairly fun period, and I have enjoyed my career all my life. It hasn’t been a “I have to support the family” situation. I really love the work.

**Goldman:** And you were also chairman of some committees or subcommittees?

**Fullwood:** Yes; for example, 2221, 2222, 2226, etc.

**Goldman:** What advice would you give to people who are just starting to get interested and involved in committee work?

**Fullwood:** With committee work, you don’t always see the results of it right away like you do when you’re working on a project in the lab or something like that. But when you start seeing the generation of a document that is able to transform the technology, then it really is fun.

**Goldman:** I agree. Also, I always tell people, “You can make an actual contribution. As long as you don’t just sit there like a bump, your thoughts, help, and time are worthwhile. You can have an effect.”

**Fullwood:** It’s like the old adage; if you are only looking out for yourself and look inward, you don’t grow very much. But as you look



Hamed El-Abd, Lionel Fullwood, and Gene Weiner.





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outward and ask, “How can I contribute?” — whether it’s socially in the community or with IPC—when you are contributing and giving of yourself, I think it makes your life a lot more rounded and a heck of a lot happier.

**Goldman:** And you can learn so much.

**Fullwood:** Yes. One of the nice things about the interaction with the committees is that you always learn from your peers, and you can have some fun doing it. As you know, I was always the person that corrected the English grammar. That has been a problem for me ever since I came to America. Americans neither speak English nor do they speak correctly (laughs).

**Goldman:** I suppose it must grate on your ears every time.

**Fullwood:** It does. Quite often, when you find a technological niche that you can not only contribute to but also be involved in (e.g., correcting the way the documents are written), that’s a major contribution. And it became more and more significant all the time that I was working in Asia. For example, I speak Cantonese fairly well. I understand Mandarin a little, but when you’re working in a foreign language and recognize the way Americans have constructed a lot of IPC documents, they’re not well understood by people whose native language is not English. One of the things that I also contributed to was saying, “We need to make these documents so that people who speak foreign languages can understand them too.”

**Goldman:** Were you involved in the translations?

**Fullwood:** No, when you get into the technical jargon, translation is a lot more difficult. I was well aware when IPC set up their China office—the people over there do an excellent job. I did assist them in clarification and understanding what the English documents said so that they could be translated into Chinese.

**Goldman:** Any other words of wisdom for our readers?

**Fullwood:** I would say particularly to people who seem to want to either play games or make a bunch of money in a business situation, there is nothing more enjoyable than being involved in the development of something technical that you can not only wrap your brain around but also your hands.

**Goldman:** And the satisfaction that comes from accomplishing something significant.

**Fullwood:** Yes, it’s absolutely satisfying. While I have minimized my involvement in the last year, I still do some consulting to keep my brain functioning, and I still think it’s a lot of fun.

**Goldman:** Good to hear. One last question: Have you chosen a university for the Dieter Bergman Memorial scholarship?

**Fullwood:** Yes, I chose Brigham Young University in Hawaii and specified “for an underprivileged Pacific Rim kid in the sciences.”

**Goldman:** That’s very nice. Thanks so much for your time.

**Fullwood:** You are very welcome, Patty. **SET**



Brigham Young University-Hawaii has been selected for the Dieter Bergman Memorial Scholarship. (Source: byuh.edu)





## Tino Gonzalez, Training, Consulting, IPC Master Instructor

Constantino (Tino) Gonzalez is president of ACME Training and Consulting and also an IPC master instructor for IPC-A-610, J-STD-001, IPC-7711/7721, IPC-A-600, and IPC-WHMA-A-620. A member of dozens of IPC standards development committees, Gonzalez currently chairs the 7-31 Acceptability Subcommittee, served as co-chair of the 5-22A/7-31B/7-31F Synergy Committee, and is vice chair of the 7-31BV IPC-A-610 Automotive Addendum Task Group. He has received numerous committee service awards and was presented with an IPC President's Award in 1994. Gonzalez holds a B.S. in mechanical engineering, and an MBA.

**Patty Goldman:** Tino, congratulations on your Dieter Bergman IPC Fellowship Award.

**Constantino Gonzalez:** Thank you. To be honest, I prefer other people that work with me to get it. They will get more enjoyment out of it than me because I am not one for public praise.

**Goldman:** Well, I think you're about to get honored in front of a whole lot of your peers at IPC

APEX EXPO 2019. I presume you're going to attend?

**Gonzalez:** I will. I'm going to go because I met Dieter Bergman 30 some years ago when IPC used to be in their first offices. We used to work long hours together there. He was very knowledgeable, a hard worker, and committed to the quality of the standards, which I always admired. I had the pleasure to know him, talk with him, and be a good friend of his. And I am also a good friend of his son, David Bergman.

**Goldman:** Yes. I'm sure that was figured into the award. They feel that you are worthy of his work ethic, or have a similar work ethic to Dieter.

**Gonzalez:** For 37 years, I worked on IPC-610 and other standards. I always thought that I had an obligation with the electronic industries around the world. They were standards that fit the budget and were fair and real in the circumstances. If you talk to some of my peers

that worked with me, they will tell you that I was very stringent and outspoken; I had no filters. They can talk to you about me in that way because I demand it. One time, somebody told me they didn't like a standard, and I asked, "Do you have a better one? If you don't have a better one, then you don't have the right to critique." We need people that come and contribute.

**Goldman:** Can you tell me a little bit more about your background and how you became involved in the industry and with IPC?

**Gonzalez:** I came from Panama on a scholarship from the government to study engineering. I went to college, worked during the night from 11 p.m. to 7 a.m. while I went to college. During my last semester, I met the sweetheart of my life, which is the mother of my six kids and thirteen grandkids. And, I started working with Control Data Corporation as an engineer.

I had an awesome boss and a good mentor; his name was Daniel Miller. He gave me the freedom to be who I wanted to be. I remember he asked me to develop one of his standards for SMT that didn't exist. So, I went, and believe it or not, I met Mr. Alan Seabright working on

the first edition of IPC-A-610. He was retiring and asked, "Can you be my successor?" I said, "Sure." Then, I became the chairman of the IPC-A-610 committee. After 30+ years, I was ready to step down and let new blood come in. But, for 30+ years, I was the chairman of IPC standards and worked on most of the standards from IPC. I never miss a meeting; I always go.

I've seen IPC go from the little office in Chicago to what it is today. Now, I am the vice chairman of the automotive addendum for IPC-A-610 and J-STD-001. I couldn't be the chairman because I came up with that idea, so I brought that idea to David Bergman. He said, "Go ahead," and gave me all the support. We are going to be releasing the second draft now of the automotive addendum at this meeting. As a vice chairman, I don't tell the other two joint chairmen how to do things. Most of the time, I am the guy behind the scenes supporting their efforts and helping out.

Last year, I was appointed by the attending members to be the chairman of CQI-17 from the Automotive Industry Action Group (AIAG). We are revising that document, which hasn't been revised for almost 10 years. And that is the standard the automotive industry uses for soldering systems. We are going to meet January 28 to go through the second meeting. So, I am chairing that, and I'll tell you that IPC has been really good to me. On the IPC website, I talked about how IPC impacted my life. IPC has given me global exposure, a lot of knowledge, and a big network. IPC has a lot of benefits, and I made a career out of it.

Today, I'm considered an expert on standards in the world—process control, the acceptability of PCBs and PCAs, etc. I do shows, workshops, certifications, and all of that stuff. I now spend my time helping companies to be more efficient, reduce scrap, implement DFM, and all the good things that go with that. Further, I do a lot of consulting for process control, line efficiency, and disputes between customers and suppliers. I also do audits. I do not advertise myself on the internet. My work is the advertising; I still have a simple website—nothing fancy, and I haven't found the time to finish it—but I don't need it because I stay pretty







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busy with referrals from existing customers to new ones.

**Goldman:** Tino, you're a grandfather, and you've spent a lot of years in the industry and at IPC. What makes you keep doing it?

**Gonzalez:** The love for it. My father always said, "If you want to do something, do it right. Otherwise, go find a tree, and by sitting down, you will doing something with value added. You will get more out of it than not doing your job completely 100%. If you do love something, do it right; otherwise, get out of the way." And that is my philosophy.

I love standards, and there are two reasons why. One, because nobody pays attention until it is too late. You have scrap in front of your face, or you have a problem, and two, because nobody respects it. The only time people pay attention to the standards is when it is time to shed cost and they're trying to find if there is some kind of miracle.

I really love what I do because I see the importance of workmanship standards and the impact they have on companies. It can lead to

a lot of rework and ridiculous acceptability. If you don't put the real standard there, it can cause companies a lot of money. And that's one of the things I've always been concerned with. The other thing is you learn a lot. IPC has been a school for me. Some people don't realize that, but I did.

**Goldman:** I was just going to ask you what advice you would give to a person, especially a first-timer, at a meeting? But you may have already answered that.

**Gonzalez:** I know many of them through my business, and I have incorporated them into IPC committees. Some of them are chairmen now. One thing that I tell them very seriously is if you are going to come, make a difference. They are good friends of mine and customers too. There are opportunities to participate in IPC standards has a lot of benefits, especially on the technical side, but there's also a lot of potential for networking and personal growth.

Many go just to go, but I don't get that. For the people that I coach and mentor, I tell them you come to IPC and make a difference. I'm constantly bringing people to IPC committees, especially from Latin America. I explain how they should behave themselves, what they need to know, what they need to do. Some of them work for Toyota, Continental, INVAP SE, Flextronics, GPV, and many more.

**Goldman:** One final question, Tino. Have you chosen a university for the Dieter Bergman Memorial scholarship?

**Gonzalez:** Yes, it is the school where I graduated—South Dakota School of Mines.

**Goldman:** That's good to hear, and again, congratulations. Thanks for your time.

**Gonzalez:** I thank God for everything I have become. Thank you, Patty, and bless you and everybody that has helped me to get here. I bet Dieter is in heaven working with God's standards. **\$6T**





## Cao Xi, Technical Director, IPC Board of Directors

Cao Xi is the technical director of the advanced process lab and director of the assembly process technology committee at Huawei Technologies Co., Ltd. He has more than 20 years of working experience in DFM, DFR, and process technology research and application of electronics production including consumer electronics. He has presided over a number of high-density assembly technologies projects (package, module, board, and system level) from R&D to mass production. He is the main contributor of Huawei's electronics assembly technology platform and DFX standard system. He has 10 patents in the electronics assembly field, is chairman of the IPC 7-31 Standard Working Group in China, and is also a member of the IPC Board of Directors.

**Patty Goldman:** Cao Xi, congratulations on receiving the very prestigious Dieter Bergman IPC Fellowship Award. Please tell me about your background. How did you get into the

field of electronics, and how long have you been involved with IPC?

**Cao Xi:** After my graduation, I first joined Delta Electronics Inc. where I worked for four years as a manufacturing engineer focusing on the electronic assemblies. After that, I joined Huawei and have been working here for around 20 years. During that time, my focus was on electronic production design and manufacturing, and I am now the technical director in this field. I first contacted IPC 20 years ago when we joined as their member because we use lots of IPC standards, so we wanted a connection to IPC.

**Goldman:** Do you work with IPC mostly in China?

**Xi:** Yes, mostly. But I am also on the IPC Board of Directors.

**Goldman:** Will you be at IPC APEX EXPO 2019 to receive your award?





**Xi:** Not this time, but I will normally visit the United States two or three times every year because we have lots of our vendors and partners there. I will also join the IPC Board of Directors meetings when I'm there.

**Goldman:** What IPC committees and standards have you been most actively involved in?

**Xi:** For standard activities, I was primarily involved with IPC China organization 10 years ago and I am also a member of IPC's Asia committee. At that time, Chinese companies were users of IPC standards. We wanted to understand the standards, so we translated the English version into a clear Chinese version. This was a huge translation task where I worked very closely with David Bergman to set up a list of the most frequent used standards.

Also, as a manager, I encouraged my team members to join this task, so about 10 people from my group—which is mainly from my team in Huawei—became involved in this translation task. Many of our team members had close working relationships with IPC staff mostly in Asia. This is how I began. At that

time, we mostly focused on the standards related to quality such as IPC-610.

For the second stage, we had many questions on the standard relating to our daily work, and sometimes also from our customers and vendors who had questions for certain rules or numbers relating to the standards. Thus, we began to collect these questions, and have an annual meeting with IPC staff and sometimes standards editor to have a discussion on how to optimize these standards. In some cases, we'll do DOE tests to verify which one is more reasonable.

Since then, many new standards and groups had been set up. For example, we have a team focused on CFX—the standard related to smart factory. Inside our factory, we have some demo lines to explore ways to set up connections between different machines for data sharing. Based on these connected demo line, we can collect raw data to perform root cause analyzes for quality issues and also to optimize our efficiencies.

We have discussed this with David Bergman, VP of IPC, as I think this is also an important direction for the next few years for IPC. So, we're working very closely with this



IPC group, and this is the current focus for my team members and me to be involved.

**Goldman:** What is your advice to a person just starting to get involved with IPC and standards in our industry?

**Xi:** For me, we get many benefits from IPC standards and related activities. From my understanding, IPC is an organization supporting the whole electronics industry and building up a huge collection of standards. Based on these standards, thousands of companies are able to save costs and share the platform, which is an industry move for them. This is a very important platform for standards.

For a new person joining this industry, my first suggestion is to spend time reading the important IPC standards. They should know the basic requirements for quality, design rules and guidelines, reliability test methodology, etc. There's lots of knowledge embedded in these standards because it is the output of the industry for many years.

Secondly, IPC is a leader in improving or optimizing standards. If newcomers want to join these activities, they will have a connection to IPC and a window for them to connect to the whole industry. I think this is a good platform to share and discuss ideas, and to optimize standards and rules.

**Goldman:** And I always tell them that they will learn so much when they get involved.

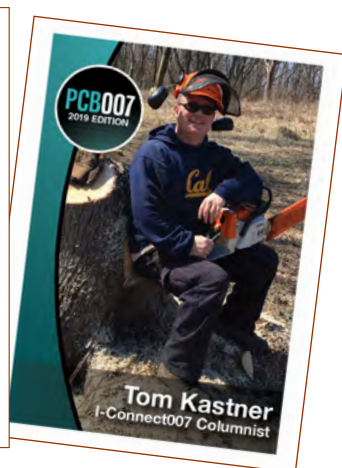
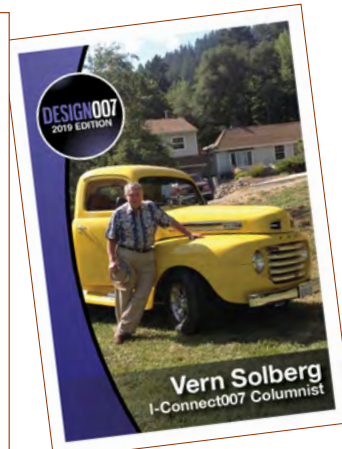
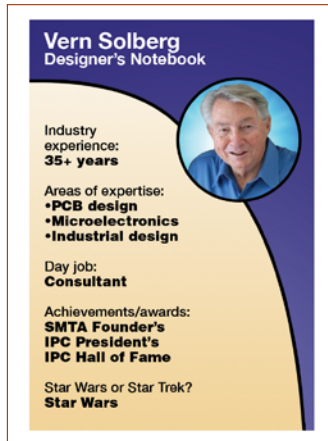
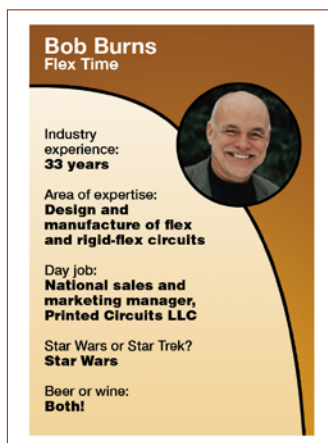
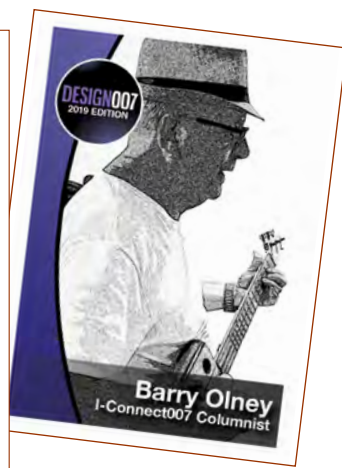
**Xi:** Yes, they will.

**Goldman:** Have you chosen a university for the Dieter Bergman Memorial scholarship?

**Xi:** Yes, I chose The Hong Kong University of Science and Technology. The university has a Center for Advanced Microsystems Packaging, and I like it.

**Goldman:** Good to hear, and again, congratulations. Thanks for your time.

**Xi:** Thank you. **S&T**







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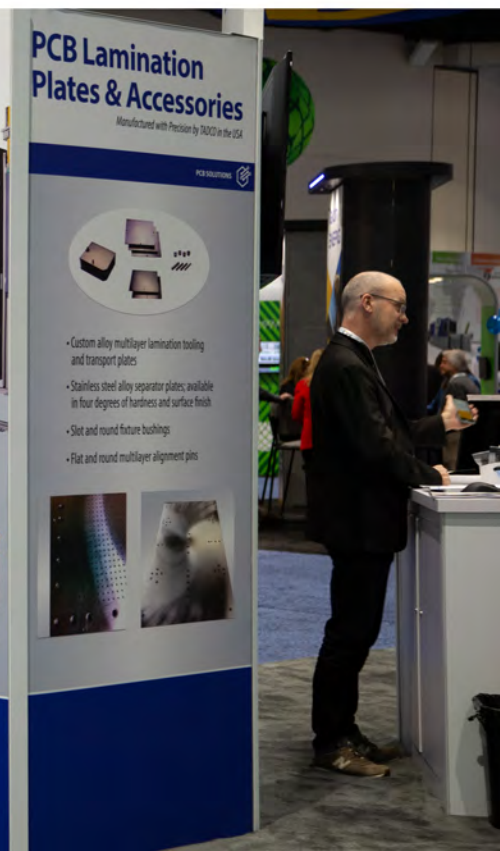


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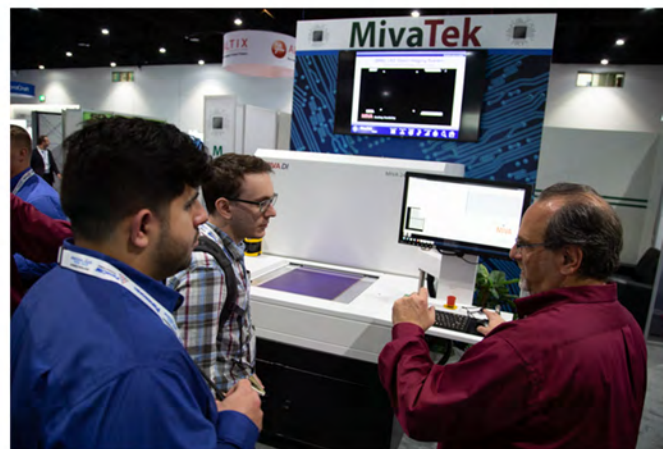
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# Two Full CFX Demo Lines at IPC APEX EXPO 2019

by **Dan Feinberg**  
I-CONNECT007

Dan Feinberg spoke with David Bergman—IPC VP of standards and technology—at IPC APEX EXPO 2019 about CFX, IPC’s Connected Factory Exchange software used for machine-to-machine communication. With 80+ companies now supporting CFX, IPC set up two full lines to be demonstrated at the show.

**Dan Feinberg:** Hi David. It’s good to see you again. Let’s talk about CFX. This is something that has been relatively new to me, but as I’ve looked at it over the past couple of days knowing that you were going to be here, it’s something that I find very interesting. And I see a tremendous amount of interest in it here at the show. Why don’t we start by assuming that there are a lot of people like me who don’t know what CFX is in detail.

**David Bergman:** It’s good to talk to you, Dan. At its basic level, CFX stands for the Connected Factory Exchange. What it’s intended to do is facilitate machine-to-machine and machine-to-manufacturing-execution-systems communication and become the common language between these systems. IPC CFX will serve as the foundation of Industry 4.0, the fourth

industrial revolution. Industry 4.0 and smart factories are used somewhat interchangeably.

What the industry recognized was there had been multiple attempts over the years to facilitate machine-to-machine communication. IPC’s Board of Directors brought up 4.0 at one meeting about four years ago, I didn’t know anything about it. I read a lot—as much as I could find on Google—and it seemed like a marketing effort. When they said, “We have to get equipment companies all to agree to work together and have their machines speak the same language,” I thought, “There’s no way that’s going to happen.” Some companies have been working on 4.0 implementations, but they want you to buy everything from them.

Three years ago, we had a meeting in Las Vegas. I entered the meeting room, and approximately 80% of the world’s capital equipment companies were represented. They were serious about finding some way to work together. What had changed was the customer demand. The customer said, “This is needed. We’re not going to buy everything from you. We need to mix and match. It’s too difficult to get our machines to communicate with each other now, so we need a better way. We need a standard.”

Now, there were standards out there, but the committee concluded these were inadequate.





“We’re trying to do more. There’s more IoT coming and communication taking place. We need something that’s going to be somewhat future proof. How are we going to approach this?” They spent over a year looking at different formats because there are many communication standards out there. SEMI has one, IPC had CAMX—which the committee considered upgrading—so there were a number of formats out there. But the question was, “Will the options be sufficient? Which direction should we go?”

After a year and a half, they finally decided. They needed something secure because everybody was worried about data security in their factories. They also wanted a protocol that allowed customizing a piece of equipment such as adding a bar code reader or vision system or not. They wanted to have all these options to communicate to the system. The committee concluded to look at the approach as a series of building blocks or in other words to say, “I have building blocks. We’re going to create messages for all of these different blocks.”

The building block concept gained traction. We ended up selecting AMQP, which is a communication protocol that the banking industry uses. We felt it enabled significant security. AMQP also doesn’t require a broker, so every message doesn’t have to go through a central

point. You can have machine-to-machine communication, which is perfect for the smart factory. If solder paste inspection equipment can talk to a solder paste printer, one can start to build feedback loops.

**Feinberg:** Or maybe even a soldering robot such as those being shown here.

**Bergman:** Correct. They felt that they were onto something. As they started to talk about individual messages, more companies became involved and the standard began to take form. The industry worked very hard on this. Some key events made this significantly easier than previous efforts. We had a company develop a software development kit (SDK). The SDK makes it easier for a company to output CFX messages—to go from their native machine language into CFX.

Our first CFX demonstration was at IPC APEX EXPO 2018 because we wanted to show CFX was possible. At that time, we managed to show 22 companies with 34–40 machines on the show floor pushing CFX messages to the cloud and back to attendees’ cellphones so they could monitor what was going on. If you went to one of the booths and they had a piece of machinery speaking CFX, it was running or simulating running. When they opened it, it

stopped. They could monitor the status using their mobile device. All of those messages being pushed with CFX.

The success of the 2018 demo launch created even more interest. We've implemented more CFX demonstrations now, including in two in Europe and one in China. All along the process, we've added companies that have expressed interest. Right now, we have about 80 companies that are listed on our IPC-CFX website that indicate they support the CFX effort. Several large OEMs have allowed us to include their logo as they believe CFX will help their company implement Industry 4.0. So, we're building awareness.



**Feinberg:** Of the 80 supporting companies, do those include the ones I'm seeing at IPC APEX EXPO 2019 with CFX supporter signs?

**Bergman:** Similar to 2018, any company with the signs in their booth is most likely pushing messages actively to the cloud now, and people can see that there are messages coming. We have about 80 machines at the show this year as part of this demo. In 2019, to make it more challenging, the committee said, "We'd like to do actual manufacturing." As we were lining up companies they said, "We don't just want one line; we want two lines." So, now we have two lines. One is a CFX only line, and the other is a combination of two IPC standards—CFX and IPC-Hermes-9852. The equipment requirement doubled for everything.

**Feinberg:** If you have one that's running the two lines, do those standards compete in any way? If so, how is that handled?

**Bergman:** It's interesting because we talked a lot about that. The second standard is IPC-Hermes-9852. The Hermes standard was developed by the equipment industry to replace an

old SMEMA standard. SMEMA had written a standard that intended to cable machines together for them communicate. What they wanted to do is to go from proprietary cables to Ethernet cables and software. Their 9852 is

now approved as an IPC standard as well. The equipment companies wanted to show both standards at the same time. So, the committee created some messages within CFX to accept that. Meanwhile, Hermes is intended for line control. It offers some interesting advantages such as facilitating reduction

of required barcode readers and facilitating some enhanced automation from equipment with less processing power such as conveyors.

**Feinberg:** Or less storage.

**Bergman:** Yes. CFX pushes a lot of data, so conveyors may not be able to accommodate this, but Hermes makes it easier for conveyors.

**Feinberg:** And CFX doesn't?

**Bergman:** Not at this point. In the CFX line, the conveyors are not actively communicating between the two machines, so you need barcode readers between each machine.

**Feinberg:** Is there an advantage to using both CFX and Hermes?

**Bergman:** Yes. You can eliminate the need for the extra barcodes readers; you don't need one for each machine. You can just have one at the beginning of the line and another at the end of the line, and then Hermes messages take care of the rest. We wanted the industry to understand that we didn't see these as competing, but being complementary.

**Feinberg:** That's a key point because there's a huge difference between having the perception





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of something that would slow it down and having to wait until they fix it versus something that is actually slowing the process; two plus two is five.

**Bergman:** Correct. They also wanted to highlight that both of these documents were industry-controlled standards—free and open—and not controlled by any particular company. That became an integral point to the IPC Committee efforts. We’ve been very happy with the results. IPC had never set up a manufacturing line at a show, so that was fascinating in itself. And we did not just set up one line but two with all of the associated problems that the industry faces. The end goal is that if these pieces of equipment speak the same language, it should really help with plug and play. If you get a new piece of machinery and it’s CFX compliant, the company already knows what messages can come out.

**Feinberg:** That is a huge advantage. Very significant.

**Bergman:** You don’t have to have custom interfaces written for each one of them. It should only be a matter of doing minor configurations.

**Feinberg:** And you don’t have to have an idle new line sitting there waiting. Especially if it’s a line that requires some kind of expert installation from the manufacturer, and the manufacturer is saying, “When are you going to be ready so that we can do the final tweaks and get it running?” Well, it’s plug and play. You’re ready. That’s a huge advantage.

**Bergman:** And we have just scratched the surface. Of all the presentations that we talked about, CFX is the foundation for the house. We have the language. The industry is going to take advantage of the common language and be able to make the line do the cool things, but that’s not really the standard. How do you use those messages, feedback loops, and better communication in your execution systems and dashboards to help people be more productive? The possibilities are endless. If you get a chance to see some of dashboards, one of the participants in the demonstration has taken their factory system and is receiving CFX messages, so you can see what’s going on in the line. It’s fascinating.

**Feinberg:** The huge advantage is consistency. I’ve tried to see your lines this morning know-





ing we were going to be talking about this, but I couldn't get near them.

**Bergman:** They were very busy. Just before I got here, I walked over there to see what was going on, and it's still pretty packed. What's fascinating is the attendees are very engaged. We have somebody from each company because every piece of equipment is from different companies. They're talking about how it works for them and what they're doing. From the interaction between the attendees, I think it's a great demo.



**Feinberg:** I spoke to a couple of people in some of the booths that had the CFX supporter sign. I said, "I see you're supporting CFX." I'm saying that not knowing a whole lot about it and hoping they don't ask me much. I'd be much better off now than I would've been three or four hours ago. Not only did I get an affirmative, but a strong affirmative about how happy they were to be supporting CFX. In one case, it was the owner of the company. Overall, it sounds impressive. You have come a very long way from the first demo last year. It's something to be very proud of.

**Bergman:** Definitely. The standard was approved a couple of weeks ago. The ballot closed, so the first revision was done by the middle of January. I still have to get it published, but it's approved and done, so 1.0 is fixed. We have several hundred messages—over 300 now—and we recognized that there are more messages needed. But at some point, we created a parking lot for new messages as the committee agreed we needed to get the main core settled. We thought, "We have 70% done, so let's vote on this. This will add high levels of value. People can start working on their implementation. Then, we can add extra messages." Now that version 1.0 is done, work will begin on the additional messages.

I'll tell you an even a cooler thing that blew

us away and has been super exciting. The SDK was written in .NET Windows format. So, this comes with a higher processing overhead. You need a Windows system to run that. We have one member who makes soldering irons that said, "I can't put a Windows system in my soldering iron. How am I going to do that? I can't afford that." So, this company went out, got a small chip, and used Linux.

**Feinberg:** I was just going to mention Linux.

**Bergman:** And they put it in the cartridge so now they can track how long the cartridge has been used. They even have a feedback mechanism to the operator that says, "You're making a good joint," or, "You're making a bad joint." You can then also communicate that to your execution system.

**Feinberg:** Not only that, but they have open-source software, and for a small company who likes that can say, "You did this really well, but we like this better. We're going to do some writing."

**Bergman:** Correct. Another interesting point to share is you mentioned robots earlier. Because I needed duplicates for each piece of equipment, I couldn't get a commitment for a second solder paste deposition system. One member vol-



unteered, saying, “I have a little robotics system that can do paste dispensing quickly. How about that?” I figured, “Why not? Let’s see. If nothing else, we can look at how flexible CFX is. I can have a robotics solder paste dispenser and put the board into your SPI machine.” It has been fascinating to see creative people figuring out what to do.

The latest thing that happened on Monday was they said, “Now that IPC-CFX is approved, we have the SDK for .NET. There are other software platforms or formats. Why not get an SDK to help people that want to implement in those formats?” So, we have task groups building CFX SDKs for Linux, Python, and LabVIEW, and I have to get a leader for one that will be JavaScript. We will kick those off, and that will expand the universe of potential equipment that can quickly implement CFX messaging.

**Feinberg:** Impressive.

**Bergman:** It’s really that easy and has been fun to see.

**Feinberg:** I have to come over and see it. For this particular show, one of the things they’ve asked me to do is do a write-up of my impressions. Obviously, I’ve been at every show since day one. I’m seeing more positive stuff at this show so far than maybe ever, such as CFX and robotics. Also, some of the people I’ve interviewed have said that their confidence in the economy is good and they haven’t been better

in many years. None of them are necessarily connected to each other, but it’s a confluence where four to five years ago, everything seemed to be a little more negative. Usually, there’s some negative and some positive. This year, everything I’m hearing is positive. I’d like to congratulate you.

**Bergman:** That’s great to hear. Thanks, Dan.

**Feinberg:** We have some huge changes coming to our industry, and all of it positive. This sounds like something that’s going to add to the consistency and reliability of the equipment, consistency, and reliability of the end products of IPC members, and with things like autonomous driving coming and 5G enabling medical electronics, the timing couldn’t be better.

**Bergman:** Within two years, I think you will start to see some amazing smart factory stuff. There are already people starting to show a lot of it, and I believe CFX will help that expand exponentially. We are already getting glimpses of this. As we reach out to raise IPC-CFX awareness, we have heard from other manufacturing industries, saying, “Wait a minute—secure communication? Breaking down your processes into building block messages? That could work for our industry. Can CFX be in the metal forming industry? Can I do this in the automotive industry?” Yes, you can. It’s likely that this model may extend activity beyond just electronics manufacturing.

**Feinberg:** We saw some things at CES like autonomous farming because 5G is enabling us to do so much more. We’re entering a different world, and it’s not bad either; it’s good stuff. I’m going to come by as soon as your line gets a little bit smaller for a firsthand demonstration. Thank you so much for talking to me. I appreciate it.

**Bergman:** Thanks, Dan. My pleasure.

**To find out more about IPC-CFX, [click here.](#)**





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# What Does CFX Mean to You?

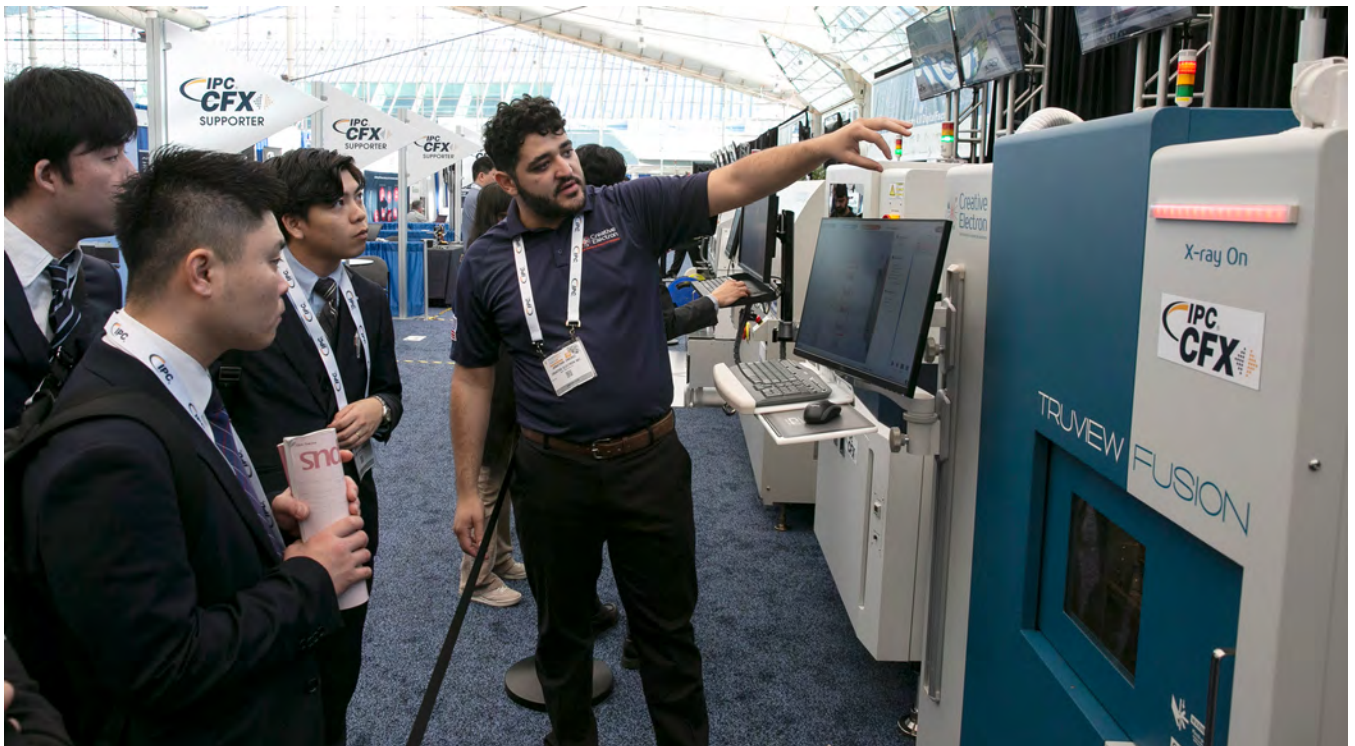
by Nolan Johnson  
I-CONNECT007

The Connected Factory Exchange (CFX) initiative was a highlight at IPC APEX EXPO 2019 with two full demo lines. While wandering the show floor, I asked six different companies with CFX supporter signs two questions: “What does supporting CFX mean to your company’s product lines specifically?” and, “Do you see this as a competitive advantage?” Read their responses here.

*Editor’s note: Responses have been edited slightly for clarity.*

Griffin Lemaster  
COO, Creative Electron

The most important part of the whole concept of CFX and Hermes, in general, is communication between machines. CFX is establishing that vertical communication up to a cloud where each machine can display the defects that are passing, and you can see what other machines are getting defects and passing. It actually works in a two-way street where we can take data from the AOI, for example. We have an AXI system, so we can take data from the AOI that says, “There might be an issue on U21, pin two.” Then, we can target that with





the X-ray and take an image with that. CFX and Hermes pushing that sharing of data and the collaboration that happens between companies, which is what we're primarily using in getting involved with it now.

It's in the very earliest stage. We're glad to be part of it in this initial push of this technology and communication. We think it's going to benefit the entire industry. If you have an entire line that can communicate seamlessly, then you have self-healing lines and the ideal factory 4.0 that we're striving for. This is the right stuff in that direction. We're happy to be here experiencing that and learning as much as we can at this point.

There's still a ways to go. Hermes has nice horizontal communication where you can program a board size and change all the systems down the line to the right board size. You can transfer barcodes all the way through it, so it has that horizontal level of communication through the lines. When you combine CFX and Hermes, you get a very good mix of the data. It facilitates data collaboration between different vendors.

The next step going forward for R&D is taking that data even farther than just collaboration by fusing it together and coming out with actual items. That's what we hope to see going forward and happy to be part of it. CFX is the built highway, and now we have to figure out how to move things forward to the next step.

I think a lot of companies are going to get involved with this. Some companies have shown their own communication protocols already. They have a full line, so they have communication protocols, but equipment manufacturers that don't share data with each other need something like CFX to transfer that data. CFX gives a good head start on it, especially for the rest of the manufacturers who don't have entire lines. So, it is a competitive advantage for us that we are Hermes and CFX compatible. Now, you have an additional feature you can offer your customers and with more capabilities, whether it's display,

communication between machines, or making actual items. It's definitely a competitive edge.

We have some data, but not nearly enough. There's not nearly enough data being shared right now between systems in a line. You're getting a pass-fail rate and a number to look at, but you don't have any analogous data; it's just a yes or no. You get bad or good. That's the data being shared right now.

As an X-ray company, we must have an AOI expert explain exactly what is going on with data, to what degree it is bad, and that data all has to be combined later. We're not there yet with data sharing. The biggest hurdle we see coming that needs to be overcome is data sharing between companies—how much data we can share, and the right platforms to share data.

### **Chris Dayney and Monte Cramer** Training team leader and apps engineer, Fuji America Corporation

**Chris Dayney:** We have a lot of interest from our customer base for a factory standard related to Industry 4.0. CFX meets the need for a smart factory as a machine vendor through universal connected factory communications. It means there's a new IPC standard, and we're going to continue to be involved.

For us, it opens the doors to more data collection, IoT, IoM, and more of what our customers want especially related to CFX, which is the bigger focus for us. It's no longer a pro-



proprietary, must-have-our-software situation, which is what we want them to have, but we understand the universal language is a long time coming. Overall, we're very excited to be involved with it and participate. From the ground up, we don't want to wait; we want to jump on now.

**Monte Cramer:** If we were doing a head-to-head competition with somebody and we were both at the same level, the company with CFX would get bought. It's a competitive advantage to have your machine use the standards that everybody else is using when you present it to a customer.

**Dayney:** IPC being involved is also key. If it was just a software supplier trying to develop this, then we'd be locked into one software supplier for this. CFX as an IPC standard is going to be a big point. Factories are going to need or want that speed.

## Hoa Nguyen CTO, Metcal

For us, CFX is critical. It is a standard of communication protocol. Once you go to your customer, you don't have to have the

hassle of an NDA. Before that, every time you'd use your proprietary format, you'd have to deal with an NDA. That's the fact, and we've been through it with a few customers. Now, with this IoT communications protocol being standardized, it will make that process easier.

Since we can standardize that, customers like Apple, Plexus Corporation, etc., don't have to create 10 different applications or pull 10 different types of data from 10 different devices. Now, they can use one software, which can be developed internally by them, and they can deal with the communication protocol. We have that back and forth exchange of information; we've been doing that for the last four or five years. We tried to get some feedback from customers, and the proprietary format is always a hassle for us.

The next thing is data analytics, which, we need to work closer to customers to understand their expectations and what they're looking for. Whatever we do here, it will definitely be value added for our customers without a doubt. Also, I absolutely see it as a competitive advantage because there are some cus-





tomers from the military and medical industries. They want information and data; that's the first thing they usually say. So, if we can provide a set of data, that will definitely be an advantage.

**Ryan Dai**  
**Senior software engineer, Test Research Inc.**

First, I'm in R&D and am actually writing for a different standard. In our company, another R&D person is responsible for CFX but he couldn't be here for now. Our company would like to participate in both CFX and Hermes because we think it's more like a trend. When we want to reach Industry 4.0, maybe we should give more information between each machine or in the server, so that we can correct it, and it becomes more automatic. I think we wanted to join this protocol because we want to achieve Industry 4.0 as well.

I think it's more cooperative than competitive right now. We've cooperated with both sides together and had a very good experience. And I think it's better for Industry 4.0; we should achieve this goal together. Which brand of which machine should be decided by our own client, but if the clients decide to buy local machines and we can attune CFX and Hermes together, I think that's important for us to cooperate with each other.

**Juan Briceño**  
**Sales manager, Americas, Viscom AG**

What we get out of CFX is the interoperability. We see the machine-to-machine interoperability regardless of brand as an important part of their business and making sure we can play in an environment. We see this as something that we need to do to be a part of where the industry and equipment are going. We need to play well together with everybody.

**Scott Thompson**  
**Site support manager, Yamaha**

The Japanese JARA standard will primarily be our standard. CFX will be supported for our international work, and most of our work with CFX is being driven by customer demand. **S&T**







by Pete Starkey  
I-CONNECT007

Introduced by IPC President and CEO Dr. John Mitchell, JB Straubel, CTO and co-founder of Tesla Inc., discussed the company's history in a keynote presentation entitled "Accelerating and Disrupting Innovation: The Tesla Story."

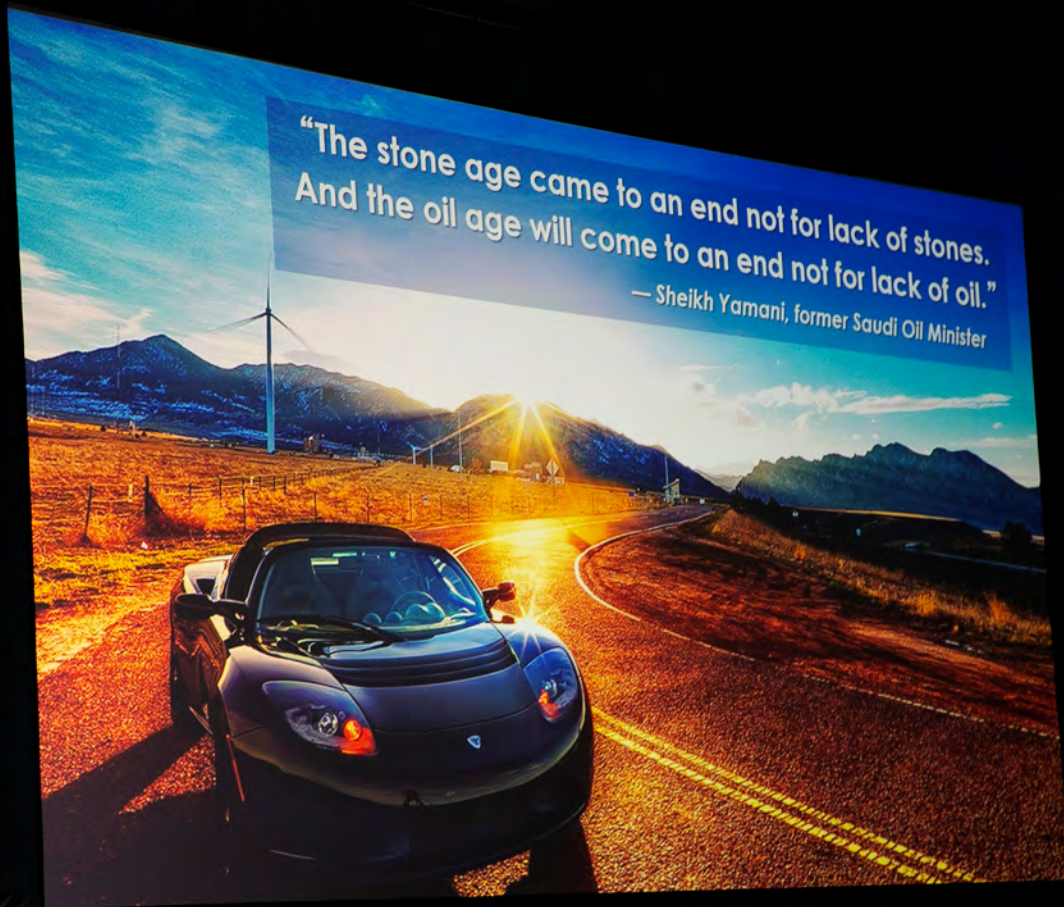
"What problems are you solving, and what are you passionate about?" were his opening words as he described how Tesla had been inspired to tackle the issue of the exponential growth in atmospheric carbon dioxide pol-

lution from fossil fuels in transportation. "It will force us to reinvent a lot of the technology around us; it's up to engineers to fix the problems!" And he reminded the audience how incredibly thin the atmosphere actually is—the majority of it lying within 10 miles of the Earth's surface.

The time was right for Tesla to bring new thinking into the concept of electric transportation when the company observed the quantum shift in battery technology from lead-acid to lithium-ion that had been driven by developments in portable consumer electronics. Until







that time, electric vehicles had been slow, heavy, and short-range, and fell into the golf-cart category. Anything beyond that had been the territory of hobbyists, and the mainstream automotive industry had dismissed the opportunity to move away from the internal combustion engine.

But in 2002, having recognised the potential of lithium-ion power storage to enable electric cars to become accepted as premium vehicles, the Tesla team committed to realise that potential. When they announced their first Roadster prototype in 2005, they were dismissed as a crazy startup company. Their reluctance to follow the rules led them to be labelled as disruptive by those whose attitude would stifle innovation.

But there was no rule book! Their Model S was designed from scratch and built around a battery pack that formed the floor of the vehicle with its centre of gravity below wheel-spindle

height, which resulted in consequent benefits in road-holding stability and safety. New electronics were developed to control the electro-mechanical functions, and a decision was made to eliminate buttons, knobs, and switches—to make everything software-controlled.

Further, Tesla built their own version of a gigantic iPad right in the middle of the car. Additionally, they made the whole car connected via a built-in 3G modem so that they could integrate the whole user experience as well as update firmware and software and perform maintenance functions by two-way data transfer. This gave them a flying start into the technology of intelligent vehicles and autonomous driving.

Tesla quickly gained credibility as a serious manufacturer of automobiles, and the precedent that they had set resulted in the automotive industry moving quickly to jump on the electric vehicle bandwagon. But what about





the supporting infrastructure? Straubel drew an analogy with the cell-phone network. Electric cars needed a network of charging stations strategically placed to optimise their range and provide a fast-charge facility. None existed, so Tesla decided to do it for themselves, beginning in California in 2012, and expanding rapidly in the U.S. and subsequently in Europe and Asia.

And how do they support the demand for batteries as the production of electric vehicles grew? Straubel made it clear that they so far represented less than 0.4% of the global motor industry. But Tesla predicted that even by 2020, there would be a requirement for 50 GW hours-worth of battery capacity. Once more, they took the initiative to build their own battery factory called the Tesla Gigafactory with a high level of being environmentally conscious, knowing that certain essential materials might



be difficult to source. To partially mitigate this, Tesla founded a new company named Redwood Materials for the recycling of post-consumer electronics waste and the recovery of usable materials.

Straubel closed with a quote attributed to Sheik Ahmed Zaki Yamani: "The Stone Age did not end for lack of stone, and the oil age will end long before the world runs out of oil!" **S&T**





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# Best Technical Paper Award

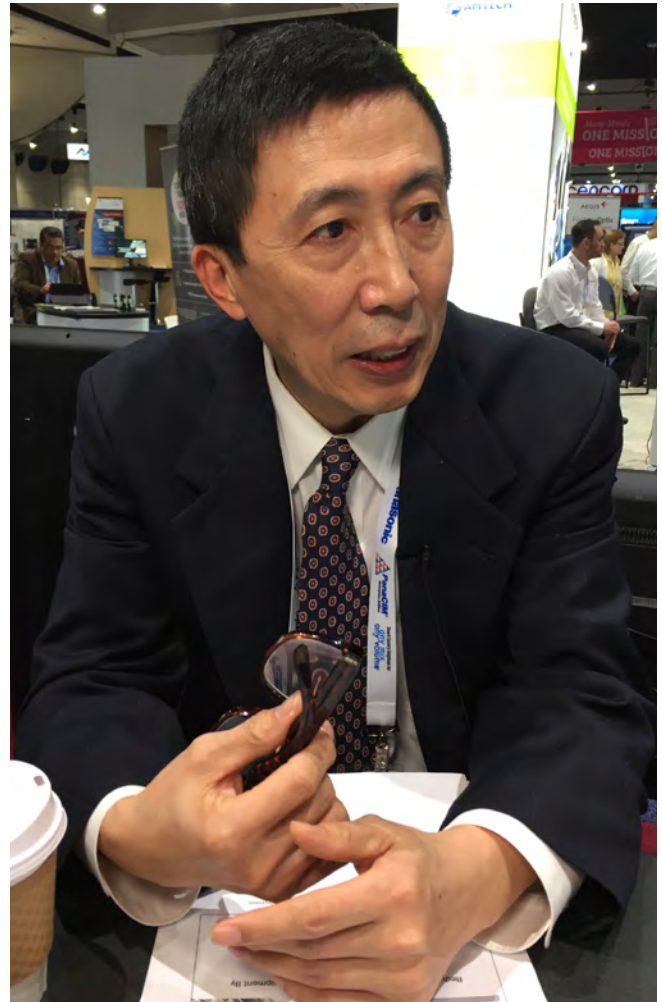
by Happy Holden  
I-CONNECT007

I sat down with Dr. Chen Xu, distinguished member of technical staff at Nokia, and one of the authors of the paper titled “Reducing Dust Deposition on Electronic Equipment by Optimizing Cooling Air Flow Patterns,” which won the Best Technical Paper Award at IPC APEX EXPO 2019. Xu’s co-author is Jason Stafford, a researcher at Imperial College London.

**Happy Holden:** I’m here with Dr. Chen Xu about his award-winning paper. First, can you tell us a little bit about yourself to put everything into perspective?

**Chen Xu:** Thank you very much. You may not remember this, but we have run into each other quite a few times. I started in ‘97 in Bell Labs, and I left Lucent to join Cookson Electronics for approximately four years between 2002 and 2006. Then, I came back to Lucent again. I was a member of the technical staff, and eventually a distinguished member of the technical staff at Lucent (which became Alcatel-Lucent), and eventually Nokia a couple of years ago. My responsibility is understanding material-related issues impacting the performance and reliability of our products. I received my Ph.D. in Germany many years ago in physical chemistry, so that is my background. More recently, I have focused on environmental impacts on product performance and reliability such as corrosive gas, temperature, humidity, and particularly the dust of the environment. That was the focus of my research for the last 10–15 years.

**Holden:** What led you to do this particular research in dust deposition on electronic equipment? Was that an assignment from Nokia or just the evolution of all of your work?



**Xu:** It’s more of an evolution of all of my work, and also, as I said, I have been working on improving the reliability of our products specifically related to the impact of environmental conditions. We have products deployed worldwide. We make the telecommunications equipment, so we have products deployed everywhere in all kinds of environments. As you can imagine, some environmental conditions in developing countries such as India and China are not as good as in North America. The dust concentration can be very high, and you are probably familiar with the air quality index, which among others, is also a reflection of the dust concentration in the environment.



For instance, one of the air quality index measurements is PM 2.5 concentration, which is the concentration of dust is smaller than 2.5 microns. You also have PM 10, which is the concentration of dust smaller than 10 microns. In a few minutes, we will talk about why PM 2.5 is more important for electronic products.

Due to the ubiquitous presence of dust in the environment, it's unavoidable for the dust to deposit onto the electronic equipment. Even so, our products are designed to tolerate certain degrees of dust deposition. Following the Telcordia standard, we need to do a qualification test to make sure our products can survive in certain dusty environments. If the dust concentration becomes too high, then it can impact the quality, performance, and reliability of the product. There are different ways how the dust can impact the reliability of electronic products mechanically, chemically, or electrically.

For instance, if you have some moving parts like fans in the electronics, the dust accumulation can interrupt the motion of the moving parts. Also, it can impact the heat transfer, thermal performance, and cooling efficiency of your product if you have dust deposition on a heat sink. In terms of the chemical way, because of the composition of the dust, typically, it contains ionic compounds such as salt or some other corrosive agent, which can corrode your product.

Electrically, for a water-soluble compound like ammonium sulfate, nitrate, and any kind of ionic salt compound, when the humidity becomes high enough or above the critical relative humidity, the ionic compound can pick up moisture from the environment and form an electrolyte solution, which is conductive. This can cause impedance reduction on the surface and all kinds of issues such as electrical failures and so on.

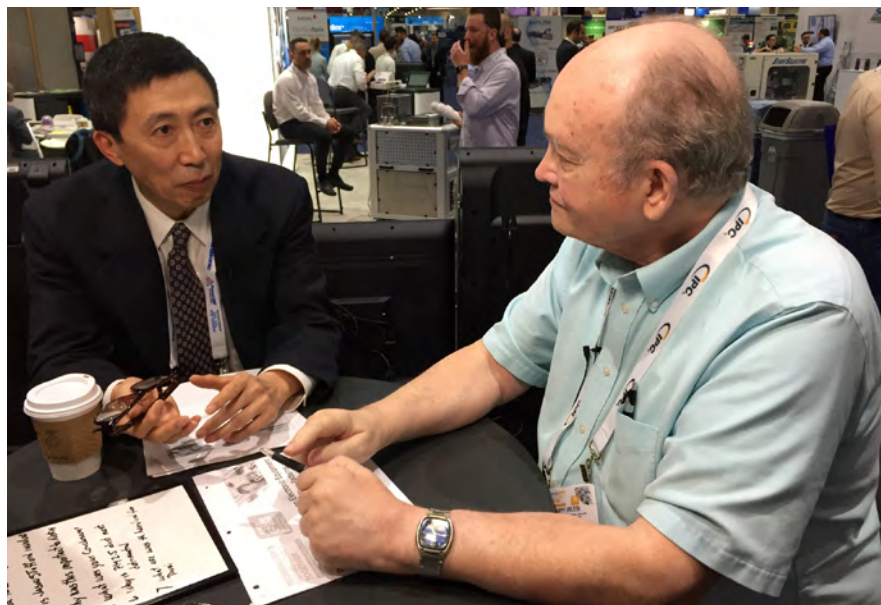
**Holden:** I know what you're talking about. I once had to troubleshoot a problem at Hewlett-Packard when various RF amplifiers they had designed

would stop working at certain times during the summer. When we finally found out that the designer didn't take into account the humidity effect of the dielectric constant of laminate, and when the humidity got very high in Louisiana, the dissipation factor would go up. Then, the RF amplifier wouldn't work, but if we took it back into the building in a laboratory, then it would work. But out in the field, it wouldn't. It wouldn't work only during certain times of the year. Not taking into account the humidity effects on laminate materials is why people use conformal coatings and things like that.

**Xu:** Right. That is exactly the problem we are facing with the dust. It very often becomes a no-trouble-found issue. In the lab, when you get the product returned, you do diagnostics, and it works just fine. Eventually, we realized if you run the testing at the high relative humidity, then you can reproduce some of the failures.

**Holden:** Now, it's interesting because you have a co-author—Jason Stafford of Imperial College London. Since he's not here, can you explain his contribution?

**Xu:** When I first observed this preferential deposition of dust at certain locations of the circuit board, we had some speculation on why it happened. Then, we thought we needed



to talk to the expert in fluid dynamics and do some experiments, modeling, or simulations to see whether our speculation was valid. We went to Jason because he has a Ph.D. degree in fluid dynamics, and he's very familiar with simulating flows and doing experiments to understand how air flow affects dust deposition. We started to work with him a few years ago, and he did most of the experiments in Ireland when he was with Nokia. Then, he left to join Imperial College London.

**Holden:** Was there a practical result of all of your research and work in terms of how Alcatel-Lucent and/or Nokia designed or redesigned some of their equipment?

**Xu:** Yes. If you look at the industry, there are multiple ways developed to deal with the dust issue because it's a problem for everyone in the electronics industry. However, it has become more of an issue recently due to more deployments in challenging environments and the increasing circuit density and decreasing pitch size, making the electronics more susceptible to dust. When you have a little bit of dust deposition, due to fine pitch, the effect of dust becomes even more pronounced. Also, as an end customer, there's a trend to use less-controlled environments. It takes costs and energy consumption to have good environmental control. You need to do the heating, you need good air circulation, and you need to filter the air because dust affects everything such as cooling efficiency, for example.

To save ongoing operating costs, the end user would like to reduce the control of the environmental conditions. So, the equipment is increasingly exposed or deployed in the environment with high dust concentration. There are multiple ways to mitigate the dust effect on the electronic equipment, but no one has looked at air flow and the impact of the air flow pattern on the dust deposition rate. What we found is that if you can optimize the air

flow pattern, you can decrease the dust deposition rate by a factor up to 100 for PM 2.5 particles. That's quite a large impact.

**Holden:** I read through your paper and recognized that everybody knows that because of cooling, you have to have good air flow and circulation, so you put in a fan and it's finished. It's interesting that you explain how air is not just air. Air has things in it; not just humidity, but particles, which we call dust. And it comes into your device, it has an impact. You illustrate a lot of different parts of the electronics and where dust settles or attaches, so it's not just air. Of course, dust can mainly be an insulator, but it could be an electrolyte, which is probably even worse.

**Xu:** Exactly.

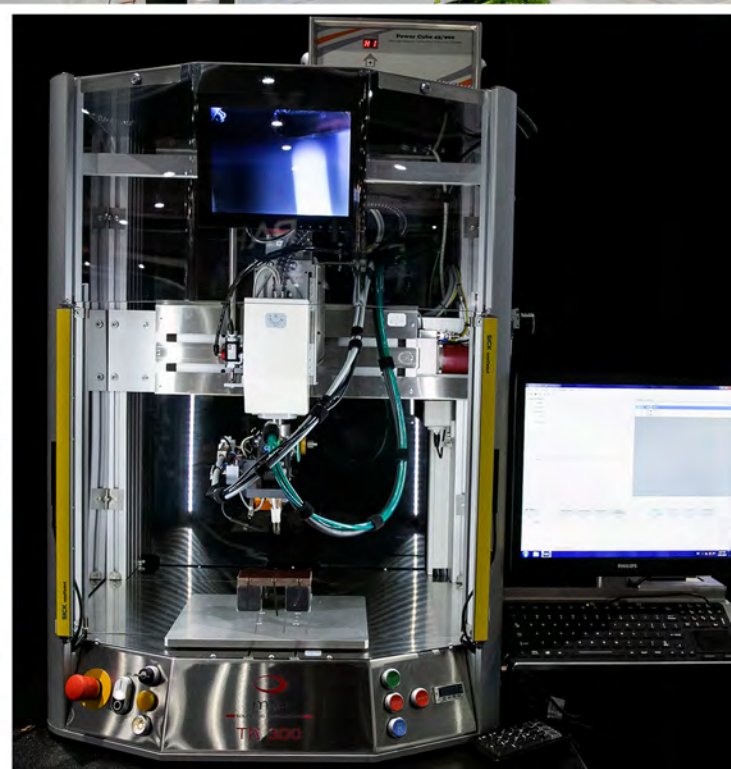
**Holden:** It's not a trivial problem because all of that will interfere with its cooling effect, and that's what you're trying to do. Out of all of this, what were some of your conclusions?

**Xu:** Basically, what we're trying to do is optimize the air flow to minimize dust deposition. At the same time, when we optimize the air flow, we don't want to reduce cooling efficiency. That's what we have been able to achieve in our work by optimizing the air flow to reduce the dust deposition rate by a factor of 100. The impact on cooling efficiency is as little as 1–5%; our simulations have demonstrated that, which is the major result of our experiment.

As I mentioned before, some of the key conclusions include that we observed localized dust deposition at a certain location. Through our work, we have demonstrated this highly increased preferential deposition is related to the air flow pattern. Specifically, if you have air flow parallel to the circuit board, dust deposition is very low, but if it becomes perpendicular to the circuit board at an inclined angle,











then the dust deposition rate becomes much higher. When you design your circuit board or cooling process, you need to take that into consideration. You want to try to keep the flow parallel to the surface as much as possible.

Also, people typically use air filters to reduce the dust infiltration. One of the downsides of using air filters is the air restriction due to the air filter. You will have some air pressure drop. For example, in a typical air filter with a MERV rating of 7 or 8, we will reduce the air flow by a factor of 50%. That would certainly reduce the cooling efficiency. Then, you need to increase the air flow and increase the fan speed, which means higher energy costs.

When you select an air filter, you have to strike a balance. On one hand, you want to have a high enough efficiency to reduce the dust concentration, but you also want to minimize the air flow reduction. It's about finding a balance between the two. What we also found was that when you use air filters, it actually increases the dust deposition by changing the air flow pattern, so you have to consider that. This work also highlighted the importance of maintaining a low concentration of PM 2.5 dust at the data center, and the most practical and cost-effective way for removing PM 2.5 is at the room level.

**Holden:** I think it's important for a lot of designers of mechanical enclosures to read this paper because in your conclusion, you prove that putting in air filtration could actually make the problem worse instead of better. That is not common knowledge or intuitive.

**Xu:** Correct.

**Holden:** Why did you single out 2.5 microns?

**Xu:** There were a couple of reasons. If you look at the composition of the particles, typically, the particles can be divided into larger and smaller

particles. The larger particles are typically particles larger than 2.5 microns, and smaller particles usually have a diameter smaller than 2.5 microns. That's called PM 2.5, and PM 2.5 particles tend to contain a higher content of water soluble ionic compound between 20–50%. For the larger particles, the ionic compound content is much lower between 5–20%. Due to the higher ionic content, PM 2.5 particles are more detrimental to electronics than the large particles. Also, PM 2.5 particles are much more difficult to remove than large particles using air filters. Thus, PM 2.5 particles have the most impact on electronic products.

**Holden:** Thank you for your time, Dr. Xu. Hopefully, we can look forward to publishing your paper eventually. If people don't have the IPC proceedings and want to contact you, where can they reach you?

**Xu:** You can email me at [chen.xu@nokia-bell-labs.com](mailto:chen.xu@nokia-bell-labs.com).

**Holden:** Thank you very much. It was good to see you again, and congratulations on your award.

**Xu:** Thank you. S&T



## Student Photo Contest

### Meet Our Volunteer Student Photographers



I-Connect007 invited three local college students to participate in their photographic coverage of IPC APEX EXPO 2019 at the San Diego Convention Center. These student photographers from The Art Institute of California–San Diego and San Diego City College roamed the show floor and captured a variety of photos that were submitted to the I-Connect007 Student Photo Contest. After the show, the I-Connect007 team reviewed their photos and selected the top submissions.

It is a pleasure to introduce our volunteer student photographers, announce the photo contest results, and showcase their work. So turn the page and enjoy! ➡



## Student Photo Contest Winner



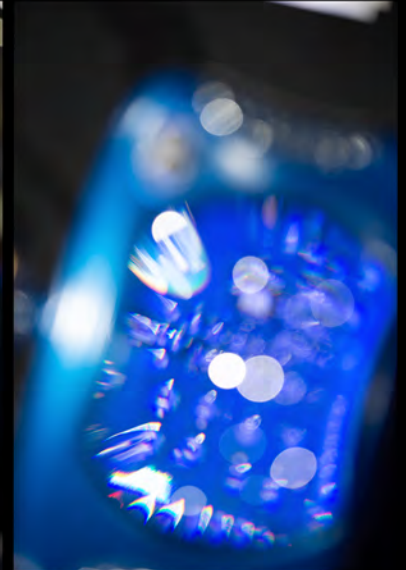
### Stephen Howell

Stephen Howell left a career teaching writing to pursue his interest in the photographic and graphic arts. Currently, he is a full-time student at San Diego City College as well as a freelance photographer. When he's not in the field shooting or working with Adobe Suite, you can find him spending time with his wife and daughter.





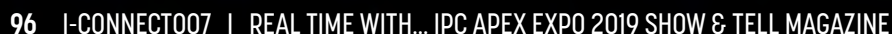
## Photographs: Stephen Howell







Creston Bailey is a photographer from Texas living and working in San Diego, California. He is a digital photography student at The Art Institute of California–San Diego. Primarily a portrait photographer, he wanted to expand his portfolio to include event photography and volunteered his efforts of the I-Connect007 Student Photo Contest.

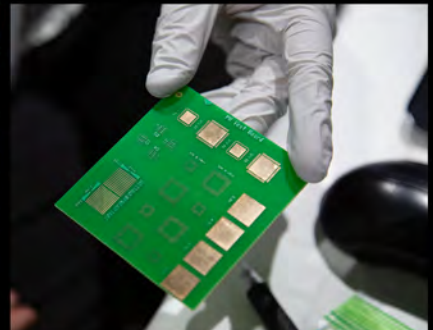




# Student Photo Contest Runner-up

## Alex Dungan

Alex Dungan is a photographer based out of San Diego, California, and a U.S. Navy veteran. He is currently finishing up his B.S. in digital photography at The Art Institute of California—San Diego and has been a member of the dean's list his entire academic career. Upon hearing about the I-Connect007 Student Photo Contest from a colleague, Alex entered to test his photographic skills in an area unfamiliar to him—trade show photography. When not in school or shooting commercial work, Alex can be found following his other passion—partaking in and photographing the lifestyle of a mountain climber.



# IPC APEX EXPO 2019: Perhaps the **Best One Yet**

by Dan Feinberg  
I-CONNECT007

I am just back from this year's IPC APEX EXPO show and gathering of the clan in San Diego, California. I have been to every one of these events since the first one in Boston over 20 years ago, and I feel that this just may have been the best one yet. The main show floor was absolutely full of exhibitors with no room for any additional booths, and the overflow hall was also well populated including a demonstration line showing the high value of IPC's Connected Factory Exchange (CFX).

The first thing anyone trying to measure the value of a trade show would do is consider the attendance. The pre-show events had good attendance, and the show itself started relatively crowded on day one; overall, attendance was good throughout the rest of the show. Even on the final day just a few hours before closing, there was modest but reasonable traffic throughout much of the show floor. When you would ask those who were exhibiting, "How is the show going for you?" 90% of those who we asked replied quite positively.

There was also a lot of new technology on display, and the level of automation and inclusion of robotics on exhibit has increased a quantum level in the past few years. The evolution-

ary advances in equipment were significant and valuable. The only group that indicated less than satisfaction—either through verbal statement or expression with booth attendance when asked—was some of the solder and wave soldering segment. Perhaps that is due to the reduced level of wave soldering compared to the growth in other manufacturing processes globally.

The keynote speech from JB Straubel, CTO and co-founder of Tesla, was interesting not so much due to the technology, but more about the story of the company's vision, startup, and navigation through the various pitfalls encountered when starting a new company using an evolutionary technology. He also addressed how Tesla tried to change the market direction of an industry with a long history, which was informative and fascinating.

The increasing value of IPC membership and its commitment to the industry was more evident this year than ever before. The increased

focus given to the new CFX standard and hard work by the committee as well as the commitment of IPC staff and members to other valuable standards, education, and the new IPC Student Chapters was quite evident. I hate to mention just a few of the key IPC staff and those from the industry that I found so committed to the industry because there are many oth-





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Contact:  
**Kurt Palmer**  
**714-379-5090**



On the show floor, numerous companies showed that they and their products supported the IPC CFX standard. If I were in need of new manufacturing equipment in 2019 and beyond, this is something that I would be sure to educate myself on fully before making any purchase.

There are going to be numerous articles regarding IPC APEX EXPO 2019, but one thing that stood out was the Executive Forum on Advancing Automotive Electronics. It is obvious that the last few years have seen a significant increase in electronic content in today's automobiles and that trend will only increase. The prediction is that soon 50% of the cost of an automobile will be due to electronic content.

This past year, the IPC Hall of Fame members set up a committee headed by Gene Weiner to inform and educate the industry on the trends, needs, and progress of the automotive electronics segment. A great deal of work went into arranging this event, and it was well worth the effort. The pre-show day of meetings does make it difficult for many to attend, but those who did found the event to be informative and valuable. The day-long series of talks by automotive and industry executives was especially quite valuable to those who plan on taking part in this growing market segment.

Next year's IPC APEX EXPO will also be in San Diego during the first week of February. I hope to see many of you there. **SET**

ers whose efforts are worthy of mention, but I had a chance to speak to Dr. John Mitchell and David Bergman at some length. I find that their commitment to the new standards and to educating the next generation of young technicians and engineers inspiring.

About the CFX standard, per IPC, "IPC CFX is an electronics manufacturing industry developed standard forming the foundation/backbone of Industry 4.0 applications. IPC CFX simplifies and standardizes machine-to-machine communication while also facilitating machine-to-business and business-to-machine solutions."

**Dan Feinberg**  
Fein-Lines

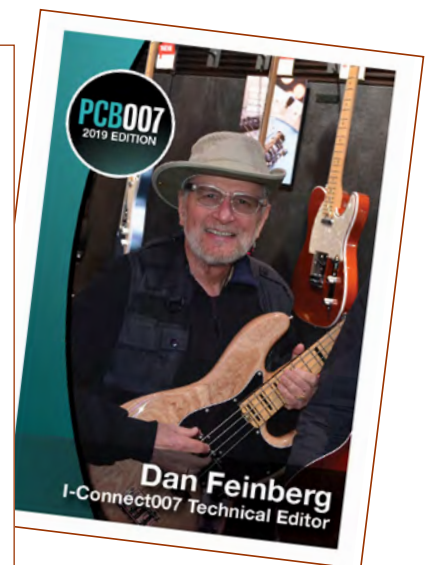
Industry experience:  
**50 years**

Areas of expertise:  
•**Management consulting**  
•**Technology transfer**  
•**New product market introduction**

Day job:  
**Founder and president**  
**Fein-Line Associates Inc.**

Alma mater:  
**USC**

Members only:  
**Dan is a founding member of the order of the PWB Dinosaurs (for long-time industry veterans)**







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# PERFECT SCORE:

## Hand Soldering at IPC APEX EXPO 2019

Ryosuke Matsunami  
Perfect score, first place

by Nolan Johnson  
I-CONNECT007

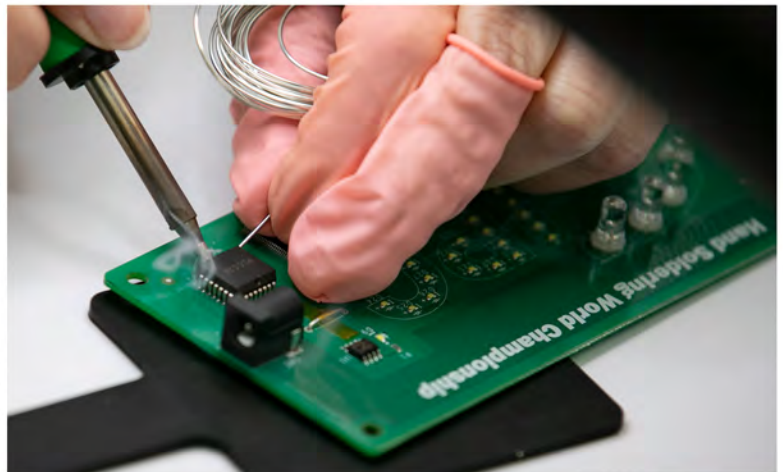
The first-ever IPC Hand Soldering World Championship and Rework Competition took place on the show floor at IPC APEX EXPO 2019 live on January 29 and 30 in San Diego, California.

The official competition roster boasted 12 competitors from around the globe including

Britain, China, France, Germany, India, Indonesia, Japan, South Korea, Thailand, and Vietnam. And the competition was close indeed. With less than 13 minutes separating all of the competitors' raw times, the competition director, IPC's Kris Roberson, commented that much of the final rankings boiled down to work accuracy.

The top three finishers, as announced by the competition judges were Le Van Linh,









Spartronics Vietnam Co. Ltd., Vietnam, claiming third place; Wenji Zhang, Jiangsu Jinling Mechanism Manufacture Factory, China, who took second place; and Ryosuke Matsunami, PWB Corporation, Japan, with a perfect score of 634, earning first place. Complete results can be found in Table 1. [Click here](#) to watch the award ceremony.

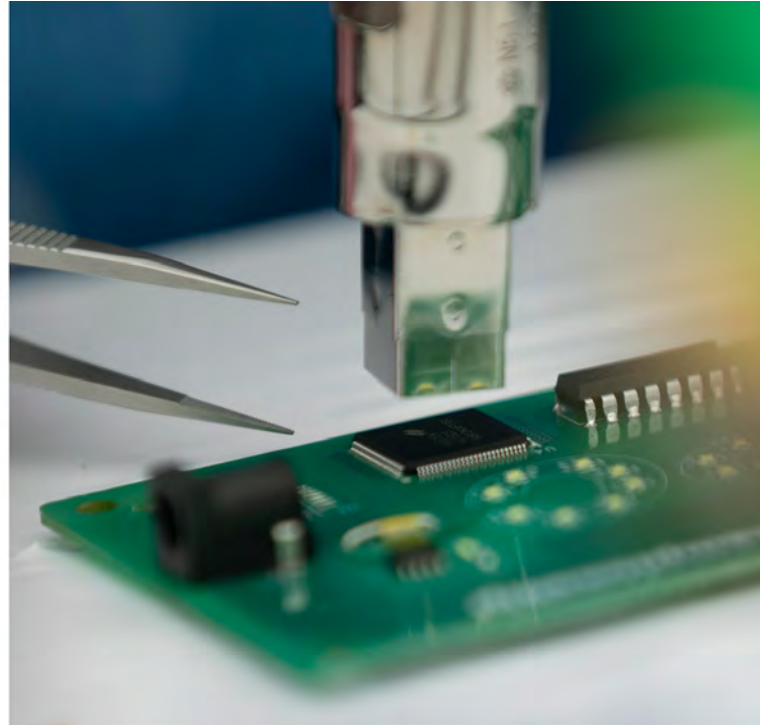
Hand soldering has become even more skillful and challenging as parts technologies and dimensions have evolved. As a result, the IPC hand soldering competition is a growing competitive program around the globe. Each year, the competition uses a different board design and parts lists and includes a variety of unexpected twists that reflect real-world situations.

This year, the competitive twist was a rework requirement in addition to standard assembly.

The board presented to the competitors was fully assembled and functional. Competitors were required to remove specific components and prepare the assembly to receive new components. This process simulates a real-life situation where an assembly has been tested, and nonfunctional components have been identified. The removed components must not be damaged. In an actual assembly, those components would need to be returned to the lab for failure analysis. The board is required to be functional at the end of the assembly process.

Competitors' work was judged first on quality. Points were deducted for flaws and problems with workmanship, work practices, and safety. In the case of a tie in points, the competitor with the fastest overall time takes the nod. American Hakko Products Inc. and





Country	Contestant	Points
Japan	Ryosuke Matsunami	634
China	Wenji Zhang	628
Vietnam	Le Van Linh	625
Thailand	Sukanya Judon	618
France	Catherine Cardinal-Simoan	618
Indonesia	Mey Nurjanah	613
France	Nathalie Kaladgew	594
India	Mr. Kantharaju, M/s	585
UK	Przemyslaw Marswalek	546
Korea	Hyo Sup Song	530
China	Ying Wang	528
China	Yan Yang	527

Table 1: Results of the 2019 IPC Hand Soldering World Championship.

Thales Dms France SAS provided the soldering stations and inspection equipment. Blackfox Training Institute and others coordinated and supplied certified judges for the competition.

In addition, on the last day of IPC APEX EXPO 2019 (Thursday), the soldering stations were used as part of IPC's STEM Student Outreach program, which was a new addition this year. Selected students from local high schools took part in a program that delivered practical demonstrations including contemporary soldering skills and equipment. Then, in teams of five, the students used the soldering stations to assemble some boards themselves.

From competitors to experts to novices, hand soldering and rework were heavily featured at IPC APEX EXPO 2019 and proved to be an exciting addition to the show's programs. **S&T**





# Making Connections at IPC APEX EXPO 2019

by **Tara Dunn**  
OMNI PCB

There is a lot of magic that happens at IPC APEX EXPO each year, and it is an event that I always look forward to. Compared to most, I am a relative newcomer to this event, having only attended the past five years. Every year, I leave with new friends, new industry informa-

tion, and new excitement for what this industry can accomplish when working together.

Those of you who know me know that I believe in making connections. I believe in connecting people with technologies and materials, connecting people with others in the industry, and connecting my customers with suppliers. IPC APEX EXPO 2019 allowed me to do all of that!







In terms of connecting customers with new technologies and materials, it is exciting to see the show growing and expanding to the pavilion area. While walking the show floor, I feel that I need to walk through more than once. The equipment demonstrations catch my attention, and it is always fun to see things in action. I always feel like I get distracted moving from one eye-catching thing to the next and

need to repeat the route to ensure I don't miss things! The technical conference and committee meetings are similar. It is difficult to choose which sessions to attend because all of the information is interesting and relevant.

This year's theme was "Technology's Future Comes Together." There is just not enough time to participate in all the sessions highlighting upcoming technology in our industry. Technol-





ogies that caught my eye included e-textiles, Mina—an advanced surface finish enabling low-volume soldering to aluminum with applications in both low- and high-power requirements—and information on an emerging ALD ink used as part of a semi-additive process (SAP) or modified SAP (mSAP), enabling sub-mil lines.

When talking with others, the topic of microvia reliability seemed to be one of the hottest topics, and I understand that those sessions were often standing room only. One new thing I participated in this year was IPC's "passport to prizes" activity where you collected stickers from participating exhibitors for a chance to win a prize. A raffle of completed cards was held on Thursday, and I was actually one of the winners (I chose the video doorbell)!

In terms of connecting people with others in the industry, the networking at IPC APEX EXPO is invaluable. Our industry seems to be a fairly small industry. People may change positions, but most are still in this industry. I don't

think I walked anywhere in the conference area or on the show floor where I didn't run into people that I knew. It is always great fun to catch up with people that I don't regularly get to see.

IPC helped facilitate making connections by hosting a networking event on Tuesday afternoon and an ice cream social on Wednesday on the show floor. In addition, there was a welcome reception for those visiting the show for the first time, an international reception, a women in electronics event, and trivia networking night. The event luncheons on Monday, Tuesday, and Wednesday also provided great networking opportunities with high-end meals.

I was also able to connect my customers with highly reliable suppliers. Most of the suppliers I represent were in attendance, so it was fantastic to catch up with everyone all in one location. Many of my customers were also in attendance, so I was able to spend time meeting with them more formally and also interact in the more relaxed social environment that a trade show can provide.

Although the schedule for the week was hectic and involved activities and meetings from early morning until later in the evening, as always, I left the event feeling excited about the new technologies and materials I learned about, thankful for the education and standards work that IPC members provide, and happy for the chance to interact with both customers and suppliers at the same event. I look forward to IPC APEX EXPO 2020. **\$6T**

**Tara Dunn** is the president of Omni PCB, a manufacturer's rep firm specializing in the printed circuit board industry. To read past columns or contact Dunn, [click here](#).

**Tara Dunn**  
 Flex Talk

Industry experience:  
**20 years**

Areas of expertise:  
 •Flexible circuits  
 •Printed circuit boards  
 •Micro electronics

Day job:  
**President, Omni PCB**

Sage advice:  
**If you believe you can, you can.**

Favorite quote:  
**"Life is not measured by the breaths you take, but by the moments that take your breath away." -Maya Angelou**





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I don't know who you are

I don't know your values

I don't know what you stand for

I don't know your reputation

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**Learn how we can help you!**

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# Five IPC APEX EXPO Exhibitors Earn 2019 Innovation Awards

IPC—Association Connecting Electronics Industries has announced the winners of the IPC APEX EXPO 2019 Innovation Awards, a celebration of the innovators and forward thinkers who are changing the technological landscape of the electronics industry.

A panel of industry experts rated and scored each product and assigned a numerical value to each submitted product based on the following criteria: How is this product innovative? How is this product changing the manufacturing industry? What value will customers experience with this new product?

The IPC APEX EXPO Best of Innovation Awards were presented on January 29 during the opening keynote to the following companies:

GreenSource Fabrication LLC for their PCB fabrication facility—the only fully automated

and green PCB fabricator of its kind. All chemicals and water are reclaimed and reused, and the facility's daily water consumption is 500 gallons regardless of the factory load.

Meyer Burger (Netherlands) BV for an inkjet printer for PCB solder mask. This novel inkjet-printed solder mask solution for PCB, combines a dedicated production inkjet printing system based on Meyer Burger's PiXDRO product line, Agfa's unique DiPaMat solder mask ink, and advanced printing strategies for optimized layer deposition.

Nordson DAGE for Explorer one, an entry-level, operator-controlled, manual X-ray inspection (MXI) system for checking manufacturing quality in electronics assemblies. Common manufacturing defects such as open or bridged solder connections, BGA reflow quality, and





voiding can be checked quickly and easily on a high mix of product types across a PCB.

Henkel Corporation for its LOCTITE ECCO-BOND UF 1173—a novel underfill that can withstand harsh environments and the elevated operating temperatures inherent with smaller, higher-functioning devices. In addition to its performance benefits, the product prioritizes health and safety.

Vayo (Shanghai) Technology Company Ltd. for its DFM Expert v5—a unique 3D DFA/DFM solution for electronics manufacturing.

“The IPC APEX EXPO Innovation Awards allow us to celebrate the innovators and forward thinkers who are changing the technological landscape of the electronics industry,” said Dr. John Mitchell, IPC president and CEO. “This year, product and service submissions were certainly innovative, and the companies did an exceptional job in identifying their product’s unique value in the industry. The innovative submissions directly indicate the strength of the electronics industry and its ability to respond to new challenges resulting from emerging technologies in the electronics marketplace,” Mitchell added.

Members of the award review board include Dave Geiger, Flex; Don Dupriest, Lockheed Martin Missiles and Fire Control; Carsten Salewski, Viscom Inc.; Martin Goetz, Northrop Grumman Corporation; and Terry Kocour, Lockheed Martin Corporation. **S&T**



# IPC APEX EXPO 2019: Another Year Here and Done

by **Patty Goldman**  
I-CONNECT007

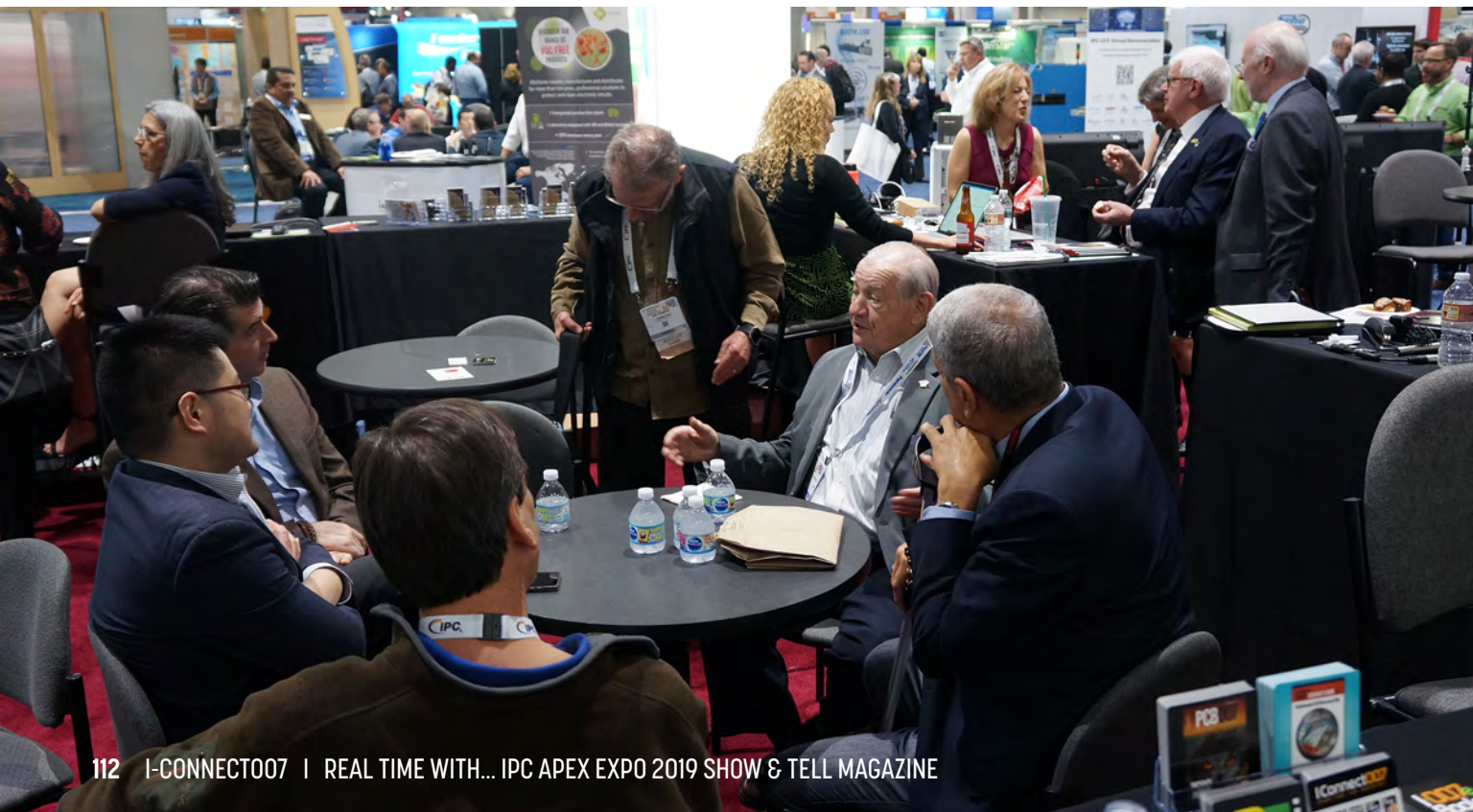
Ah, the bittersweet ending to the IPC APEX EXPO 2019 show and conference! Anticipated for months, the few days of actuality just whiz by. By the end, we're all eager to get back home but always sad to say goodbye to friends and colleagues.

Of course, there's much more than just the three days of the show—so much more that you can't begin to cover it all. There were five tracks in the technical conference, numerous standards committee meetings, professional development courses (many over the previous weekend), buzz sessions, and of course, the show floor, which was larger than ever and expanded to the upper floor. You have to pick

and choose what is most interesting, important, and relevant to you.

For me, I found it hard to pick and choose. I caught a few technical papers here and there, peeked in on some subcommittee meetings, conducted a few interviews, walked the show floor to see companies of interest, and talked in our booth and elsewhere with existing and prospective columnists and customers. The list goes on.

Most of Monday was spent in IPC's Executive Forum on Advancing Automotive Technologies hosted by IPC Hall of Fame member Gene Weiner who, with a few other illustrious members, put the entire program together. It was jam-packed with top-notch speakers and subjects including just about every facet of automotive electronics manufacturing of inter-











### Michael Carano

Trouble in Your Tank



Industry experience:  
**39 years**

Areas of expertise:  
•Product development  
•Problem-solving  
•Subject matter expert

Day job:  
**VP of technology and business development, RBP Chemical Technology**

Favorite quote:  
**"It ain't over until it's over."**  
—Yogi Berra

Fun fact:  
**Once worked as an assistant to the coroner in Youngstown, Ohio**

**Michael Carano**  
I-Connect007 Columnist



### Michael Ford

Accelerating Tech



Industry experience:  
**36 years**

Areas of expertise:  
•Digital manufacturing  
•Software solutions  
•Electronics systems

Day job:  
**Senior director of emerging industry strategy, Aegis Software**

Star Wars or Star Trek?  
**Star Trek**

Favorite quote:  
**Great minds think alike, though fools seldom differ**

**Michael Ford**  
I-Connect007 Columnist



### Mark Thompson

The Bare (Board) Truth



Industry experience:  
**30+ years**

Area of expertise:  
**Engineering support**

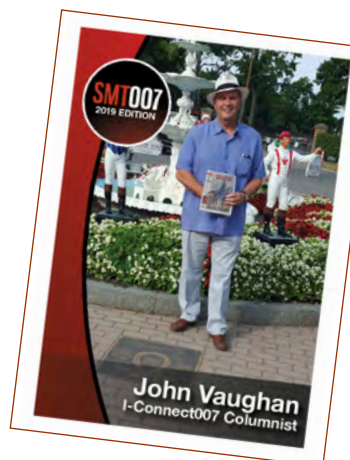
Day job:  
**Engineering support Prototron Circuits**

Fun fact:  
**Can read upside down!**

Who inspires you?  
**Nikola Tesla**

Favorite quote:  
**"I am what I am."**  
—Popeye

**Mark Thompson**  
I-Connect007 Columnist



### John Vaughan

Mil/Aero Markets



Industry experience:  
**35 years**

Areas of expertise:  
•Capturing military program business  
•Subject matter expert, military electronics

Day job:  
**VP of sales and marketing Zentech Manufacturing**

Favorite quote:  
**"Book 'em, Danno!"**  
—Hawaii Five-0

Star Wars or Star Trek?  
**Star Trek**

**John Vaughan**  
I-Connect007 Columnist

est to attendees. Read all about it elsewhere in this magazine, but you really had to be there.

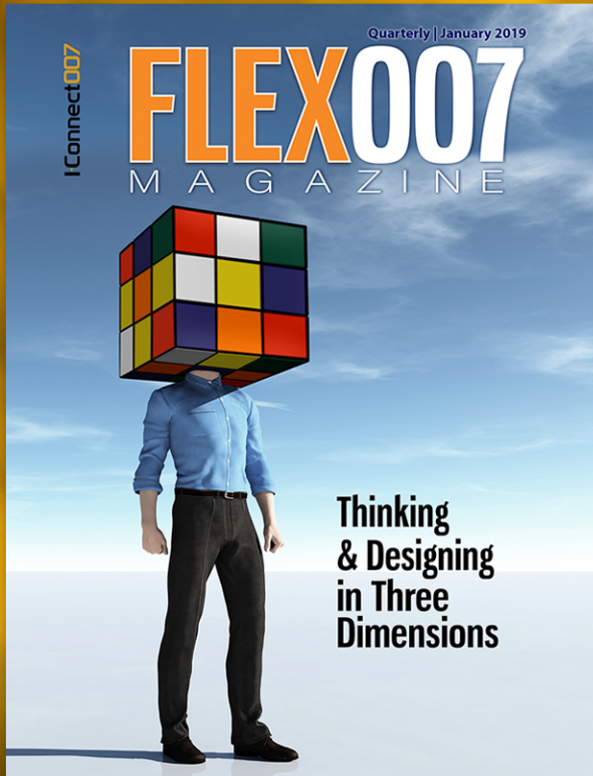
Tuesday began with the keynote speaker, JB Straubel, CTO and co-founder of Tesla (again, read all about it in this magazine), which was definitely a good follow-up to Monday's forum. Immediately following was the ribbon-cutting ceremony that officially opened the show floor. Meanwhile, subcommittee meetings were already in full swing, and the technical conference was set to begin in the afternoon. And so began the round of conference papers, subcommittee meetings, and show floor visits. So many choices and interests that no single one could hold my attention for long.

Fast forward to Thursday and the IPC STEM Student Outreach event with six participating San Diego area high schools and over 100 students attending. A day off from school, a bus ride, and the opportunity to see some fun things at the convention center. You would think the kids would be goofing around and having fun, but these kids were serious.

Colette Buscemi, IPC's senior director of education programs, oversaw a day-long agenda for the students that included a panel discussion with executives of sponsoring companies, instruction in soldering with hands-on learning, and a visit to the show floor. There was also an impromptu lunchtime panel comprising IPC Emerging Engineers (an IPC-organized mentoring program) and yours truly. This panel came about because Colette noticed that the first panel was comprised entirely of men—and mostly older ones at that—which was perhaps not fully conducive to attracting young potential engineers to our industry. However, both panels drew plenty of thoughtful questions from the students.

And then it was all over. The conference rooms were empty, booths were torn apart, and plenty of goodbyes were said. As always, it was all good, interesting, and enjoyable. Renewed and new friendships were made, I caught up on moves and new companies, and innovative ideas were put forth. Here's hoping it will all carry forward through this year and into next. See you in 2020! **S&T**





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# Executive Forum on Advancing Automotive Electronics

by the I-Connect007 Editorial Team

Presented by IPC Hall of Fame Council, the Executive Forum on Advancing Automotive Electronics proved to be a jam-packed day, which started with a call to order by the forum chairman, Gene Weiner of Weiner International Associates. What followed were 10 presentations on all facets of automotive electronics from materials, fabrication, and reliability testing to market information and future needs.

According to Weiner, the objective of the forum was “to provide information on the complete supply chain for automotive electronics including materials, process, product development, Tier 1 requirements, global sourcing, reliability, and the use of analytics for cost control and troubleshooting. The idea was to provide an international global outlook with speakers from Europe, Asia, as well as the U.S., and provide something of value and use to every attendee.”

IPC President and CEO Dr. John Mitchell started with an overview of the past, present, and future of electronics for automobiles including the first headlamps and radios,



today’s sophisticated controls, and a peek at what we can expect in the upcoming years. He outlined IPC’s growing role in automotive electronics via various committees and specifications.

The fabrication of PCBs—the foundation of all electronics—was amply covered by Alex Stepinski, VP of GreenSource Fabrication. Stepinski focused on recent innovations at GreenSource that



enabled the construction of circuit production lines with the capability for single-piece flow, autonomous work cells, and extreme traceability capabilities, which can yield higher quality levels and shorter cycle times than ever before while also eliminating the traditional environmental footprint of a PCB factory. He illustrated how these key innovations relate to the future of the automotive industry supply chain and the need for high reliability in increasingly complex circuitry.

The next presentation was “The Global Outlook for Specialty Chemicals and Materials in Automotive Electronic Packaging” by Joe D’Ambrisi, global VP of electronics marketing and technology, and Don Cullen, director of marketing, both of MacDermid Alpha Electronics Solutions. They gave an illustration of the future that combines printed electronics on a flexible substrate and molded into a final assembly resulting in a new 3D package.







Dr. Udo Welzel, team leader for engineering assembly and interconnect technology, is responsible for the integration for high-performance logic automotive electronic control units at Robert Bosch

GmbH. His presentation “Enabling Connected, Electrified and Automated Mobility: Challenges for Assembly and Interconnect Technology” provided the view from a leading Tier 1 automotive electronics supplier. He began with three global trends in automotive electronics: electrified mobility, connected mobility, and automated mobility. The three challenges for assembly and interconnect technology can be summed up as mission critical, harsh environment, and high-volume production (perhaps 0.5 million parts per day). Mission critical referred to the very high reliability necessary for all electronic components in autonomous vehicles. The harsh environment meant not just the external conditions but also those generated within the electronics themselves, most notably heat and high voltage. Dr. Welzel finished with the importance of automotive specifications and standards within the industry.

Bob Neves, chairman and CTO of Microtek Labs China and member of the IPC Board of Directors, spoke on “PCB Reliability Testing for Automotive Electronics—The China Story.” He began by saying that “automotive” should be expanded to “transportation” to include railways, trucks, and beyond. He exemplified this by pointing out that since 2010, China has spent \$100 billion per year on its railway system. Neves then focused on testing and reliability, discussing the causes of failures including conductive anodic filament (CAF) and the widened temperature cycling necessary for testing automotive boards. An unusual comment was that he was focusing on the reliability



ity and analysis of one via rather than the usual IPC D-coupon daisy chain. This will need to be looked at in the future.

“Developing a New Dry Film Photoresist to Meet Automotive Very Fine Line Circuit Needs” was presented by Carlo Favini, founder of Elga Europe. Through a multicompany-multinational cooperative program, Elga has developed photoresists that enable very fine features of less than 10-micron line and space with a resist thickness of ~25 microns.

Larry Wilson III, leader of Nexteer Automotive’s Global Electronics Costing Team, provided both a cost history and forecast of automotive electronics by following the history of a particular motor vehicle. He gave an unusual perspective of global purchasing from EMS companies.



Next, Ventec International Group’s new Technology Ambassador Alun Morgan gave an enthusiastic talk on “Developing Universal Solutions To Automotive Materials Challenges.” Morgan’s talk

focused on challenging thermal management issues for automotive applications. By working collaboratively with Tier 1 automotive suppliers, Ventec quickly developed thermally conductive laminates as a solution with the key advantage that they provide a simple and universal adoption route for all suppliers.

Dwight Howard, manager of electrical engineering with APTIV LLC’s (formerly Delphi Automotive Systems) Electronics and Safety Division, spoke on “Integrated Intelligent Transportation and Key Enablers.” He discussed key enablers for integrated intelligent transportation such as vision where he used the example that LiDAR doesn’t work in fog



while RADAR doesn't work in a tunnel; therefore, both are necessary. He focused on the advanced development of emerging vehicle-to-vehicle (V2V) and vehicle-to-infrastructure (V2I) applications and advanced automotive receivers programs.

"Striving for Zero DPPM" was the topic for Randy Hierbaum, VP of sales at Optimal+. Optimal+ is working with Continental in Guadalajara, Mexico, for this and to improve process cycle times as well. He showed how to use analytics for cost control and rapid troubleshooting.



Weiner continued, "One of the most interesting things is that automotive electronics requirements, in some cases, are more rigid or tougher than the military industry except for documentation and security. And the military industry, more and more, is beginning to look at automotive requirements."

After the forum, Dan Feinberg, I-Connect007 technical editor and a forum attendee, asked Weiner if the forum had met its goals. Weiner replied, "Yes. One of our presenters was also awarded one of the five Innovation Awards at IPC APEX EXPO 2019. The comments we've received since then are still coming in, and are all favorable. Attendees rated the program 4.6 out of 5.0 when asked if they would recommend it to others." **S&T**





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# 2019 IPC EMS Management Meeting Wrap-up

by Tracy Riggan

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

EMS leaders gathered on Monday, January 28, at IPC APEX EXPO 2019 to discuss issues critical to EMS providers today including supply chain issues, customer contracts, labor optimization and talent shortages, and market insights. Roundtable sessions offered dynamic discussions. Participants noted that the sharing of experience and networking that took place at these meetings was invaluable.

The highlight of the day was a supply chain challenges panel and discussion featuring supplier, distributor, and end-user perspectives on addressing component supply and lead time challenges. Panelists included Steve Ulm of Vishay, one of the world's largest manufacturers of discrete semiconductors and passive electronic components; Olaf Korn of Arrow Electronics, a global provider of products, services, and solutions to industrial and commercial users of electronic components and enterprise computing solutions; and John Caltabiano of Jabil Inc., a top manufacturing solutions provider.

Among other factors, the panel pointed to customer-specific requirements as a key driver of supply chain disruption. Vishay's Ulm brought to light many of the contributing

factors to the growth in lead times and recent slowdowns. Arrow's Korn highlighted the constant mismatch between downstream demand levels and upstream production capacity and complex demand patterns causing distortion of demand. He suggested BOM flexibility and forecasting far beyond lead times are key to mitigating supply chain disruption. Caltabiano from Jabil tagged a "new normal" with regards to how we think and plan supply chain, pointing to a consolidation of the supply base, demand expansion, and rapid technology transfer among other trends.

Elsewhere in the agenda, Jeff Roth and Allen Anderson of F&B Law Firm gave a thorough review in the much-needed area of customer contracts. Roth and Anderson addressed features such as compliance clauses, potential pitfalls or "gotcha" clauses, and other critical contractual considerations. The gentlemen from F&B stressed the critical nature of legal review in protecting company interests.

Throughout the day, the forum tackled labor issues from two directions—automation opportunities and talent shortages. Neil Hamlett of IBM Watson brought to light some developing AI solutions. These new AI capabilities may soon have application in manufacturing processes where the challenges are affordability and practicality in high-mix, low-volume situa-











**Dennis Fritz**  
Defense Speak Interpreted



Industry experience:  
**46 years**

Areas of expertise:  
•Circuit board fabrication  
•Defense electronics  
•Technology roadmaps


Day job:  
**Consultant, Fritz Consulting**

Achievements/awards:  
**IPC Hall of Fame  
IPC President's Award**

Sage advice:  
**You have two ears and one mouth. Use them in proportion.**



**Phil Kinner**  
Sensible Design



Industry experience:  
**20 years**

Areas of expertise:  
•Conformal coatings  
•PCB reliability  
•Reliability test methods

Day job:  
**Global business/technical director - coatings division, Electrolube**

Favorite quote:  
**"Make sure your worst enemy doesn't live between your own two ears."**

Who inspires you?  
**Albert Einstein**



**Greg Smith**  
SMT Stencils 101



Industry experience:  
**25+ years**

Area of expertise:  
**SMT stencil manufacturing and design**


Day job:  
**Manager of stencil technology, BlueRing Stencils**

Star Wars or Star Trek?  
**Star Wars**

Favorite sports team:  
**Colorado Rockies**



**Istvan Novak**  
Quiet Power



Industry experience:  
**22 years**

Areas of expertise:  
•Power integrity  
•Signal integrity  
•Electromagnetic compatibility

Day job:  
**Principal SI and PI engineer Samtec**

Favorite quote:  
**"Learning never exhausts the mind." -Leonardo da Vinci**

Sage advice:  
**Always aim for the perfect solution, but use what best fits the situation.**

tions. Colette Buscemi, IPC's senior director of education programs, provided a quick update on IPC workforce development initiatives as a lead-in to a roundtable discussion on experiences, ideas, and strategies to address workforce and talent shortages.

As the day progressed, topics turned global once again. For example, IPC's Director of Market Research, Sharon Starr presented some recent EMS survey findings. North American EMS sales growth remained solid through the third quarter of 2018 for companies with less than \$100 million in annual sales. Profit margins declined slightly in the third quarter, averaging 4.3%. Starr also announced that the IPC survey program will expand globally this year and be open to new participating companies for 2019. Interested members can sign up until February 15 by contacting [marketresearch@ipc.org](mailto:marketresearch@ipc.org).

In the realm of strategic planning, Jack Calderon, Chaim Lubin, and Patrick McGrath from Lincoln International described an electronics super cycle they believe is beginning now. This super cycle is driven by exceptional growth in new technologies such as cloud services, IoT, integrated circuits, 5G networks, and the smart grid. Lincoln International is forming a smart technology consortium to study these developments. The speakers also shared that while mergers and acquisitions decreased in 2015 through 2017, they were up in 2018 with lots of private-equity investment. Also, EMS companies are borrowing again and investing in growth.

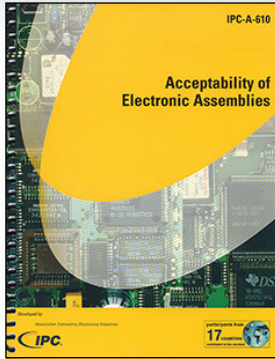
Chris Mitchell, IPC vice president of global government relations, provided attendees with a global trade update including information on the U.S.-Mexico-Canada Agreement, China 301 tariffs, trade policy pipeline, private sector response, and IPC's advocacy efforts to address these issues.

The day ended with a dinner and reception, allowing the participants to recap the day's events and network with peers on a variety of industry issues. The EMS Steering Committee is already planning next year's agenda and is interested in hearing from fellow EMS leaders on growing areas of interest. To share your ideas, contact me at [TracyRiggan@ipc.org](mailto:TracyRiggan@ipc.org).

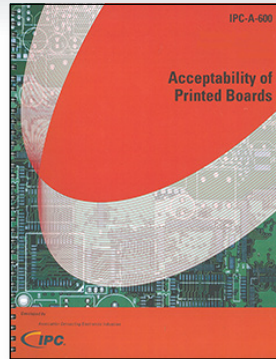




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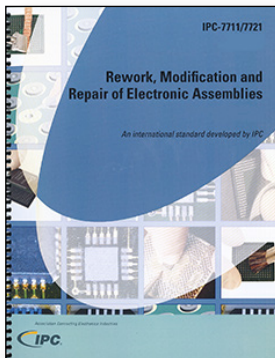
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CIT or CIS



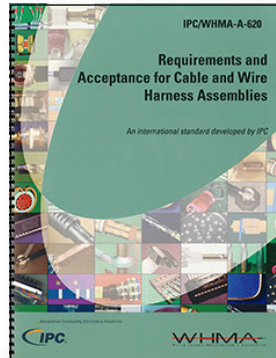
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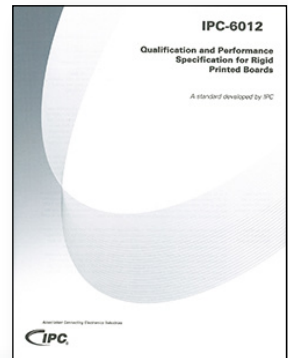
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# IPC APEX EXPO 2019

## Observations

by Steve Williams

THE RIGHT APPROACH CONSULTING

The 2019 iteration of IPC APEX EXPO in San Diego in late January had a lot to offer and did not disappoint, depending on your perspective and place in the electronics food chain.

### CM-centric

I am old enough to remember when this conference was primarily for printed circuit fabricators and raw material suppliers. NEPCON, the predecessor of the current IPC APEX EXPO show, was legendary in the PCB fabrication industry with multiple shows and locations each year. Until the past five to 10 years, this show was much the same. As I walked through the two show floor halls, it was crystal clear that this venue has morphed into a showplace for contract manufacturers and equipment suppliers to CMs. For the last few years, printed circuit fabricators are relegated to “PCB row”—the last couple of rows in the primary hall that house one or two U.S. companies and a handful of Asian ones. I’m not saying this is bad, just different.

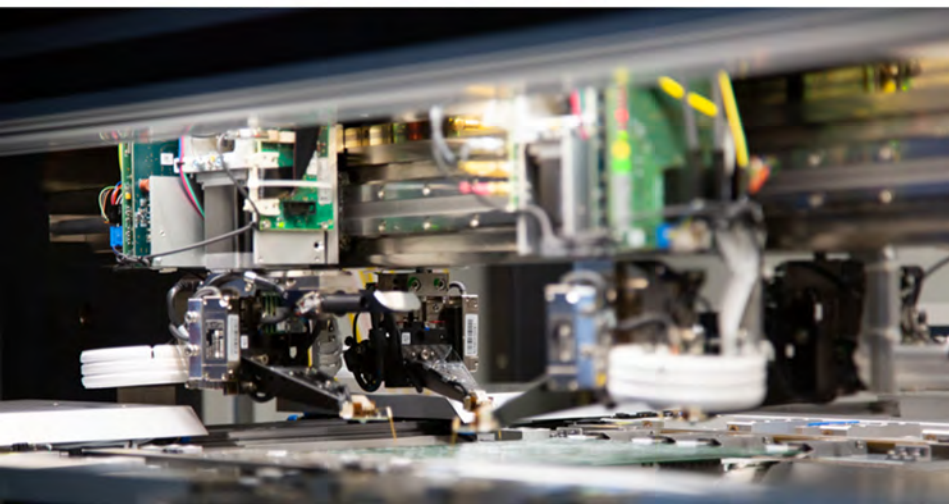
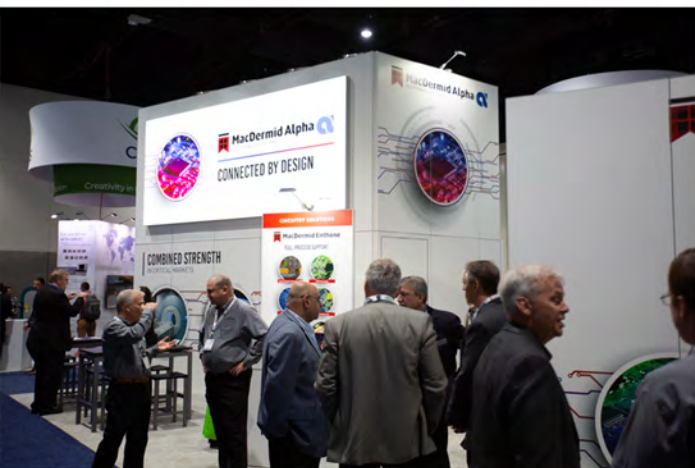
### Keynote

I attended the keynote by JB Straubel, the brains (CTO and co-founder) behind Tesla’s electric car empire. Not being an advocate of electric vehicles, I wasn’t sure what to expect and was more than a little bit skeptical going in. However, I was happily impressed with his talk. Everyone knows Elon Musk, but it was a very interesting story of Tesla’s innovation from the guy who invented their electric vehicle technology.

### Video Interviews

As I normally do, much of my time was spent as a guest editor in the I-Connect007 booth doing *Real Time with... IPC APEX EXPO 2019* video interviews with some of the personalities and companies in our business. View the [full library](#) to see other interviews conducted by other guest editors and me. Below is a synopsis of my most interesting interviews of the show. In a shameless shout-out, the folks at I-Connect007 do a fantastic job at all the shows finding the people, products, and companies that PCB fabricators want to hear from.









## John Vaughan VP of sales and marketing, Zentech

John talked about a critical topic for anyone doing milaero work in the industry, and about the new NIST regulations that have kicked in recently

to protect these companies from cyber threats. We also discussed Zentech's dominance in this market sector, and John's column "[The Fourth Pillar of Defense Acquisition](#)," which is a must-read for anyone entertaining playing in this sector.



## Joseph D'Ambrisi SVP, MacDermid Alpha Electronics Solutions

Joseph rolled out the recent company rebranding into two distinct business units; MacDermid Alpha and MacDermid Enthone. The driving force for this merger was to offer customers the advantage of an integrated product offering combined with cross-functional knowledge in the circuitry, assembly, and semiconductor segments. They believe having a strong foothold in every step of the electronics supply chain is crucial to the ability to help customers succeed. MacDermid Enthone will support the printed circuit fabricators while MacDermid Alpha will support the contract assembly and OEM part of the food chain. This synergy provides a solution that is optimized for both of these critical supply chain partners.



## Norihiro Koike CEO, Saki

Norihiro described the technology behind Saki's industry-leading AOI and 3D equipment. Imagine if a 3D automated optical inspection (AOI) or solder paste inspection (SPI) system could be self-programming, require only a few clicks, and take less than 10 minutes to program. There's no need to imagine because Saki offers this technology today! In the last few years, the talk of the show has been IoT and machine-to-machine communication. Again, Saki is ready to support today's smart factories that require open innovation for automated SMT lines. The Saki system feeds back real-time process data, which allows the SMT equipment to make minute adjustments based on that data.



## Annegret Lewak Head of sales, Meyer Burger

Perhaps my personal favorite interview, Annegret discussed the rollout of their advanced inkjet solder mask printing equipment at this year's show. While Meyer Burger is the world leader in photovoltaic solar systems, the focus for IPC APEX EXPO 2019 was their inkjet solder mask technology for PCB fabricators. Although this equipment is a very mature technology primarily in Europe, the show was the company's



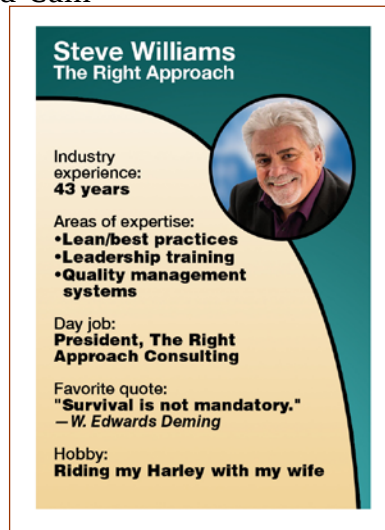
introduction to the U.S. market. The combination of advanced software and hardware provides industry-leading accuracy and speed.

## Step-function Technology Leap

As previously mentioned, this was particularly fascinating to me since I cut my teeth in the industry using the technologies that this is replacing. I remember how excited my screeners were when stainless steel mesh and Cam-lock frames replaced the old polyester screens and hand tightening of the frames. The next major advancement was when coating equipment took the human factor out of the equation. Like many PCB processes, screening is a very messy operation that tends to rely on as much art as it does science. Inkjet printing takes this all off the table while improving registration accuracy, resolution, and cost. This certainly will take the industry by storm as inkjet legend printing did.

## Rock On

IPC APEX EXPO continues to raise the bar on providing access to the equipment, education, and technology that our industry needs. Just as important is the opportunity to network with international colleagues, suppliers, customers, and competitors all under one roof! **S&T**



## RELATED VIDEO: Advanced Inkjet Solder Mask Printing Equipment



Meyer Burger Head of Sales Annegret Lewak speaks with Steve Williams about rolling out their inkjet solder mask printing equipment, which offers advanced accuracy and resolution imaging.

# Attendees Speak!

by Kelly Dack

IPC APEX EXPO 2019 featured new products and materials and the latest technologies and solutions aimed at improving PCB design, fabrication, and assembly processes. The I-Connect007 team roamed the show floor, recorders in hand, and asked various attendees to tell us their impressions of the show and what caught their attention. Here are the highlights.

*Editor's note: Responses have been edited slightly for clarity.*

**Dan Beaulieu**  
President, D.B. Management Group



I've seen a lot of optimism at this show. If you watch the booths, for example, everybody is much more active. Sometimes you go to shows, and people are sitting back waiting for something to happen. Here, people are coming in and buying. There is a lot of activity. Also, the smart machines are incredible with CFX, machine-to-machine communication, and data collection. That's the future. Automation and AI are everywhere and very significant this year. It all feels new. I can't wait for two years from now to see where we are going to be.

I just spoke with somebody from Koh Young about smart automation. I asked him, "What happens when we are all sharing this information?" I read that if a self-driving car has an accident in Tokyo, the AI in every self-driving car in the world learns from it. So what are we going to do with competing companies learning all of this?



**Peter Chen**

Sales manager, DediProg Technology Co. Ltd.

This is my third time at the show, and as a vendor, there has been a lot of traffic and people coming from all over. Today's the last day, so I think people are coming slowly, but the past two days have been going well. The automatic IC programming machine also stood out. It's pretty exciting to help smooth the manufacturing production line.



**Cary Chiu**

Manufacturing engineer, Northrop Grumman



There are a lot of great vendors in the area with things to offer. It's interesting to see how technology is progressing such as lots of metrology inspection stuff, which is really nice. But a lot of things don't apply to what we do, which is mainly assembly. I'm in electronic assembly manufacturing. With CFX, we're seeing a lot of things that we weren't expecting and potential solutions. Plus, the Tesla car at the conference was a complete hit. Love it.

**Joe Clark**

Principal, Downstream Technologies

This has been a great show for us. We've generated a lot of leads. We're relatively new to this show, and it's a big show for us, so it takes some time to get your footprint here. A lot of my involve-





ment has been with the IPC-2581 consortium. The nice thing is we're seeing that the industry is embracing these intelligent design standards more and more, which is also what's driving a lot of the interest in our products because people want to improve the handoff between design engineering and manufacturing, whether you're a captive manufacturer or external.

## Brian Cronin

### Systems subject matter expert, Aegis Software

The show has been absolutely fantastic. We've gotten lots of leads and had a tremendous amount of traffic at our booth. Unfortunately, I haven't had the opportunity to walk around the show floor much because I've been so busy. The Tesla does give me car envy, though, and I don't need any of that (laughs).



## Peter Ellegaard

### CEO and founder, Acculitx Inc.



We came to look at new manufacturing techniques and products, and we definitely learned about some new vendors. We probably made three or four contacts that we'll follow up on and do some serious talking with. Overall, it's a very cool show. We love it.

## Walt Hills

### Electronic engineer, Rohrback Cosasco Systems Inc.

What brought me here is a lot of interesting technologies, such as the giant spring humidifiers. I'm a design engineer, so I'm trying to see what's out there, what's new, what other people are doing, and if we can do research for some of our products that are up and coming. I am involved with a brand-new product—an environmental corrosion monitor that does differential pressure and



relative humidity and temperature. We're seeing where maybe some of those applications might go, and talking with some of the reps. Reps are very helpful, and some were giving us some advice on what to try, so it's nice to see that it's not cut-throat competition. It's more like, "If you can do better, maybe you can recommend some of our stuff." We're not directly competing with people; we're trying to supplement each other cooperatively.

## Edward Hockenberry

### President, Electronic Test Equipment Manufacturing Company (Etemco)

When we've come to these shows in the past, we've been looking for something specific such as AOI equipment. This year, we're not looking for anything specific, so we're looking at everything. I think what I've found interesting is that when you come to the show and you're not specifically shopping, you see more stuff. The rework stuff has also been pretty interesting. The X-ray counters opened our eyes a little bit as to what you can do with those. We have Samsung equipment, which is now Hanwha, so we were looking at their machines. It's pretty impressive pricing wise when you're looking at a machine that places 80,000 parts an hour. We bought a machine eight years ago that placed 20,000 parts an hour, and they're the same price now, which is pretty impressive.



## Edwin Hoh

### Business development manager, Keysight Technologies

This is my first time at the show, and it has been great. I think it's the biggest collection of all manufacturers from diverse backgrounds focused on PCB manufacturing. I also saw a tool company giving away drones where you did soldering and stuff onto the drone that you could take home.



## Dale Lee

**Staff DFX process engineer, Plexus Corporation**



Some of the highlights for me have been the chance to see old colleagues that I haven't seen for many years, some of them for almost over a decade. I've also enjoyed checking out new advanced technologies and materials for next-generation products. Classes and committee meetings are progressing very well too, and attendance is good. I've been on some panel discussions, and now I have to prepare for a presentation.

## Cherie Litson

**Master design instructor (MIT, CID, CID+), EPTAC Corporation**

I'm having fun. I've been going around and going through the "passport to prizes" thing where you visit different booths, talk to people, and you get a little sticker. Once it's filled out, you can submit it for the chance to win a prize. When I've been talking with all of these different companies about what they do, I ask, "How does a designer fall into place with that, and what would they like to see from the designers?" It has been a little give and take.



I was just at the Universal Instruments booth watching the pick-and-place machine. One thing that comes up all the time in the CID course that I teach is, "Why do I have to orient my components all the same? Does that help?" With the new technology these days, it doesn't. But what I did ask is, "What format do you want to see from designers, and what works from you?" They said, "Anything but Gerber." And when I asked about the data format as it comes to them, they said they have to massage it like crazy.

The most interesting thing I've seen besides the Tesla, which was a lot of fun to sit in, was a solder mask machine that would print out silkscreen super thin—10 microns—and readable with one- to two-mil lines. The capability of being able to do that takes care of a lot of

issues that we have with fine-pitch parts without being too expensive.

## Clay McElhany

**Director of operations, EE Technologies Inc.**



It has been a great year so far. We're looking at a lot of new technologies and equipment. AOI is something we're looking at as replacements for old equipment that we have, and I'm really impressed with what we're finding.

## Mauricio Mendez

**Senior PCB engineer, Plexus Corporation**

All of the printed electronics have been fascinating. I think it's good for wearables and these kinds of things. I want to bring that to our company too. The future of electronics is coming. It's awesome to see new PCB technologies and materials coming around.



## Gordon O'Hara

**Senior director of automation, Bright Machines**



We make robotic cells for this industry and also software and automation solutions. I see a lot of renewed interest, and I like that they distributed the large vendors, so there's more traffic all over the show floor as opposed to them picking prime locations.

## Leo Ortiz

**Business development manager, TestEquity**

I come to the show every year. I wouldn't miss it. The show has a lot of presence of different companies, and I see a lot of customers that I already know from Mexico, so it's really great to see them again. We're distributors of test equip-





ment and MRO products, supplies, cleanrooms, etc. The most interesting thing I've seen is the beautiful displays with everybody's products and brands, which are very well represented. I've worked with a lot of the companies here including JBC, Weller, Yamaha, Juki, and Key-sight Technologies, which is one of our biggest lines.

### Greg Papandrew Sales director, Millennium Circuits Limited

It has been constantly busy the past two days. There's a lot of traffic, and the whole attitude has been very positive, especially on the EMS side who buy circuit boards from me. I've seen friends from the industry, and the weather here today compared to everywhere else in the country is much better. I also think IPC is getting better. I see a lot more international representation here as well, whether it's from South America or across the ocean.

Of course, every customer talks about trade tariffs and things. There is some misinformation out there such as thinking, "China has tariffs but Taiwan doesn't," but it doesn't mean it's necessarily cheaper. A lot of customers like total cost of acquisition, but they don't consider that you might have a better price in China, and yes there's a tariff, but together, it's still less than maybe Taiwan. Some people will



say, "I don't like to see tariffs," but what's your bottom-line price.

### Steve Redington Senior engineer, U.S. Army Fuze Development Center

I've seen a lot of interesting stuff. We came here trying to get information on equipment, so that has been very helpful for us to have the opportunity to see what's out there and what competitor's products are. We were specifically interested in solder paste inspection, AOI, and ink-jet printing. Solder paste printing stood out the most to me because it could solve a lot of future problems for us. We've been trying to avoid it, but with the way technology is going, I think solder paste printing is going to start to pick up and become a lot more mainstream.



### Bharat Sutaria Vice president, SVTRONICS Inc.



I've attended IPC APEX EXPO for the last 10 years. We're a contract manufacturer and have lot of SMT equipment including MYDATA. Last year, we spent about \$2.5 million on purchasing MYDATA, Heller, and Seika machines. A BGA rework machine is on our wish list this year. But I think the attendance was lower than last year. **\$ET**



## IPC APEX EXPO 2019 by the Numbers

- **9,796** in total event attendance (includes attendees and exhibitor personnel)
- **5,292** attendees from **56** countries
- **440** exhibitors on **150,400** net square feet of exhibit space
- **2** full CFX demo lines
- **6** buzz sessions
- **30** professional development courses
- **21** poster presentations
- **74** technical papers
- **102** committee meetings
- **2,155,280** (over 2.1 million) pounds of equipment on the show floor



# Impressions From the Show Floor

by Dan Beaulieu  
D.B. MANAGEMENT GROUP

I don't know the statistics from IPC APEX EXPO 2019 such as the number of attendees and exhibitors, but here are my impressions as I walked a half mile from where most of my clients were located in the 100–300 sections of the show floor all the way over to the #3119 I-Connect007 booth.

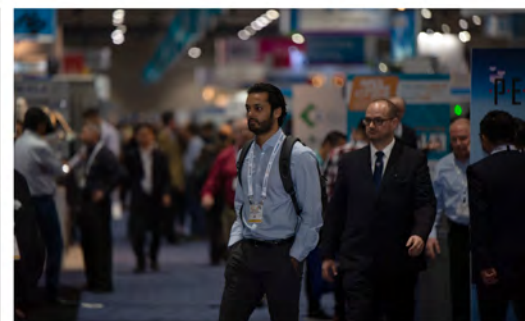
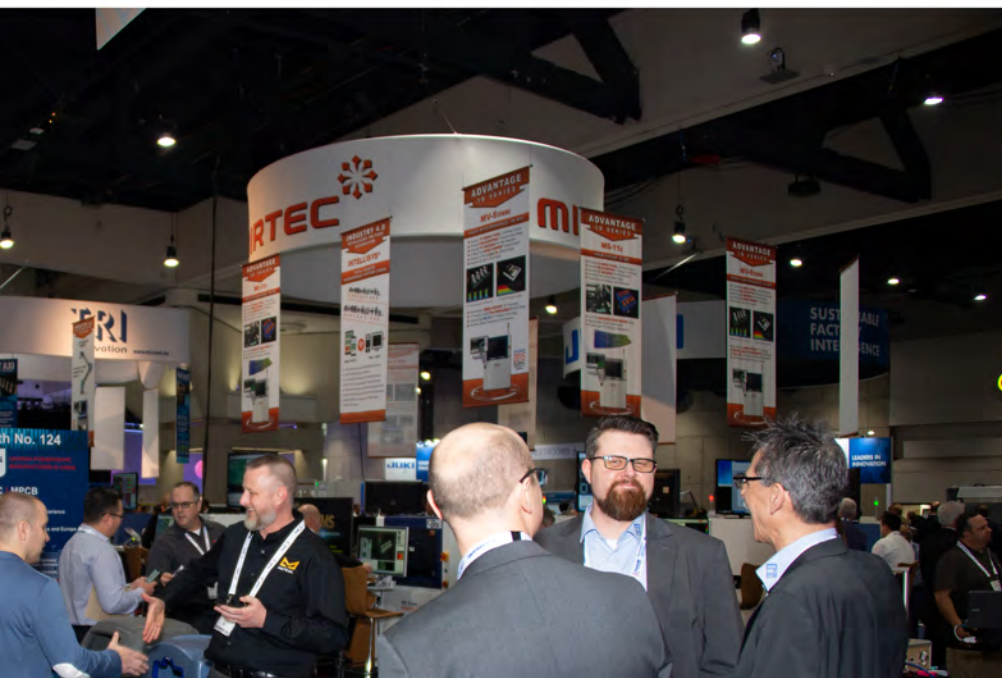
Most of the booths were much more active than in other years; many were very large and designed for the presentations that they gave throughout the day. I also got a kick out of the sophistication of all of the people I-Connect007 interviewed last week in the *Real Time with... IPC APEX EXPO 2019* video series. It has been so long since we pioneered this technique at CPCA many years ago that now everyone is used to being on camera and have no problem

telling their story in all the calmness and alacrity of seasoned veterans.

People were there with their checkbooks as well. I know that Altix sold two of their DI machines. And when I interviewed *Mirtec's* Brian D'Amico, he told me that they had sold eight out of the nine machines they had brought, and he thought that they would sell the ninth one before the show ended a few hours later. Further, there were many new types of what I used to call “machines of the future” including at least six brands of direct imaging machines.

It was an exciting show for those who chose to spend their time and money to make it exciting. There were still a few who hung in the back of their booths looking at their phones, but for the most part, most of the booths—especially the huge ones—were filled with life and activity reflecting the mood of an upbeat global economy.







However, I would advise China PCB companies to come to the show a little better prepared and manned or “womanned” by people who understand their product and know how to sell it in the American marketplace. Many of them seemed lost when it came to why they were there, but there were many more Asian PCB shops at the show than American shops. This may have been because Americans were split up between IPC APEX EXPO in San Diego, California, and DesignCon in Santa Clara.

And yes, that is my one and only criticism. IPC gods, please do not schedule this show opposite of DesignCon like you did this year or at the same time as any large global shows like you did last year. There are enough dates and few enough good shows that you should be able to work together and coordinate your show schedules.

In the end, it was a good show for everyone involved and is still worth visiting or exhibiting at for years to come. **S&T**

**Dan Beaulieu** is president of D.B. Management Group. To read past columns or contact Beaulieu, [click here](#).



## IPC APEX EXPO 2019 Time-lapse & Drone's Eye View



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Dan Beaulieu  
D.B. Management Group L.L.C.

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# And the Award Goes to...

At the Tuesday luncheon, IPC presented important awards to some of the outstanding IPC volunteers who serve on standards committees, lead professional development courses, and contribute significantly to the industry through IPC.

In this section, we highlight the recipients of Corporate Recognition Awards, the IPC Rising Star Awards, and the IPC President's Awards as well as those elected to the IPC Board of Directors. Elsewhere in this magazine, you can find interviews with the recipients of the Dieter Bergman Fellowship Award and the Raymond E. Pritchard Hall of Fame Award, IPC's highest honor for volunteers.

## Corporate Recognition Awards

### Peter Sarmanian Corporate Recognition Award: Naval Surface Warfare Center (NSWC)—Crane

Named for former IPC Board Chairman Peter Sarmanian, this corporate award recognizes an IPC member corporation in the PCB industry that has taken a leadership role and made contributions to the industry while demonstrating support of IPC through participation in technical and/or management programs.



NSWC—Crane—is a naval laboratory and a field activity of Naval Sea Systems Command (NAVSEA) with mission areas in expeditionary warfare, strategic missions, and electronic warfare. The warfare center is responsible for multidomain, multispectral, full life-cycle support of technologies and systems enhancing capability to today's warfighter.

### Stan Plzak Corporate Recognition Award: NASA

This award is named for former IPC Board Chairman and founding member of the IPC Electronics Manufacturing Services Industry



Management Council Stan Plzak. The award honors and recognizes a corporation (or division) in the electronics assembly industry (supplier, EMS company, or OEM) that has taken the initiative to actively contribute to enhancing the industry while demonstrating support of IPC through participation in technical and/or management programs.

The National Aeronautics and Space Administration (NASA) is an independent agency of the United States Federal Government responsible for the civilian space program as well as aeronautics and aerospace research.



## IPC Rising Star Awards

The IPC Rising Star Award is given to IPC members who have taken leadership roles and provided support to IPC standards, education, advocacy, and solutions to industry challenge efforts. Their contributions have made a significant impact upon IPC and the industry within the past five years and will continue to have a lasting impact for many years to come.

### Milea Kammer, Ph.D., Honeywell Aerospace

Dr. Milea J. Kammer is a materials engineering technical manager at Honeywell Aerospace and holds a Ph.D. from the School of Materials Science and Engineering at Purdue University. Since her graduation in 2014, Dr. Kammer has played an active role in multiple IPC committees and is now one of IPC's Emerging Engineers.

Most recently, she assumed the role of co-chair of the IPC J-STD-001 committee. Through this engagement, she is driving the industry toward incorporation of new technology requirements while managing a committee of more than 100 active participants. Dr. Kammer is also a regular contributor to the Pb-free Electronics Risk Management Council (PERM), providing technical input for document creation and research studies. Outside of her IPC participation, she is a recognized and sought-after resource for her metallurgy knowledge and understanding of aerospace electronics materials and manufacturing processes.



### Matt Kelly, IBM

Matt Kelly is a senior technical staff member and senior inventor within IBM Systems. He is responsible for helping lead technology development, design, prototyping, integration, and supply chain enablement of IBM's next-generation enterprise server and storage hardware. His technical contributions to the industry

include 80 publications and 20 United States patents.

Kelly is a member of IBM's Academy of Technology, SMTA Board of Directors, ReMAP Board of Directors, and active in a variety of other industry associations including IPC, JEDEC, and iNEMI. He has been the recipient of the ASM Engineering Materials Achievement Award, IBM's Corporate Technology Award, IBM's Chairman's Environmental Award and the winner of nine industry Best Paper Awards since 2007. Kelly holds a B.S. degree in chemical engineering from McMaster University, is a licensed professional engineer in the province of Ontario, is a Master Black Belt in statistical methods, and has received his MBA in strategic management from Sir Wilfrid Laurier University.



### Hans-Peter Tranitz, Ph.D., Continental Automotive GmbH

Dr. Hans-Peter Tranitz is a principal expert for mechanical joining of both metals and plastics. In his role as head of backend technologies in Continental's electronic plants headquartered in Regensburg, Germany, he is responsible for the final assembly of all kinds of automotive electronic devices delivered to basically all major OEMs. His team manages worldwide expert networks that develop internal standards for design and manufacturing needs. Dr. Tranitz is also active in diverse German Industry Councils and contributes to IEC standardization committees.

Based on this experience, Dr. Tranitz co-initiated the IPC 5-21M Cold Joining Press-fit Task Group where he serves as a co-chair to develop a high-reliability press-



fit standard, IPC-9797. He has also presented at several IPC conferences on tin whiskers and press-fit technology. Dr. Tranitz received his Ph.D. in physics at Chemnitz Technical University with further postdoctoral fellowships at the Universities of Cincinnati and Regensburg.

### MaryAlice Gill, Jabil Circuit

MaryAlice Gill works for Jabil Circuit's Nupro Consumer Health Division Clothing+Team. The products developed in her division integrate electronics into textiles for consumer and medical markets. She is responsible for project management of design, and process and product development projects to move products from concept to mass production. Gill started in Jabil's R&D group where she developed printed electronics capabilities with a wide range of materials and applications.

Gill is an active member of the IPC D-70 E-Textiles Committee and IPC D-60 Printed Electronics Committee. She is also vice-chair



of the IPC Printed Electronics Terms and Definitions Task Group, and has presented at IPC APEX EXPO 2017 and IPC E-Textiles 2018. Gill graduated from the University of Florida with a B.S.

### IPC President's Award

The President's Award is given to IPC members who have exhibited ongoing leadership in IPC and have made significant contributions of their time and talent to the association and the electronic interconnect industry. Individuals can receive this award only once.

### Bhawnessh Mathur

Bhawnessh Mathur is an experienced executive with OEM, distribution, and EMS experience. He has been head of supply chain at



IBM's Server Group, Arrow Electronics, and Sanmina. Mathur has also been the CEO of two large EMS companies, most recently at Creation Technologies. At Creation Technologies, Mathur implemented strategies to overhaul the organization's approach to an external, customer-driven focus. He enabled the company to earn industry recognition including three consecutive service excellence awards and achieved significant customer gains through reengineering efforts. Concurrently, Mathur generated key cost reductions through new programs and operational consolidations.

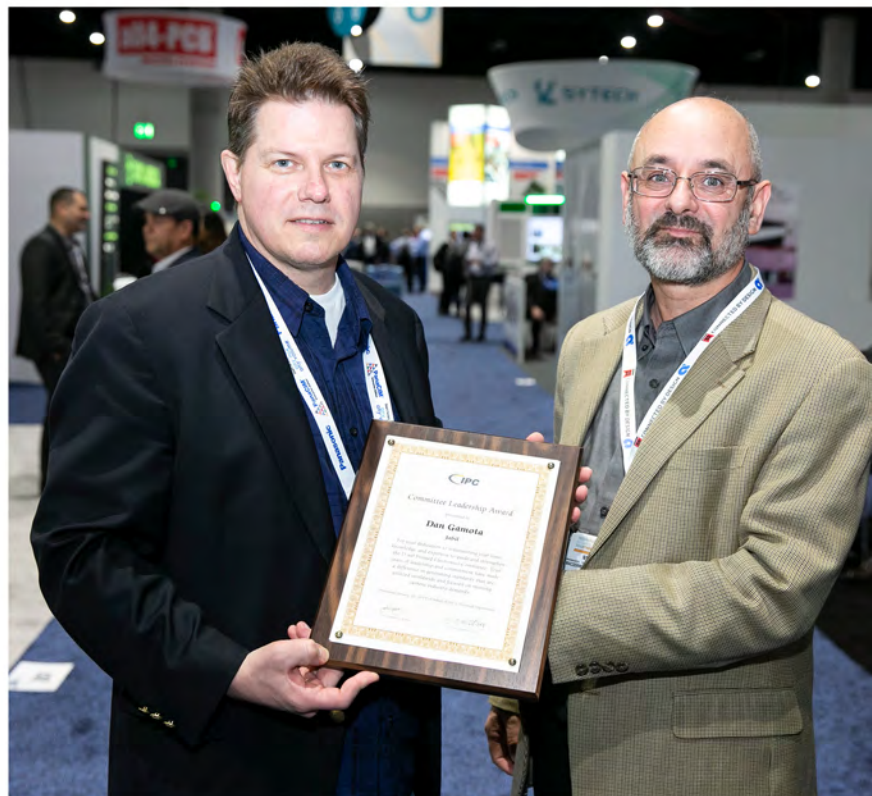
Mathur has been one of IPC's strongest supporter for the last 10 years. He and his companies have supported standards development, IPC APEX EXPO, and IPC IMPACT Washington, D.C., and has hosted more than a dozen members of Congress at his facilities. Further, Mathur has been an active and contributing IPC Board Member, chair of the Government Relations Committee, and a member of the EMS Committee. He has provided leadership from the board level to individual IPC members who have expressed interest in learning more about IPC.

### Udo Welzel, Ph.D., Robert Bosch GmbH

Dr. Udo Welzel studied physics at the University of Bayreuth (Germany) and obtained a Ph.D. degree in chemistry from the University of Stuttgart (Germany) in 2002. While serving at the Max Planck Institute for Metals Research in Stuttgart as head of the service laboratory for X-ray diffraction until 2012,









he started a collaboration program with Robert Bosch GmbH on lead-free soldering. In 2012, Dr. Welzel joined the Automotive Electronics Division of Robert Bosch GmbH where he now leads a team in the Engineering Assembly and Interconnect Technology Department responsible for assembly and interconnect technology integration for high-performance logic Automotive electronic control units.

Dr. Welzel is also responsible for standardization activities for IPC and IEC. For IPC, he serves as co-chair of the 5-21M (Cold Joining Press Fit) and 7-31BV (A610/J001 Automotive Addenda) tasks groups; at IEC, he is the chair of Technical Committee TC91 (electronics assembly technology). Dr. Welzel's support and leadership in standardization have been recognized by the IEC 1906 Award in 2014 and the IPC Rising Star Award in 2017.

### **Mark Wolfe, John Deere Electronic Solutions**

Mark Wolfe currently leads electronics supply chain activities for John Deere Electronic Solutions. Wolfe joined John Deere Electronic Solutions (formerly known as Phoenix International) in 1995 as the BP of sales and marketing. Since that time, he has held a number of executive positions including general management, operations, quality, and most recently supply management. Before joining his current company, Wolfe was director of sales and marketing for EMD Associates. He received his B.S. degree in electrical engineering from the University of Minnesota.

Wolfe has been involved with IPC and the EMS Executive Council for nearly 30 years, currently serves on the IPC Board of Directors

and is chairman of the EMS Steering Committee. In addition, he has been directly involved in the development and launch of key EMS-related IPC programs: program manager certification and EMS industry contracting.

### **Election of Officers: Four-year Term Through February 2023** **Second-term Nominees**

#### **Peter Cleveland, VP of the Law and Policy Group, Director of Global Public Policy (GPP), Intel Corporation**

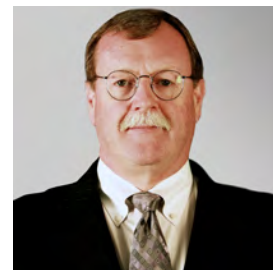
Peter Cleveland is VP of the Law and Policy Group and director of Global Public Policy (GPP) at Intel Corporation.



Cleveland oversees a team of attorneys and policy professionals worldwide and acts as the company's public policy liaison to foreign governments and regulatory bodies as well as the U.S. Congress and Trump Administration in Washington, D.C. He is a member of the New York and the District of Columbia Bars and the Council on Foreign Relations.

#### **Jeff Timms, CEO, ASM Assembly Solutions Americas**

Jeff Timms has more than 35 years of experience in the electronics industry. Timms started his career at Universal Instruments Corporation in 1984. Then, he joined Siemens as a global



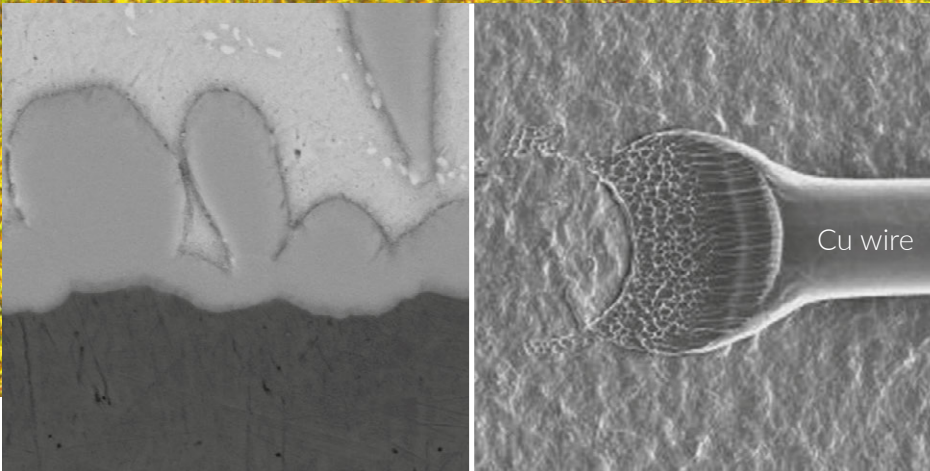
account manager in 1997 and grew through the ranks until reaching the position of division VP of assembly solutions under the Siemens Energy and Automation Operating Company. From there, Timms joined Microscan Corporation in 2008 as president. In September of 2011, he accepted an opportunity to lead ASM AS Americas. He has supported IPC by hold-







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ing positions as member and chairman of the tradeshow subcommittee, a member of the IPC SMEMA Council, and most recently the former chairman of the IPC SMEMA Council.

### **Nilesh Naik, CEO, Eagle Circuits**

Nilesh Naik has been involved in the electronic manufacturing services industry for the past 30 years. Naik began his electronics career at Eagle Circuits, a quick-turn interconnect manufacturing services company, and has been instrumental in its growth and diversification into various aspects of the EMS industry. By recognizing the importance of design, fabrication, and assembly communities within the supply chain, he has continuously challenged his peers to be more inclusive and broader in their reach and encouraged them to constantly change with the environment. Naik received his BSME from Southern Methodist University and an MSEM from Stanford University. He was a past IPC Board Chairman and currently serves as the interim president of the TiE-Dallas Chapter.



the business groups including desktop PCs, industrial servers and storages, graphics cards, automotive electronics, set-top boxes, and smart home devices for various customers. Fu established the global operations (Brazil, China, Czech Republic, Mexico, and the U.S.) for PCBA and system integrations. He received a master's degree in mechanical engineering from Oklahoma State University.

### **Carsten Salewski, Member of the Executive Board for Sales, Marketing, and International Business, Viscom AG**

Carsten Salewski is a member of Viscom AG's Executive Board for sales, marketing, and international business. Salewski was initially engaged as a software developer and project engineer for customer-specific projects. After the successful conclusion of his studies with the thesis titled "Multi-Sensorial Feature Extraction on Three-Dimensional Objects Using a 5-Axis Portal System," he also took responsibility for sales of customer-specific image processing solutions and as unit manager, established the business unit IBV.



In 2003, Salewski assumed management of international business in America, and in 2004, started as CEO of the American subsidiary headquartered in Atlanta, Georgia, along with the associated business locations in Silicon Valley, California, and Mexico. Since 2001, he has been involved as an executive employee in various areas of Viscom AG including sales and management as well as a business unit and subsidiary manager. With more than 20 years in the electronics industry, Salewski has significant experience with international major customers and trade fairs. He is chairman of the IPC SMEMA Council. Since 2015, Salewski has also been a volunteer member on the Board of Directors of the German American Chambers of Commerce in Atlanta. **S&T**

## **First-term Nominees**

### **Foo-Ming Fu, Chairman and CEO, HaiNa Cognitive Connections**

Foo-Ming Fu is currently the chairman and CEO for HaiNa Cognitive Connections (HCC), a newly established company in Foxconn fully focusing on PCB assembly (PCBA) business and advanced surface-mount technology (SMT) development. In addition to leading HCC,



Fu also manages the Cloud Enterprise Infrastructure Business Group at Foxconn. He has been with Foxconn since 1999 and leads





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# ✓ Seven Takeaways From IPC APEX EXPO 2019

by **Chris Mitchell**

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES



IPC's most recent annual conference and trade show, IPC APEX EXPO 2019, took place in late January, and by all indications, it was among the best IPC shows ever! The overall success and quality of

IPC APEX EXPO is a testament to the innovation and growth taking place in the electronics industry as well as our members' passion and commitment to standards development, learning opportunities, and pro-industry initiatives.

Here are my top seven takeaways from APEX EXPO from the perspective of someone whose job requires translating our highly technical industry into everyday language that policy-makers and their aides can understand.

## **1** IPC's Connected Factory Exchange (CFX) Took Center Stage

IPC-CFX is an industry standard designed to serve as the digital backbone of electronics manufacturing companies. By simplifying and standardizing machine-to-machine communications, CFX is establishing a foundation for Industry 4.0 applications. The surest sign of CFX's success were the dozens of exhibitor booths sporting "CFX supporter" placards. You couldn't miss them on the show floor, nor could you miss the interest in the two full-scale CFX demonstration lines, which hosted hourly tours throughout the week. To learn more, please visit [ipc-cfx.org](http://ipc-cfx.org) or contact IPC VP of Standards and Technology [David Bergman](#).



## 2 Sector-specific Initiatives Paved the Way for New Innovation

In a sign of how critically important electronics are in supporting the growth and innovation of other industries, IPC APEX EXPO 2019 was the venue for a well-attended executive forum on the future of automotive electronics, a separate “buzz session” on e-textiles, and standards committee meetings related to both. As the automotive and textile industries integrate electronics into their products in increasingly creative ways, they will rely on partners like IPC to establish the necessary standards to ensure high reliability and performance. Contact [Sanjay Huprikar](#), IPC VP of solutions, to learn more about our work with the automotive industry, and [Chris Jorgensen](#), director of technology transfer, about our work with the textile industry.

## 3 IPC-1791 QML Program Is Poised for Significant Growth

Also at IPC APEX EXPO 2019, the U.S. Department of Defense’s (DoD’s) Executive Agent for Printed Circuit Boards hosted its annual meeting. IPC Director of Validation Services Randy Cherry was on hand to update participants on the development of IPC-1791—Trusted Electronic Designer, Fabricator and Assembler Requirements—and its associated qualified manufacturers list (QML) program. The IPC-1791 standard and QML program aim to establish a trusted supplier program focused around the design, fabrication, and assembly of PCBs. The existing standard will get its first revision this month, and seven companies are now participating in the beta test audits. As the DoD seeks to strengthen the security and reliability of its supply chain, the IPC-1791 standard and QML program will serve as a model for DoD-industry collaboration. To get involved, contact [Randy Cherry](#).

## RELATED VIDEO: IPC Global Government Relations Initiatives & Updates



In this video interview, Judy Warner and IPC VP of Global Government Relations Chris Mitchell discuss initiatives such as IPC Workforce Champions, the skills gap analysis, and how they plan to advocate for the industry and grow the supply chain in North American and around the world.

## 4 IPC Launched an Educational Foundation and Inspired More Than 100 Students

Perhaps the most fun event of the week came when IPC hosted more than 100 high school students from the San Diego area to IPC APEX EXPO for panel discussions, hands-on training in soldering PCBs, and tours of the expo floor. These students were so inspiring—smart, curious, and attracted to careers in STEM fields. The IPC Education Foundation, which launched during the show, will strive to help these students succeed. As two of its first initiatives, the foundation will partner with several organizations to distribute a basic electronics curriculum to hundreds of high schools, and it will create IPC Student Chapters at universities and community colleges across the country. Many thanks to the IPC member companies who helped make this event a huge success including Calumet Electronics and Weller Apex Tool Group. To learn more and get more involved, contact [Colette Buscemi](#), IPC's senior director for education programs.

## 5 Tesla CTO and Co-Founder JB Straubel Offered Insights on Growth and Innovation

[JB Straubel](#) offered IPC APEX EXPO 2019 participants a captivating recounting of the Tesla story. Four big themes stood out. First, Tesla's founding combined the profit motive with a desire to advance environmental sustainability. Second, developing its first roadster meant Tesla had to challenge every automotive norm with little room for fallback options. Third, improving its cars today means weighing financial and technological tradeoffs. And fourth, Tesla is focused on making smart strategic investments that leverage its technological leadership in markets that can be scaled up. All four of these points are relevant to IPC members looking to build upon their growth and technology leadership in a very competitive global economy.

## 6 2019 Looks Good for the Electronics Industry

What's the outlook for the electronics industry in 2019? A growing number of economists are voicing concerns about the possibility of major economies edging into recession as early as this year. Political turmoil in the U.S. and Europe, coupled with global trade disputes and a slowdown in China are doing nothing to calm fears. However, the industry members I spoke to at IPC APEX EXPO felt pretty good about 2019. Sales remain strong, companies are hiring, and the supply chain is slowly adjusting to global uncertainty.

## 7 IPC Government Relations Expanded its Global Reach and Grassroots Program

During our IPC Government Relations Committee meeting at APEX EXPO, I shared that our public affairs program continues to expand in breadth, depth, and geography. We are taking on new issues including federal support for lead-free research, and we are doing so with greater support from industry experts and seasoned policy experts in the U.S. and Europe with additional plans for long-term, strategic engagement in Asia in 2019. To get involved, [contact me](#), follow me on [Twitter](#), or sign up at the [advocacy center](#) on our website.

These were my top takeaways from my perch atop IPC government relations, but it cannot be said enough that the power of IPC APEX EXPO lies in the thousands of attendees who take part in standards and policy committees, executive forums, buzz sessions, and professional development courses. And of course, many thanks to the hundreds of companies who exhibited their goods and services and brought so much excitement to the show floor. **SET**

**Chris Mitchell** is IPC's VP of global government relations.



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# Volunteers **Honored** for Contributions to IPC and the Electronics Industry

IPC presented Committee Leadership, Special Recognition, and Distinguished Committee Service Awards on January 28 and 30 at IPC APEX EXPO 2019 at the San Diego Convention Center. The awards were presented to individuals who made significant contributions to IPC and the industry by lending their time and expertise through IPC committee service.

Receiving Special Recognition Awards for their contributions to the 2018–2019 Technical Program Committee were Steve Butkovich, Test Innovation LLC; Weifeng Liu, Flex; Russ Nowland, Nokia; Julie Silk, Keysight Technologies; and Bhanu Sood, NASA Goddard Space Flight Center.

For his leadership of the 8-81 PERM Self-Mitigation of Tin by the SMT Task Group that developed IPC/PERM-WP-022—Mitigation of Pure Tin Risk by Tin-Lead SMT Reflow—David Pinsky of Raytheon Company received a Committee Leadership Award. Ben Gumpert, Lockheed Martin Missiles and Fire Control; Thomas Hester, Raytheon Space and Airborne

Systems; David Hillman, Collins Aerospace; Anduin Touw, The Boeing Company; Ross Wilcoxon, Collins Aerospace; and Paul Zutter, U.S. Army AMRDEC, received a Distinguished Committee Service Award.

For their leadership of the 7-31FT IPC/WHMA-A-620 Technical Training Task Group that developed IPC/WHMA-A-620C—Requirements and Acceptance for Cable and Wire Harness Assemblies—Catherine Hanlin, Prevision Manufacturing Company Inc.; Shelley Holt, L3 Communications; and Debbie Wade, Advanced Rework Technology-A.R.T, earned Committee Leadership Awards. For their extraordinary contributions to IPC/WHMA-A-620C, Garry Maguire, NASA Marshall Space Flight Center; Michelle Moring, STI Electronics Inc.; and Pat Scott, STI Electronics Inc., received a Special Recognition Award.

Symon Franklin, Custom Interconnect Ltd., and Debbie Wade, Advanced Rework Technology-A.R.T, were honored with Committee Leadership Awards for their leadership of the



5-22BTEU European Technical Training Task Group that developed IPC/WHMA-A-620C—Requirements and Acceptance for Cable and Wire Harness Assemblies.

For his leadership of the D-33AA IPC-6012 Automotive Addendum Task Group that developed IPC-6012DA—Automotive Applications Addendum to IPC-6012D with Amendment 1, Qualification and Performance Specification for Rigid Printed Boards—Jan Pedersen, Elmat-ica, earned a Committee Leadership Award. For their extraordinary contributions, Kelvin Chang, Veoneer Canada Inc.; Nancy Deng, Ford Motor Research and Engineering; Emma Hudson, Gen3 Systems Limited; Andrew Goddard, ZF TRW Automotive; Todd MacFadden; Bose Corporation; Laurent Nardo, Continental Automotive France SAS; Michael Schoening, Q-Products Enterprise Limited; and Udo Welzel, Robert Bosch Co. Ltd., received a Special Recognition Award.

For their leadership of the 5-22a J-STD-001 Task Group that developed J-STD-001G—Requirements for Soldered Electrical and Electronic Assemblies with Amendment 1—Dan Foster, Missile Defense Agency, and Kathy

Johnston, Raytheon Missile Systems, earned a Committee Leadership award. Doug Pauls, Collins Aerospace, and Udo Welzel, Robert Bosch GmbH, received a Committee Leadership Award for their leadership of the Rhino Team that developed IPC-WP-019A—An Overview on the Global Change in Ionic Cleanliness Requirements—and J-STD-001G—Requirements for Soldered Electrical and Electronic Assemblies with Amendment 1.

Dock Brown, DfR Solutions; Karen McConnell, Northrop Grumman Corporation; and Steve Golemme, Google Inc., were honored with a Committee Leadership Award for leading the 1-14 DFX Standards Subcommittee that developed IPC-2231—Design for Excellence Guideline During the Product Lifecycle. Don Dupriest, Lockheed Martin Missiles and Fire Control, received a Special Recognition Award.

Jimmy Baccam, Lockheed Martin Missiles and Fire Control; Benny Barbero, Allied Telesis Inc.; Scott Bowles, L3 Fuzing and Ordnance Systems, Cincinnati; Peter Fernandez, Lab 126; Michelle Gleason, Plexus Corporation—Neenah Operations; Kayleen Helms, Intel Corporation; Eddie Hofer, Rockwell Collins; Waleid

Jabai, Zentech Manufacturing; Kevin Kusiak, Lockheed Martin Space Systems Company; Dale Lee, Plexus Corporation—Neenah Operations; Kristopher Moyer, CSUS; James Pierce, Axiom Electronics LLC; Robert Rowland, Axiom Electronics, LLC; Steven Roy, Hamilton Company; Rainer Taube, Taube Electronic GmbH; Theodore John Tontis, Rockwell Automation/Allen-Bradley; Cheryl Tulkoff, DfR Solutions; Louis Ungar, Advanced Test Engineering Solutions Inc.; Pietro Vergine, Leading Edge; and Linda Woody, LWC Consulting, received a Distinguished Committee Service Award for their contributions to IPC-2231—Design for Excellence Guideline During the Product Lifecycle. **SET**



# IPC Issues **Call for Participation** for IPC APEX EXPO 2020

Submit an abstract for one of the industry's premier technical conferences or provide a course proposal for one of its largest educational events. Presenting at IPC APEX EXPO 2020 in San Diego, California, will provide significant visibility for you and your company. Thousands of individuals will receive the technical proceedings of the conference, ensuring that your published paper will be seen by key engineers,

managers, and executives from all segments of the worldwide electronic interconnection industry. Presenting a technical conference paper or teaching a professional development course is a unique and cost-effective channel to promote your expertise and your organization to your customers, prospects, and the industry.

Topics for technical conference papers and professional development courses include:

- |   |  |  |
|---|--|--|
| <ul style="list-style-type: none"><li>• 3D Printing in Electronics Manufacturing</li><li>• Automation in Electronics Manufacturing</li><li>• Adhesives</li><li>• Advanced Technology</li><li>• Area Array/Flip Chip/O2O1 Metric</li><li>• Assembly and Rework Processes</li><li>• BGA/CSP Packaging</li><li>• Black Pad and Other Board Related Defect Issues</li><li>• BTC/QFN/LGA Components</li><li>• Business &amp; Supply Chain Issues</li><li>• Cleaning</li><li>• Conformal Coatings</li><li>• Corrosion</li><li>• Counterfeit Electronics</li><li>• Design</li><li>• Electromigration</li></ul> | <ul style="list-style-type: none"><li>• Electronics Manufacturing Services</li><li>• Embedded Passive &amp; Active Devices</li><li>• Environmental Compliance</li><li>• Graphene in Electronics Manufacturing</li><li>• Lean Six Sigma</li><li>• LED Manufacturing</li><li>• Failure Analysis</li><li>• Flexible Circuitry</li><li>• HDI Technologies</li><li>• Head-on-Pillow</li><li>• Board and Component Warpage</li><li>• High Speed, High Frequency &amp; Signal</li><li>• Industry 4.0</li><li>• Integrity</li><li>• Lead-Free Fabrication, Assembly &amp; Reliability</li><li>• Miniaturization Nanotechnology</li><li>• Optoelectronics</li></ul> | <ul style="list-style-type: none"><li>• Packaging &amp; Components</li><li>• PCB Fabrication</li><li>• PCB and Component Storage &amp; Handling Performance</li><li>• Quality &amp; Reliability</li><li>• Photovoltaics</li><li>• PoP (Package-on-Package)</li><li>• Printed Electronics</li><li>• Reshoring</li><li>• RFID Circuitry</li><li>• Robotics</li><li>• Soldering</li><li>• Surface Finishes</li><li>• Test, Inspection &amp; AOI</li><li>• Tin Whiskers</li><li>• 2.5-D/3-D Component Packaging</li><li>• Underfills</li><li>• Via Plugging &amp; Other Protection</li><li>• Wearables</li></ul> |
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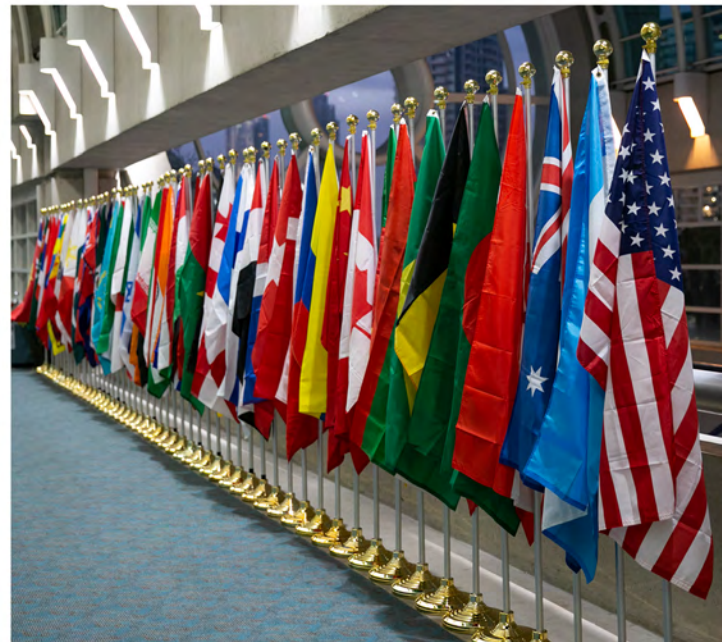
## Technical Conference Submission Requirements

Provide an abstract of approximately 300 words that summarizes technical work, covering case histories, research, and discoveries. Authors of papers selected for the conference will each receive a detailed speaker manual to assist them with numerous items including

the formatting of their papers and presentation slides.

The selection process is competitive and sufficient detail needs to be included to allow the Technical Program Committee to properly assess the content of the proposed paper. The paper should be noncommercial and describe significant results from experiments, empha-







size new techniques, discuss trends of interest, and contain technical and/or appropriate test results. Presentations will be limited to 30 minutes, which includes approximately five minutes for questions and answers.

Please note that previously published papers and/or commercially focused papers are not appropriate and will not be accepted.

## Conference Benefits

Conference speakers are entitled to a free one-day conference pass for the day of their presentations, discounted registration fees for the full conference, and complimentary admission to the exhibit hall. All speakers selected for papers who provide both their paper and presentation to IPC by October 25, 2019, will be eligible for a free full-conference pass. IPC leaves it to the primary and co-authors' discretion on how the honorarium should be distributed.

## Conference Awards

To recognize exceptional achievement, awards will be presented for the best technical paper. Each award consists of a recognition plaque for each author and a \$1,000 prize.

## Conference Paper Timeline

- Abstracts due by June 21, 2019
- Acceptance/status of your submittal by August 16, 2019
- Papers due by November 8, 2019
- Presentations due by December 6, 2019

## Professional Development Courses

Course proposals are solicited from individuals interested in teaching half-day (three-hour) professional development courses on design, manufacturing processes, and materials. Travel expenses and honorariums are offered to professional development instructors.

## Professional Development Timeline

- Proposals due by June 24, 2019
- Acceptance by July 22, 2019
- Final presentation revisions due by December 26, 2019

## Abstract and Proposal Instructions

To submit your conference paper abstract or professional development course proposal online, [click here](#).

For more information about conference participation, contact [Brook Sandy-Smith](#) or [Toya Richardson](#), or call +1 847-597-2825.

For information on guidelines for submitting abstracts (e.g., type of technical content needed) and example conference abstracts, papers, and presentations, contact [Jasbir Bath](#).

For more information on professional development courses, contact [Brook Sandy-Smith](#) or [Andrea Keefe](#).





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## ADVERTISER INDEX

Alpha Assembly Solutions.....	61
Atotech.....	51, 141
Blackfox Training Institute.....	47, 123
Burkle North America.....	17, 99
Flex007 Magazine.....	115
I-Connect007.....	109, 135
I-Connect007 eBooks.....	119, 143
IPC.....	77, 154
LPKF.....	101
Meyer Burger.....	73
PCB007 China Magazine.....	147
Super Dry.....	66, 67
Taiyo America.....	86, 87
Ventec International Group.....	7, 85

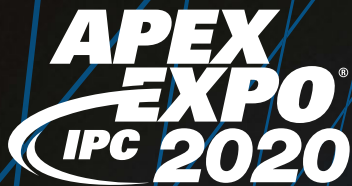
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