

I-Connect007 PRESENTS
GOOD FOR THE INDUSTRY

REALTIME with...

IPC APEX EXPO 2020 EXCLUSIVE EVENT COVERAGE

SHOW & TELL

M A G A Z I N E



APEX EXPO
IPC 2020

Youth and
Technology
on the Rise

IPC
CFX
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REALTIME with... SHOW & TELL

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- 6** Welcome to Real Time with...
IPC APEX EXPO 2020 Show & Tell
by Nolan Johnson

- 8** IPC Photo Gallery
Some of the most memorable images
from IPC APEX EXPO 2020

- 12** Elevating the Excellence of Electronics
at IPC APEX EXPO 2020
by John Mitchell

- 16** I-Connect007 Real Time with...
IPC APEX EXPO 2020 Video Showcase
Featured RTW interviews
and sponsors

- 22** I-Connect007 Real Time with...
IPC APEX EXPO 2020 Video Library
A collection of all RTW interviews at
IPC APEX EXPO 2020

- 24** Thank You, I-Connect007
Contributors!
by Barry Matties

- 30** Happy's Highlights
by Happy Holden

- 36** Congratulations to Steve Pudles!
IPC Hall of Fame 2020 Inductee
by Patty Goldman



REALTIME with... SHOW & TELL M A G A Z I N E

- 42** The Success of IPC's STEM Student Outreach Program
by Charlene Gunter du Plessis
- 46** Inspiring Next-generation Engineers Through STEM
by Barry Matties
- 50** Best Technical Papers and Honorable Mentions
- 52** I-Connect007 Announces 2020 Good for the Industry Award Recipients
- 58** Congratulations to Mike Carano!
Dieter Bergman IPC Fellowship Award Recipient
by Patty Goldman
- 68** Congratulations to Udo Welzel!
Dieter Bergman IPC Fellowship Award Recipient
by Patty Goldman
- 74** Congratulations to Bhanu Sood!
Dieter Bergman IPC Fellowship Award Recipient
by Patty Goldman
- 80** Trends From the Show:
Solder and Software
by Nolan Johnson



REALTIME with... SHOW & TELL

M A G A Z I N E

- 82** Burt Rutan's Keynote: SpaceShipOne
by Pete Starkey
- 86** Standout Conversations From IPC APEX EXPO 2020
by Steve Williams
- 88** The Impact of IPC's Emerging Engineer Program
by Barry Matties
- 96** The Evolution of IPC APEX EXPO
by Dan Feinberg
- 100** Pure 'Happy-ness': An Evening With Happy Holden
by Pete Starkey
- 104** Six IPC APEX EXPO Exhibitors Earn 2020 Innovation Awards
- 106** Alumni Week at IPC APEX EXPO 2020
by Patty Goldman
- 110** New Developments and Opportunities
by Tara Dunn
- 114** Best Practices Highlighted at the 2020 IPC EMS Management Meeting
by Tracy Riggan



REALTIME with... SHOW & TELL

M A G A Z I N E

118 Dr. Kunal Shah's Award-winning
Technical Paper
by Nolan Johnson

120 Attendees Speak!
by Kelly Dack and
the I-Connect007 Team

130 A Great Big Global Party
by Dan Beaulieu

132 And the Award Goes to....

137 IPC Board of Directors:
New Officers and Members

138 Seven Takeaways From
IPC APEX EXPO 2020
by Chris Mitchell

142 Volunteers Honored for
Contributions to IPC and
the Electronics Industry

148 Elaine Larsen's Keynote:
Motorsports and Mentoring
by Nolan Johnson

151 IPC APEX EXPO 2020
Time-Lapse Video

153 Advertiser Index and Masthead





Welcome to Real Time with... IPC APEX EXPO 2020 Show & Tell

by Nolan Johnson
I-CONNECT007

It is often said, “The third time’s the charm.” If that’s the case, then you’re now reading the “charmed” issue of *Real Time with...IPC APEX EXPO 2020 Show & Tell Magazine*. This special publication is a supplement to our other monthly magazines and brings you exclusive, in-depth coverage of the 20th year of IPC APEX EXPO.

Inside you will find event photos, video interviews, attendees’ thoughts, and reviews from our guest contributors and I-Connect007 editors. You’ll also find interviews with industry experts and continued coverage of the rapidly expanding IPC STEM Student Outreach Program.

Dr. John Mitchell’s observations set the tone for the rest of our coverage, followed by an IPC photo gallery. Next, our Real Time with... IPC

APEX EXPO 2020 video showcase and library take you right to the show floor with news, interviews, and insider commentaries from industry leaders. Then, Barry Matties thanks the I-Connect007 contributors who helped deliver all this in-depth coverage. Happy Holden shares his takeaways in “Happy’s Highlights,” and we congratulate Steve Pudles, the IPC Raymond E. Pritchard Hall of Fame 2020 Inductee, in an interview with Patty Goldman.

This year, the IPC STEM Student Outreach Program introduced nearly 200 area high school students to electronics manufacturing. Charlene Gunter de Plessis shares her perspective in “The Success of the IPC’s STEM Student Outreach Program.” In “Inspiring Next-generation Engineers Through STEM,” Barry Matties interviews a high school STEM teacher from the event, Kathy Schultz, and Arvind Karthikeyan, a participant in IPC’s Emerging Engineer Program, about how these visits amplify the les-

sons being taught in the classroom and the lasting impact mentoring young engineers can have on everyone involved. We also provide an overview of this year's best technical papers and honorable mentions.

A special addition this year is the I-Connect007 Good For the Industry award. I-Connect007 has bestowed this award only periodically, when an individual's contributions are, well, good for the industry. This year, I-Connect007 honored 14 of our columnists for their ongoing efforts to impart their knowledge and expertise and drive conversation.

Patty Goldman shares her interviews with the prestigious Dieter Bergman Fellowship Award recipients: Udo Welzel, Mike Carano, and Bhanu Sood. In my report on show takeaways, I share two main trends: solder and software. Pete Starkey captures the essence of the keynote presentation by aerospace engineer and aircraft designer Burt Rutan, and I share my conversation with Dr. Kunal Shah from LiloTree, who speaks about "Reliable Nickel-Free Surface Finish Solution for High-Frequency HDI PCB Applications," which was recognized as this year's Best Technical Paper.

Shifting gears, Barry Matties showcases IPC's Emerging Engineers Program, from the perspective of one participant, Jessie Vaughan. Then, Dan Feinberg posts his impressions of IPC APEX EXPO 2020. Last year, Dan called the 2019 edition "the best ever." This year, he makes his case for why the 2020 show outperformed 2019. Pete Starkey returns with his coverage of the I-Connect007-hosted event "An Evening of Pure Happy-ness." This invitation-only event, held Monday evening, put industry giants and emerging engineers alike in the same room with Happy Holden as the guest speaker. Happy entertained and educated, keeping the whole audience riveted as he told stories about growing up, working in the early days of the industry, and developing some of the processes we still use today.

The IPC Innovation Awards results are next in line, followed by Patty Goldman's report. As an IPC Hall of Famer, Patty's observations are always insightful. Next in line is Tara Dunn, with her review of new developments and

opportunities, featuring two new additions to the overall program.

IPC's Tracy Riggan describes "Best Practices Highlighted at the 2020 IPC EMS Management Meeting." Then, Steve Williams shares his "Standout Conversations from IPC APEX EXPO 2020," and the I-Connect007 team brings you thoughts and impressions from attendees. Dan Beaulieu then describes the show as "A Great Big Global Party."

In "And the Award Goes to...," we showcase the winners of the Corporation Recognition Awards, IPC Rising Star Awards, and IPC President's Awards. Our congratulations to everyone recognized. From the IPC Government Relations office, Chris Mitchell shares his "Seven Takeaways from IPC APEX EXPO 2020." Next, we thank the IPC volunteers who tirelessly work to develop industry standards and much more. Don't miss the IPC APEX EXPO 2020 time-lapse right behind.

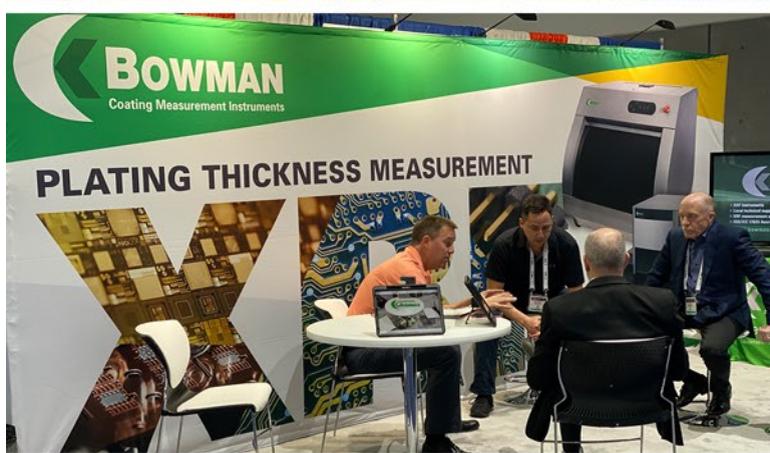
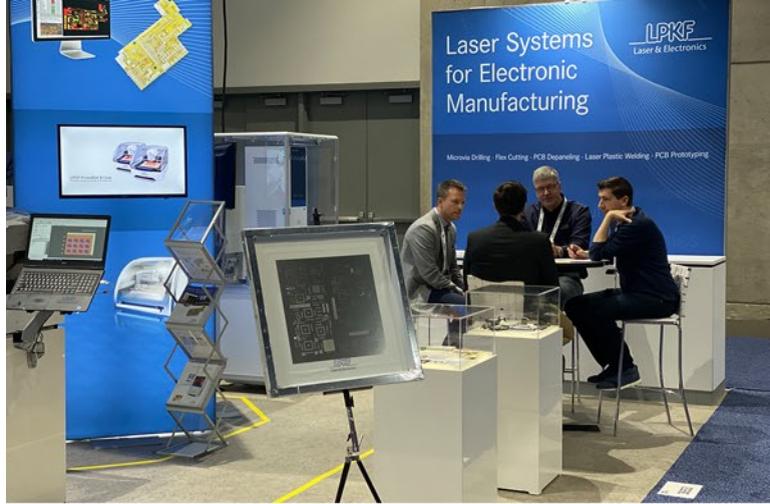
We wrap up with an interview with Elaine Larsen, this year's Women in Electronics keynote speaker. Elaine is a jet-powered dragster driver, and her keynote had much to say about ignoring gender barriers and bias, as well as being a terrific inspirational speaker. Finally, the technical portion of IPC APEX EXPO doesn't run without submitted papers. Look for the IPC "call for papers" announcement.

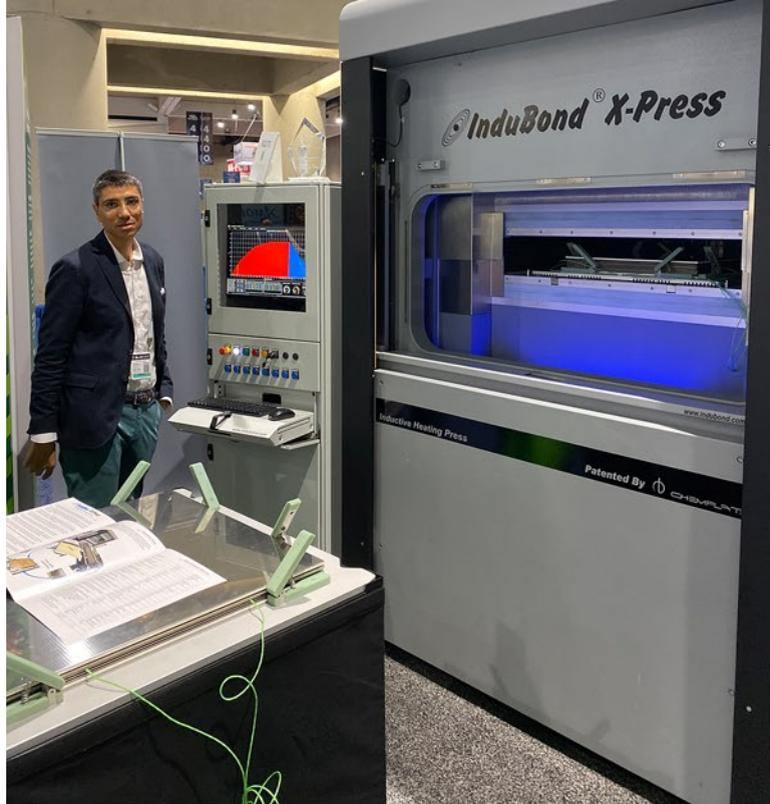
Overall, I-Connect007 wants to recognize the IPC team for all they have done not only to put on such an event but also for their ongoing and tireless assistance in producing this special edition. The teamwork and collaboration shown in this project is something that we greatly appreciate. Thank you.

If you were in San Diego for this event, we're sure you'll feel the buzz of the place captured in this special edition. If you weren't there, we hope this edition gives you a sense of understanding and excitement. See you next year! **S&T**



Nolan Johnson is managing editor of *SMT007* and *PCB007 Magazines*. Nolan brings 30 years of career experience focused almost entirely on electronics design and manufacturing. To contact Johnson, [click here](#).









Elevating the Excellence of Electronics at IPC APEX EXPO 2020

by John Mitchell

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

Every year at IPC APEX EXPO is unique, and 2020 was no exception. Not only were we celebrating our 20th APEX, but we offered many new ways for attendees to get the most out of their experience, including the Fundamentals Program, Sessions @ the Intersection, more professional development courses than we've ever provided, a robust technical education program, and the exceptional committee work to create, edit and implement IPC standards.

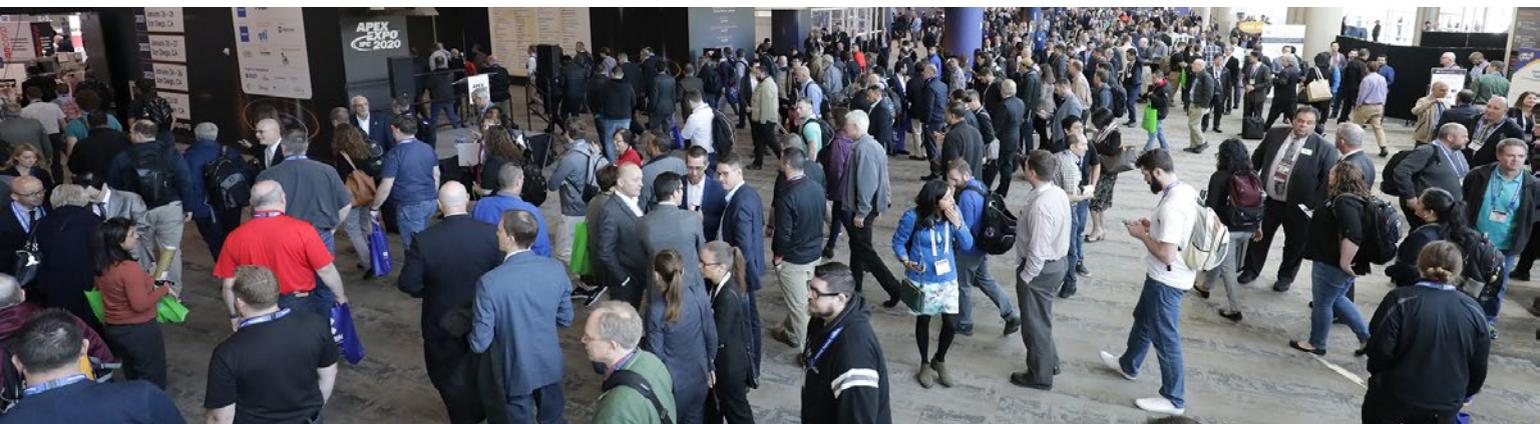
IPC APEX EXPO 2020 welcomed 9,000 professionals from 45 countries and hosted 493 exhibitors utilizing the entire show floor space to make this the largest event for electronics manufacturing in North America. We are very proud of this show and being recognized by the Tradeshow News Network (TSNN) as the fastest-growing association show for attendance in the U.S. for the years 2016–2018.

Our Fundamentals Program, created for newcomers and anyone interested in a broader

view of electronics manufacturing, included presentations on tribal knowledge, circuit board design, PCB fabrication, and much more led by subject-matter experts eager to share their knowledge with newcomers to IPC APEX EXPO. The program was very well-attended, and we look forward to building on that success next year.

Sessions @ the Intersection offered free sessions on industry topics that intersect business and engineering or two industry organizations, providing a platform for discussion on issues such as a session on why your supply chain needs diversity (in conjunction with WBENC), e-textiles developments, or semi-additive processes for building circuits, to name a few.

IPC APEX EXPO is a forum for ideas and new ways for generations to connect—something that is so important as we look to the future of our industry. Just seeing all the faces of our new emerging engineers—we have 30 in this year's class, up from four last year—along with the high school students who attended our packed STEM event, was something I thor-





The STEM Student Outreach Program was supported by IPC members and partners who were instrumental in pulling it together either through donations of equipment, the participation of trainers and exhibitors, and generous sponsorships. It's a rewarding event for all of us, and we eagerly anticipated the reaction the kids have to the event and enjoyed answering their insightful questions.

We had a wonderful opportunity to ask questions of our own when Burt Rutan, aero-

space legend, who delivered the IPC APEX EXPO keynote speech about his remarkable and creative career in engineering, reminding all of us who work with creative people to "let the innovator decide what risk to take." Another speaker that had us enthralled was Elaine Larsen, jet dragster racer, who delivered the keynote at the Women in Electronics reception, explaining how she went from her Mennonite upbringing to a career in motorsports, and how her company provides STEM outreach to local Florida students.

We introduced a few new initiatives at this IPC APEX EXPO, from our chief economist, Shawn DuBravac, who will focus on industry

ougly enjoyed. I was able to learn from emerging engineers about their career plans, as well as learn what their mentors planned to teach them. To see engineers from every age group building a stronger industry right in front of me was exciting and encouraging. Attending our packed Newcomers Reception, I was able to watch our subject-matter experts and long-time volunteers share their knowledge with a new crop of eager engineers, who will succeed them as subject matter experts with time.

The IPC Education Foundation (IPCEF) hosted their annual STEM event, welcoming 193 local high school students and 30 educators for a day-long event allowing them to see, feel, and touch what the electronics industry has to offer. Students participated in educational tracks with a focus on soldering, PCB design, and building circuits with breadboards. Students learned hand soldering from IPC trainers, talked to exhibitors on the show floor about the varied opportunities a career in electronics would provide them, and visited the CFX/HERMES production lines and participated in a career panel discussion.

We introduced a few new initiatives at this IPC APEX EXPO, from our chief economist, Shawn DuBravac, who will focus on industry

We introduced a few new initiatives at this IPC APEX EXPO, from our chief economist, Shawn DuBravac, who will focus on industry





intelligence, providing data and market research framing our industry on the world stage. He will be joined by our new chief technologist, Matt Kelly, whose skills at committee leadership and technological insights will inform what we do in the future. We also introduced IPC Design, an effort to work more closely with the global design industry, relying on a diversity of design input from across the globe.

As I walked the show floor or attended various committee meetings and other events, I received positive feedback from attendees who were enthusiastic about the innovation in this industry. The convergence of influences such as AI, additive manufacturing, and robotics are all coming together, and IPC is at the heart of it, and that is enthralling.

I thoroughly enjoyed my time at IPC APEX EXPO. It was a gathering place for the present and future of electronics, enabling all of us to connect in remarkable ways. I learn so much from committee members, exhibitors, speakers, and every attendee I meet. I never tire of hearing about all the new equipment, new ideas, and new ways of looking at this ever-changing industry.

At IPC, we are profoundly grateful to an industry that has encouraged and supported us

these last 20 years of IPC APEX EXPO, and we look forward to 20 more. We never lose sight of the fact that we could not host this giant, exciting event without the dedicated volunteers who share their time, their expertise, and their enthusiasm with all of us.

Though we wrapped up IPC APEX EXPO less than two weeks ago, our team is already preparing for next year's show, which will take place January 23–28, 2021. I look forward to seeing you in San Diego! For more information on next year's event, visit ipcapexexpo.org. **S&T**

Dr. John Mitchell is president and CEO of IPC-Association Connecting Electronics Industries.

PCB007

JOHN MITCHELL
 Experience: 20+ years
 Expertise: Management, education
 Day Job: President and CEO, IPC

COLUMN: ONE WORLD, ONE INDUSTRY

Sage advice:
 Be nimble! Change is constant, especially in the electronics industry.

Favorite quote:
 "No matter where you go, there you are."
 -Buckaroo Bonzai

Inspired by:
 Albert Einstein, who thought outside the box.

First job:
 Detasseler (person who removes the tassel from the tops of corn plants)

First car:
 AMC Hornet

JOHN MITCHELL
 I-CONNECT007 COLUMNIST

2020 EDITION

IConnect007
 MAGAZINE FOR THE INDUSTRY



ventec
INTERNATIONAL GROUP
騰輝電子

Wherever **technology** takes you,
Ventec delivers



tec-speed: High-speed/low-loss material technology

The ultimate choice for superior Signal Integrity performance

tec-speed laminates & prepregs unite one of the most comprehensive range of products in high-speed/low-loss PCB material technology.

tec-speed combines technological innovation, high-performance and superior quality, offering excellent electrical properties for reliability and stability across a broad range of frequencies and temperatures. tec-speed materials are designed for applications where good Signal Integrity is essential, including: 5G applications, telecom, router, servers, backplane & daughter card designs, high-frequency & high-speed designs, automotive & satellite communication, navigation, GPS, hand-held products etc.



Blackfox, Al Dill

The Evolution Foundation: Assisting Veterans

Al Dill, president and CEO, announces the Blackfox-inspired Evolution Foundation, a non-profit program to assist veterans with training and assistance into civilian tech jobs.



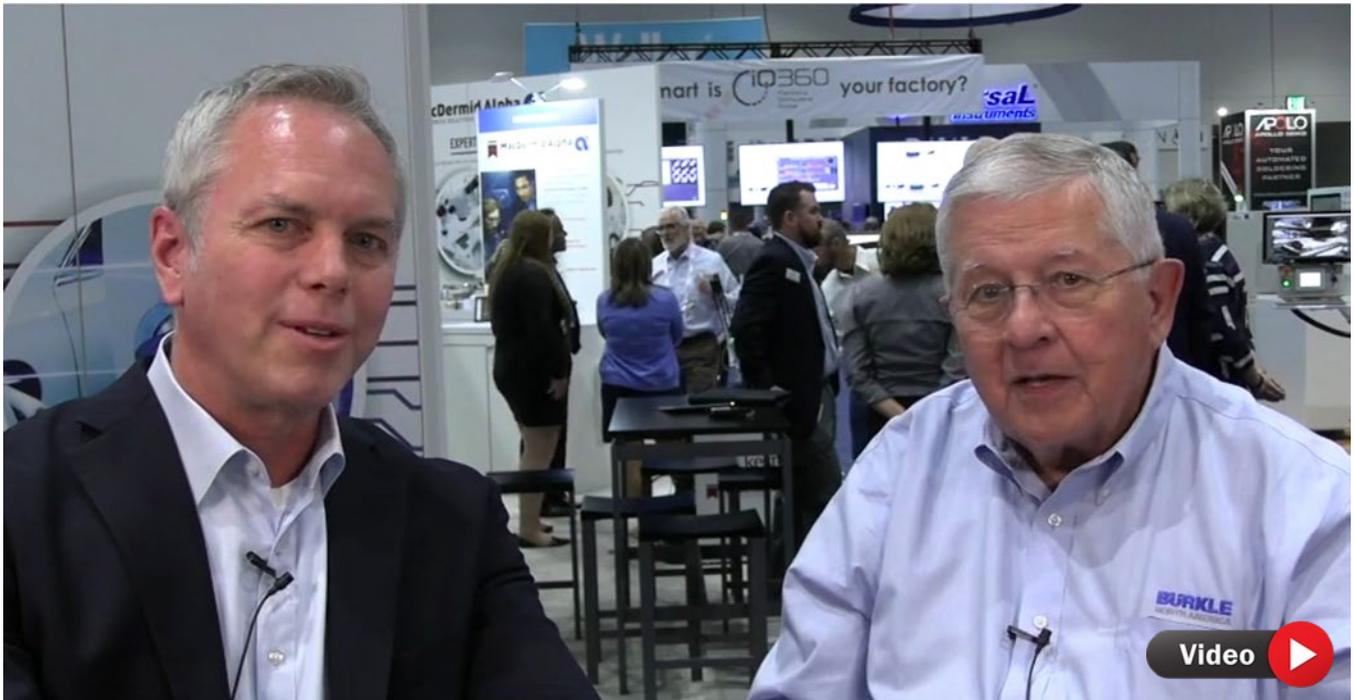
Indium, Kay Parker

The Value of Internships & IPC's Emerging Engineer Program
Nolan Johnson speaks with Kay Parker, technical support engineer for Indium Corporation, who shares her experience entering the industry from university to internships and a professional position. She also highlights IPC's Emerging Engineer Program.



RBP Chemical Technology, Ernest Litynski

Newly Appointed President of RBP Chemical Technology
Dick Crowe speaks with Ernest Litynski, newly appointed president of RBP Chemical Technology, about his background and new role and his hopes for the company in the future.



Burkle North America, Kurt Palmer

Kurt Palmer on His New Role, the Show, and a Younger Workforce

Dick Crowe and Kurt Palmer, president and CEO of Burkle North America, discuss Kurt's career history into his present role, equipment the company is exhibiting on the show floor, and the excitement about seeing a younger workforce at IPC APEX EXPO 2020.



Downstream, Joe Clark

Integrated Manufacturing Design and Verification Solutions

Joe Clark, co-founder of DownStream Technologies, gives Kelly Dack an overview of the company and their innovative product line, which serves to smooth the bumps that can occur between source design output and manufacturing line input.



IPC, Chris Jorgensen

IPC Addresses the Need for E-textiles Standards

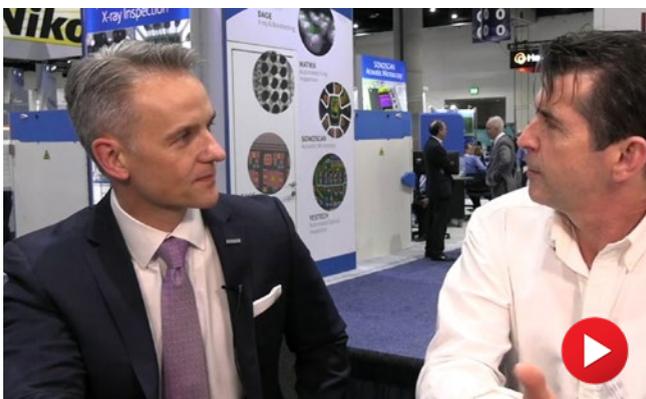
Chris Jorgensen, IPC's director of technology transfer, and Pete Starkey explore the need for standards in the e-textiles industry and IPC's recent initiative to address the topic. Chris also discusses IPC's E-Textiles Committee, and the call for papers for the 2020 IPC E-Textiles Conference.



Super Dry, Rich Heimsch

Will Moisture Management Expand to U.S. Market?

SuperDry's Richard Heimsch chats with Nolan Johnson about how the need for moisture management continues to grow in North America versus its usage in Europe, and how moisture management fits into Industry 4.0 and the smart factory. [Click here to read this interview.](#)



Panasonic, Sean Murray

Software and Information Management: Panasonic's Focus
Nolan Johnson speaks with Sean Murray—director of sales, service, operations, and logistics process automation at Panasonic—who shares the company's focus on software and information management on top of their long history in hardware and equipment.



Asymtek, Camille Sybert

Developments in Dispensing and Conformal Coatings
Camille Sybert, product manager at Nordson Asymtek, updates Nolan Johnson on the company's new developments in dispensing and conformal coatings, including Helios and Vortec solutions, among others. Camille also describes the virtual reality simulation in their IPC APEX EXPO booth.



Taiyo America, Don Monn

Solder Mask Developments

Pete Starkey and Don Monn, Midwest regional sales director at Taiyo America Inc., discuss progress with the establishment of inkjet solder mask as a production reality, now with OEM approvals. Don also addresses the development of crack-resistant white solder mask and new screen-printable formulations with very high thermal conductivity.



Ucamco, Luc Maesen

Intelligence-aided Manufacturing

Luc Maesen, Ucamco director, talks to Pete Starkey about how AI has been applied in the automation of the CAM/CAD process, resulting in the company's lamCam system, which enables intelligence-aided manufacturing designed to lower cost while achieving fewer errors and faster delivery.



IPC, Dr. John Mitchell

IPC APEX EXPO 2020 and IPC Design

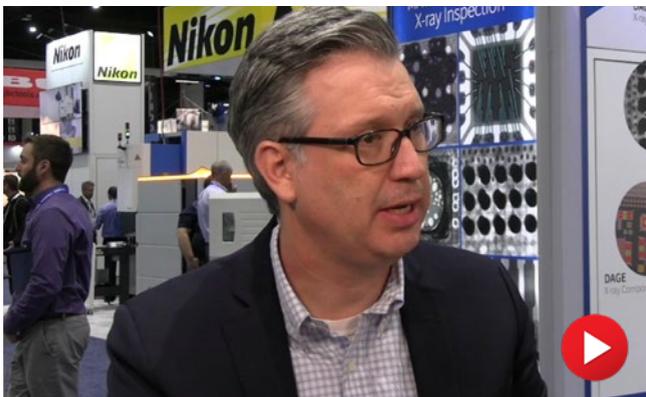
Dan Feinberg and Dr. John Mitchell, IPC president and CEO, discuss IPC APEX EXPO 2020, how the show is evolving to be a mini CES—including ideas and prototypes—new IPC initiatives, and IPC Design.



Technica USA, Frank Medina & Harry Kok

Consistent Registration: CB Tech's New Direct Imaging System

Frank Medina, president and CEO of Technica USA, introduces Harry Kok, international sales director at CB Tech, who explains the features of the CB Tech "Titan" direct imaging system, which has very high throughput capability with best-in-class registration consistently maintained from the beginning to the end of the batch.



IPC, Chris Mitchell

IPC Government Relations on Industry Intelligence Programs
Nolan Johnson talks to Chris Mitchell, IPC's VP of global government affairs, who provides an update on the work done by the IPC Government Relations Team, including their latest initiative with industry intelligence programs.



IPC, David Bergman

David Bergman on Applications of CFX
Jennie Hwang and David Bergman, IPC's VP of standards and training, address using CFX to facilitate plug-and-play smart factories.



Ventec, Mark Goodwin

Ventec: A Materials Technology Company

Pete Starkey and Mark Goodwin discuss new, high-speed, low-loss, high-frequency materials as enablers for 5G and Industry 4.0, a set of materials for automotive applications, and the stability of Ventec's inventory and supply chain.



Pluritec, Nicola Doria

Structure and Strategy of Pluritec

Pluritec President Nicola Doria explains how the international supplies and OCCLEPPO technologies have been integrated into Pluritec and the strategy of providing a complete process solution for PCB manufacturers.



Miraco, Jason Michaud

Connectors, Cables, Flex Circuits, and More

Dick Crowe and Jason Michaud, VP of sales and marketing at Miraco Inc., discuss connector and cable products with an emphasis on flex circuits.

Aegis Software, Michael Ford

Michael Ford on M2M Communication and Smart Factories

Aismalibar, Jeff Brandman

Heat-sinking Materials and Thermal Dissipation

American Standard Circuits, Anaya Vardya

Anaya Vardya on Company Updates, Flex Circuits, and eBooks

Arch Systems Inc., Tim Burke

The Need for Software and Hardware

Arlon Electronic Materials, Dave Nelson

Overcoming Failures Associated With High-power PCB Designs

Averatek, Divyakant Kadiwala

Averatek's Mina Applications

Averatek, Mike Vinson

Averatek Announces A-SAP Licensees

BFK Solutions, Barbara & Ed Kanegsberg

BFK Solutions' IPC Professional Development Course

Blackfox, Al Dill

The Evolution Foundation: Assisting Veterans

Bowman XRF, Rob Coleman

Bowman XRF Goes Virtual on the Show Floor

Burkle North America, Kurt Palmer

Kurt Palmer on His New Role, the Show, and a Younger Workforce

CyberOptics, Dr. Subodh Kulkarni

Merging SMT and Semiconductor Markets

DIS, Jesse Ziomek

DIS: It's All About Alignment

DownStream Technologies, Joe Clark

Integrated Manufacturing Design and Verification Solutions

DOX, Ken Michael & Larry Cohen

DOX on Government Cybersecurity Requirements

Electra, Shaun Tibbals

The Benefits of Inkjet Printing

Electrolube, Phil Kinner

"Coatings Uncoated!" Webinar Series and Industry Trends

Elmatica, Jan Pedersen

Developments With IPC-6012 and IPC-2581

EPTAC Corporation, Leo Lambert

IPC Training Program Development

Flexible Circuit Technologies, Carey Burkett

The Complete Solution for Flex and Rigid-flex

Gardien, Jason Posey

State-of-the-Art in Electrical Test and Visual Inspection Equipment

HDP User Group, Bev Christian

HDP User Group's Latest E-textiles Efforts

Hitachi High-Tech, Matt Kreiner

Advanced X-ray Fluorescence Techniques

Indium Corporation, Chris Nash

Indium Corporation: Low- and High-temperature Product Applications

Indium Corporation, Kay Parker

The Value of Internships and IPC's Emerging Engineer Program

InduBond, Víctor Lázaro

InduBond on Panel Lamination With Induction Heating

iNEMI, Marc Benowitz

Strategies for Handling Big Data

iNEMI, Grace O'Malley

Roadmap Sessions at IPC APEX EXPO 2020

Insulectro, Ken Parent

Insulectro's Educational Team and Their Efforts

INVAP, Rafael Malleret & Delfina Taborda (en Español)

INVAP on Aerospace Opportunities

IPC, Brook-Sandy Smith

IPC APEX EXPO 2020 Fundamentals Program and More

IPC, David Bergman

David Bergman on Applications of CFX

IPC, Randy Cherry

IPC Validation Services Updates: IoT and Connectivity

IPC, David Hernandez

Standards-based Education and Certification

IPC, Chris Mitchell

IPC Government Relations on Industry Intelligence Programs

IPC, Patrick Crawford & Teresa Rowe

IPC Design: The Newly Launched Program

IPC, Dr. John Mitchell

Dr. John Mitchell: IPC APEX EXPO 2020 and IPC Design

IPC, Sanjay Huprikar

STEM Student Outreach Program and IPC-CFX

IPC, Chris Jorgensen

IPC Addresses the Need for E-textiles Standards

IPC Education Foundation, Aaron Birney

One Year Later: IPC Education Foundation Growth

IPC Education Foundation, Charlene Gunter du Plessis

Addressing the Global Talent Pipeline

IPS, Mike Brask

Tooling Up for 2020

Isola, Sean Mirshafiei

New Facility and High-Performance Materials

KIC, MB Allen

Factory Automation: An Achievable Goal

Koh Young America, Quintin Armstrong

Koh Young America's Technical Service Team

KYZEN, Tom Forsythe

Benefits of a Total Stencil Cleaning Solution

LPKF Laser & Electronics, Stephan Schmidt

Benefits and Enhancements: LPKF's Laser Cutter

MacDermid Alpha Electronics Solutions, Tim Williams

How Kester Fits Into the Macdermid-Alpha Organization

Manncorp Inc., Ed Stone

Business Updates From IPC APEX EXPO 2020

MEK, Henk Biemans

The Value of Automated Optical Inspection

Mentor, a Siemens Business, Oren Manor

Industry 4.0: Integrating Company Solutions

Miraco, Jason Michaud

Connectors, Cables, Flex Circuits, and More

MIRTEC, Brian D'Amico

MIRTEC Continues to Lead the AOI and SPI Market

MivaTek, Brendan Hogan

Direct Imaging and MivaTek's Global Market Growth

Mycronic, Clemens Jargon

Upcoming Product and Roadmap Developments

NCAB Group, Ruben Contreras & Shaun Salas

Overcoming Challenges Through Upstream Expertise

Nordson Asymtek, Camille Sybert

Developments in Dispensing and Conformal Coatings

Nordson Select, Carlos E. Bouras

Nordson Select: Solving Customers' Problems

Northfield Automation Systems, Mike Jennings

Mike Jennings' New Role With Northfield Automation Systems

Orbotech West, Sharon Cohen

Focusing on Quick-turn Shops

Panasonic, Sean Murray

Software and Information Management: Panasonic's Focus

Pluritec, Nicola Doria

Structure and Strategy of Pluritec

Ray Prasad Consultancy Group, Ray Prasad

Ray Prasad on the Latest BGA Standard Revision

RBP Chemical Technology, Ernest Litynski

Newly Appointed President of RBP Chemical Technology

Rehm Thermal Systems, Carsten Kramer

Rehm's U.S. Operations Investments

Rogers Corporation, Tony Mattingly

Rogers' Materials and Business Updates

Sheldahl, Enid Kivuti

Flex Technology: Pushing the Boundaries

Siemens, Fram Akiki

Siemens on Challenges and Trends in the Electronics Industry

Siemens, David Rogers

Siemens' AI and Factory Automation Solutions

Taiyo America Inc., Don Monn

Don Monn on Solder Mask Developments

Technica USA & CB Tech, Frank Medina & Harry Kok

Consistent Registration: CB Tech's New Direct Imaging System

Technica USA & Wise, Frank Medina & Massimo Passerini

Revolutionary Surface Cleaning Process for Copper

Ucamco, Luc Maesen

Intelligence-aided Manufacturing

Uyemura USA, Richard DePoto

Developments in Specialized Metallic Finishes

Ventec International Group, Mark Goodwin

Ventec: A Materials Technology Company

Zentech, Steve Pudles

Steve Pudles, 2020 IPC Hall of Fame Inductee

Thank You, I-Connect007 Contributors!



by **Barry Matties**
I-connect007

As Aristotle said, “The whole is greater than the sum of its parts.” This could not be any truer. The collaboration between the I-Connect007 team and the many guest contributors has produced an impressive body of work that captures the excitement of the IPC APEX EXPO 2020. We truly thank each and every one of them for taking part in our [Real Time with... IPC APEX EXPO 2020 coverage](#). With nearly 80 video interviews, extensive write-ups, and photo coverage, this team has truly outdone themselves. We hope you enjoy this special coverage, and again, a big thanks to all of our guest contributors.

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, and is a strong, focused strategist. 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) 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





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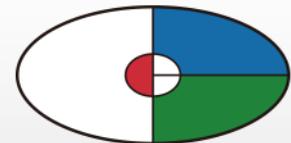
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decades of experience and more than 185 U.S. patents issued. He is the author of *Flexible Circuit Technology* and author, co-author, or editor of several other books, including *Chip Scale Packaging for Modern Electronics*. He has also authored numerous 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](#).

Dr. Jennie S. Hwang

Dr. Jennie S. Hwang—an international businesswoman and speaker, and a business and technology advisor—is a pioneer and long-standing contributor to electronics hardware manufacturing as well as to the implementation of environment-friendly lead-free electronics. Among her many awards and honors, she was inducted to the International Hall of Fame—Women in Technology, elected to the National Academy of Engineering, an R&D-Stars-to-Watch, and YWCA Achievement Award. Having held senior executive positions with Lockheed Martin Corp., Sherwin Williams Co., SCM Corp, and CEO of International Electronic Materials Corp., she is currently CEO of H-Technologies Group, providing business, technology, and manufacturing solutions. She is the Chairman of the Assessment Board of the DoD Army Research Laboratory, serving on Commerce Department’s Export Council, National Materials and Manufacturing Board, NIST Assessment Board, Army Science and Technology Board, various national panels/committees, international leadership positions, and the board of Fortune-500 NYSE companies and civic and university boards. She is the author of 500+ publications and several books, and a speaker and author on trade, business, education, and social issues. Her formal education includes four academic degrees as well as the Harvard Business School



Executive Program and Columbia University Corporate Governance Program. For more information, please visit www.JennieHwang.com. To read past columns or contact Hwang, [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 white papers; 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

Richard (Dick) Crowe

Dick Crowe has been working in the capital goods industry his entire career, marketing metal working equipment—specifically equipment for the printed wiring board and plastic card industry, among other industries—for over 50 years. He has focused on the printed wiring board industry since 1979 as VP of sales and marketing and then president of Excellon Automation. In 1991, Crowe formed his own successful business—Burkle USA (now Burkle America). Crowe has also been a member of IPC and was one of the



original members of the IPC Suppliers Council. He was also the executive director of the California Circuits Association in the late 1990 time period. Crowe is a graduate of Lawrence Institute of Technology of Southfield, Michigan, with a degree in industrial technology. Crowe is married, has three grown sons and eight grandchildren, and lives in Seal Beach, California.

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 is a member of the Printed Circuit Engineering Association (PCEA) and a CID instructor.

Oswaldo Targon

At the age of 18, Oswaldo Targon started working as an electronics 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 provides resources and advocates for PCB design professionals as well as hosts the OnTrack PCB design podcast.



I-Connect007 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 IPC 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.

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 U.K. PCB fabricator, he was recognised as a trendsetter 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.



I-Connect007 Managing Editors

Nolan Johnson

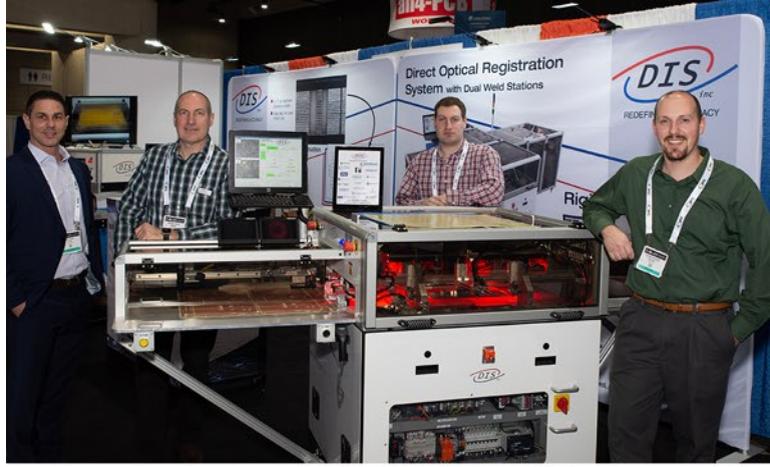
Nolan Johnson's experience includes a 30-year career focused almost entirely on electronics design and manufacturing. Nolan started his career as a software engineer at Mentor Graphics where he managed some of their initial OEM IC verification products. Later, Nolan managed and developed a series of 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. Nolan is now the managing editor of *SMT007 Magazine* and *PCB007 Magazine*. 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.



Andy Shaughnessy

Andy Shaughnessy is the managing editor of *Design007 Magazine*. He has been a writer and editor for 27 years, has covered PCB design and EDA for 20 years and was formerly a crime reporter. He has a bachelor's degree in English from the University of West Florida and is a proud Argonaut. **S&T**







Happy's Highlights

by Happy Holden
I-CONNECT007

I traveled to San Diego for IPC APEX EXPO 2020. The sky is clear and blue, the seagulls are hungry, and it's warm! It was 28°F when I left Grand Rapids, Michigan, for California. Overall, it was a very well-attended and successful show.

Siemens' Smart Factory Forum

I spent all day Monday at the Siemens' Smart Factory Forum. This was an excellent program, as Siemens has been in this business for a long time. What Siemens wanted to tell us about was how they are integrating their acquisition of Valor/Mentor into the Siemens "Big Picture." There wasn't a lot of new information for me, but there were a lot of details of what Siemens is selling for electronics smart factories.

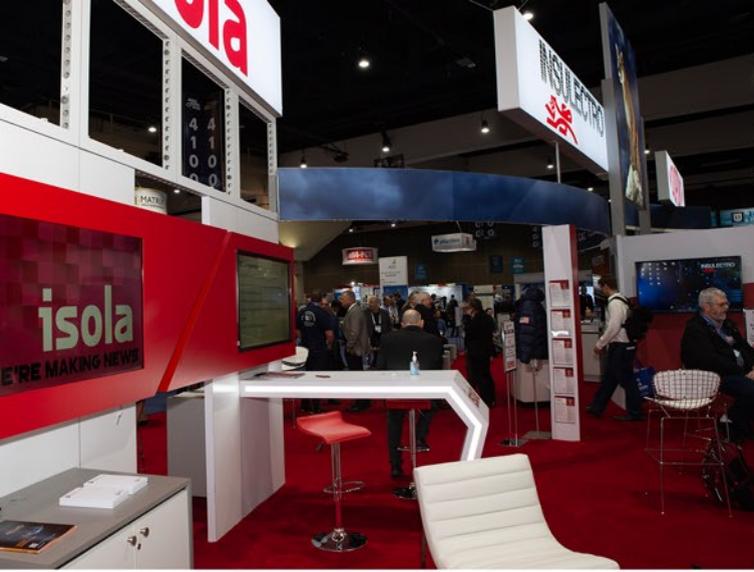
Siemens presenters opened with obligatory Industry 4.0 opportunities. Next, they shared the company's definition of what that is and

how it will affect your business. Then, it was on to the products and applications, as well as the connectivity and benefits.

Lastly, they had a customer share their case study of how they did it, and the benefits they gained from their investments. In Siemens' case, they selected Computrol, an EMS provider of high-mix, high-reliability SMT assembly for mission-critical aerospace and medical electronics. In particular, they are now reporting:

- Reduced NPI time
- Reduced process preparation for recipe generation
- Increased material turnover
- Increased equipment utilization
- Reduced maintenance and unplanned downtime of equipment
- Reduced test dropout

Overall, it was an informative day, and I am sure we will see more of this material in Siemens' papers and videos at other trade shows.



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Burt Rutan

Show Highlights

The IPC APEX EXPO keynote by Burt Rutan was excellent. The entire hour was way too short, and Burt got a standing ovation when he finished. You can read a much more detailed account of the keynote in this issue. Fortunately, Burt spent 90 minutes in the I-Connect007 booth after his keynote, revealing more stories and answering more questions. That interview will be available very soon!

I spent the rest of Tuesday, Wednesday, and Thursday attending technical paper presentations, IPC Committee meetings, and walking the floor reviewing the exhibits. For me, the important meetings on the evolution of IPC-2581 (DPMX) and IPC-2591 (CFX) were held on Monday and Tuesday.

On Tuesday, I attended the Technical Sessions, where young engineers I know presented papers for the first time. I felt it was important to show our appreciation that new engineers to PCB fabrication and assembly were taking the time to contribute like this. The three sessions were on additive manufacturing, smart

factories, and microvia testing. In between all this, I ran back down to the show floor to see more products.

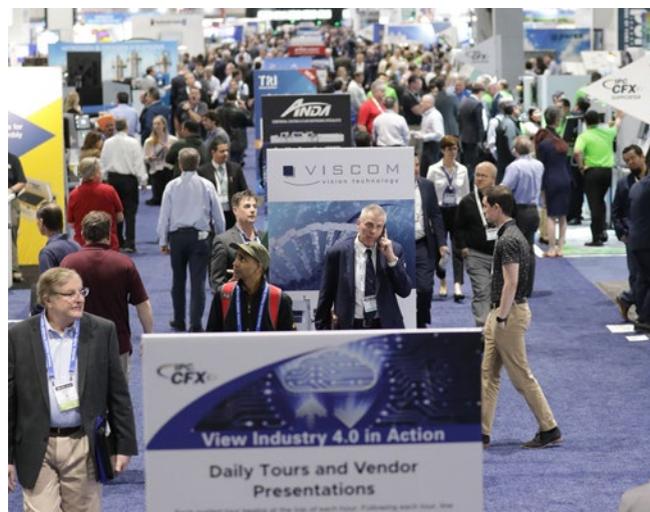
Wednesday was also very busy. Everything I deemed important was scheduled at concurrent times, but I had a report to make, so the primary focus was on our IPC Committee to solve the problem of the weak microvia interface of stacked vias. The culmination of that free session will occur at the IPC High-Reliability conference in May in Baltimore, Maryland. We then had our closed WMI committee meeting to plan our next steps, test vehicles, materials, and test criteria to solve this tricky problem. Stay tuned for future reports.

New on the Show Floor

On the show floor, most new items were actually evolutionary and refinements of what we already have, but here are some things that stood out to me.

Smart Factories

Siemens/Mentor was at IPC APEX EXPO last year but had more demos this year. IPC-CFX had a more complex running demo SMT line. What was new was CIMnetics and the presentation of SEMI's smart factory standards that have been used for the last 30 years by the semiconductor and LCD manufacturers. These are very process- and lithographic-oriented standards, which are ideal for complex multilayer and rigid-flex fabrication.



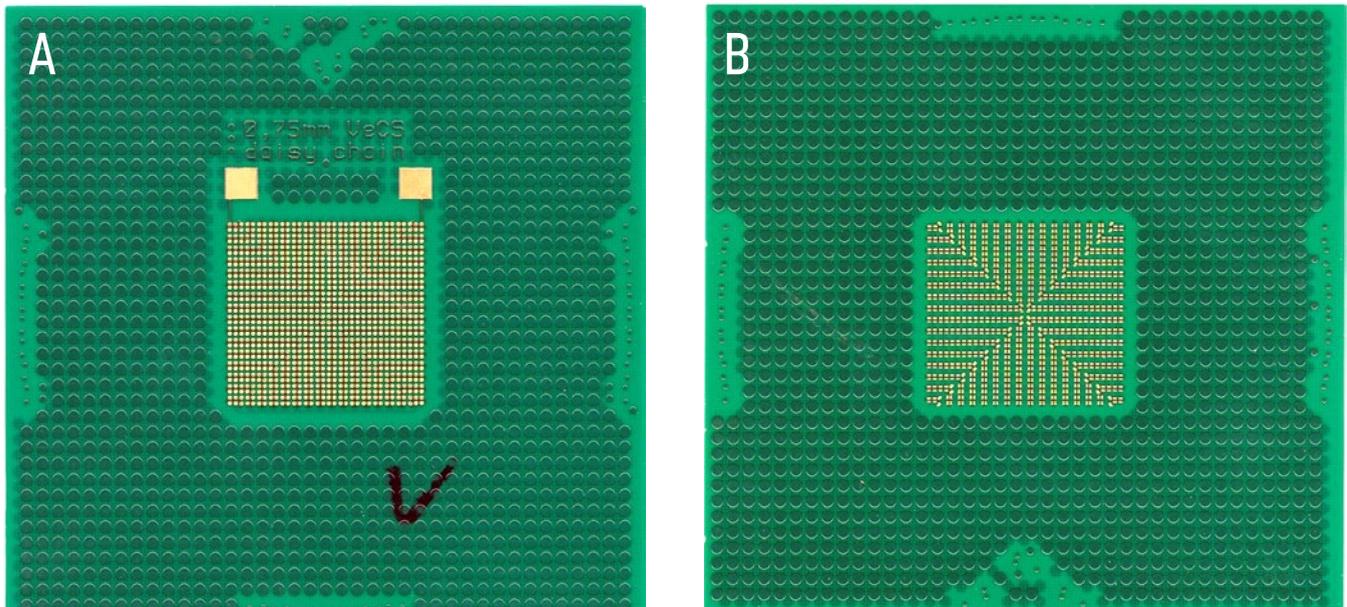


Figure 1: (A) SMT side 0.75-mm pitch VeCS reliability daisy chain and (B) channel side of the 0.75-mm daisy chain. (Source: WUS PCB, Taiwan)

Now, SEMI wants to extend the standards down the supply chain to include assembly and box-build.

A-SAP

Averatek introduced a nanotechnology for palladium catalyst that allows the creation of fine-grained, thin electroless copper deposits capable of being imaged and fabricated to 15-micron lines and spaces. Through Averatek’s booth, technical papers, and a “community of interest” session, hosted by Tara Dunn, the company introduced A-SAP to IPC APEX EXPO attendees. You can expect:

- Line width/space down to 15 $\mu\text{m}/15 \mu\text{m}$
- 10X area reduction on the board

- 90% reduction in space/weight over current state-of-the-art technology
- Additional electronic functionality within an existing footprint
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VeCS

I had a chance to talk with Joe Dickson, VP of R&D for WUS, about the roll-out and development of the vertical conductive structures (VeCS) construction developed by Joan Torné, NextGIn Technology BV. The reliability of this novel new process competes with HDI but uses all conventional multilayer fabrication equipment and processes (no laser drilling). See the sample Joe gave in Figures 1 and 2.

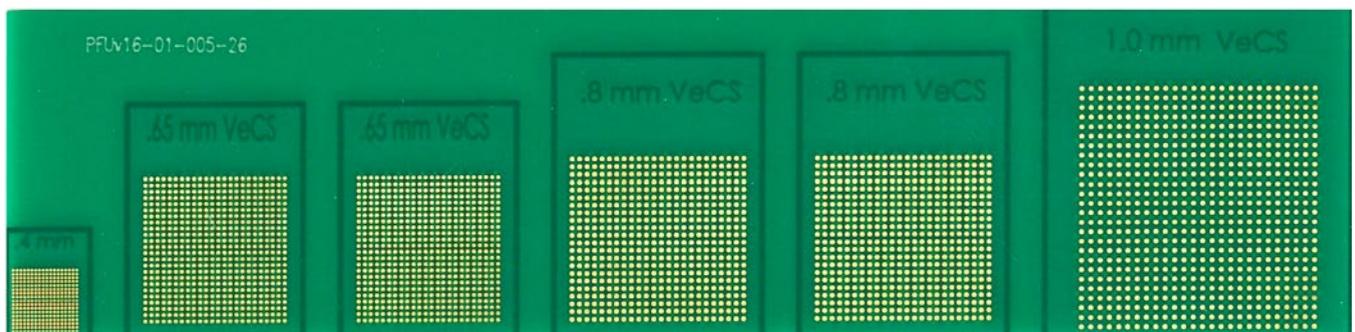


Figure 2: Daisy chain examples (0.4, 0.65, 0.65, 0.80, 0.80, and 1.0 mm). (Source: WUS PCB, Taiwan)

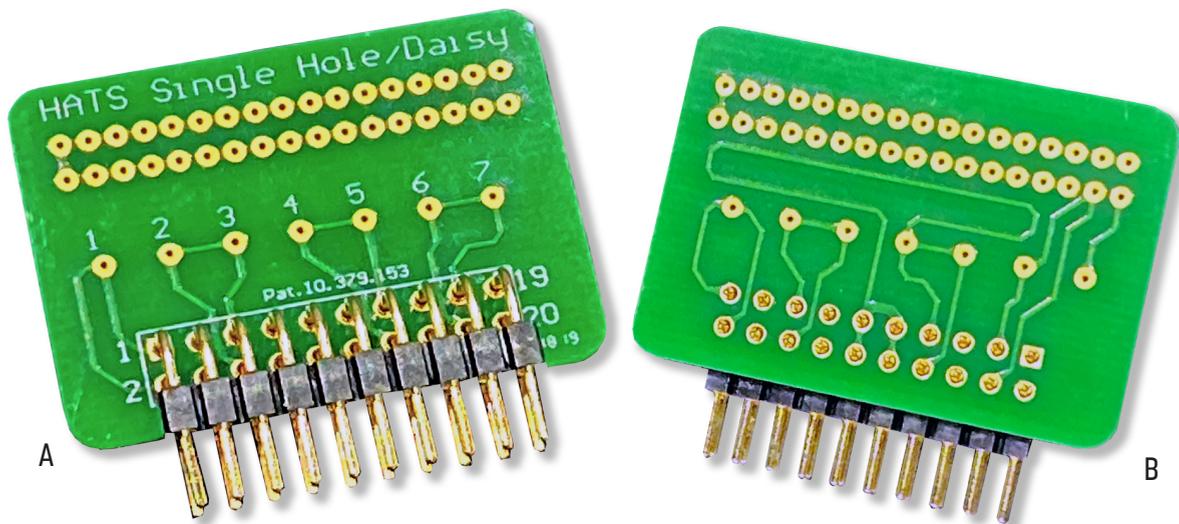


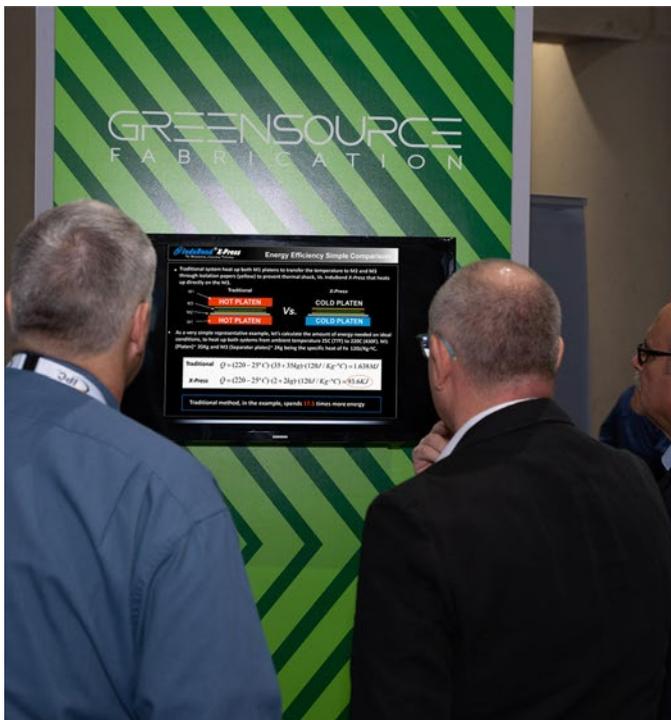
Figure 3: New HATS via reliability coupons for automotive: (A) Seven single vias for 4-wire monitoring plus a via-daisy chain for testing and (B) seven single vias. (Source: Microtek Laboratories)

Induction Lamination

Again, GreenSource hosted a piece of equipment from InduBond—one that is new to PCB fabrication and offers energy-efficient induction lamination. This equipment is 100 times more energy-efficient than a hot-cold press and is faster and capable of reaching temperatures only dreamed about in steam, hot-oil, or electric-heated vacuum presses. Other new equipment from AWP is being field-tested by GreenSource and will be introduced this summer.

Microtek Laboratories

Microtek Laboratories has introduced a new HATS reliability coupon that was perfected with the automotive industry (Figure 3). It has seven single vias so that testing will indicate when vias (microvias) begin to fail. It also has a coupon with a traditional daisy chain of vias, and their machines can take the standard IPC D-Coupon. These coupons are under four-wire monitoring while being tested for reflow soldering temperature (to 288°C), thermal shocks, and thermal cycling. **SEI**



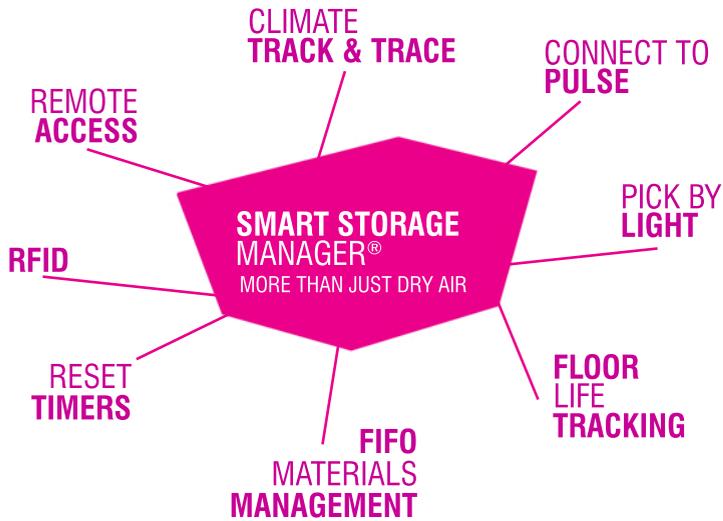


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Congratulations to Steve Pudles!

IPC Hall of Fame 2020 Inductee

by **Patty Goldman**
I-CONNECT007

With over 32 years spent working with IPC, Steve Pudles was elected to the IPC's Hall of Fame this year. Patty Goldman spoke with Steve about how he first became involved as well as his time in the organization, including his work with the EMS Management Council.

Patty Goldman: Steve, congratulations on your election into IPC's Hall of Fame. It's a big deal. Let's start with a little bit of background about you, how you got involved in the industry, and how you got involved at IPC.

Steve Pudles: I started my career working for two U.S. defense contractors, and in 1985, I made a move to a company in New Jersey that built products for other companies. There was no industry at the time; it was just a business. They had to absorb some of the fixed costs from their other declining businesses. That was my entry into the EMS industry, even though we didn't create and enable the industry until much later. I went to my first IPC meeting in 1987. I received a call from Tony Hilvers, who, at that time, was the VP of Industry Programs for IPC. He told me about this meeting that was going to take place with a bunch of companies that were in this industry and asked me if I'd



be interested in attending, so I went. As they say, the rest is history.

Then, the EMS Management Council started meeting twice a year. Some of the meetings were very moderately attended. There were companies from all over the country, but some of those companies don't exist anymore, and others have been acquired. It always tended to be small or medium EMS companies.

At one of those meetings, two people, who had been around since the beginning, had a four-hour debate about whether the industry was going to be the electronics manufacturing services industry or the electronic manufacturing services industry. I don't remember who won and who lost, but the name for the industry today grew out of that meeting. That's how I became involved in the group.

Goldman: How long have you been with Zentech?

Pudles: I have been with Zentech for about eight months. I started there after being in retirement for about five and a half years. In addition to

some things I did on a consulting basis while "retired," one of the activities I maintained was my position on the IPC board the entire time.

Goldman: I understand that; you care about the industry. Tell me what you think about getting this award.

Pudles: If I look at all of the activities that I've been involved in for both the EMS industry and IPC in general, I'm really honored. I'm proud of the body of work, including my volunteer work, over the last 34 years. I remember being the youngest person in the room, and now I'm getting to be one of the oldest, except for the other Hall of Famers (laughs). There's quite a difference in age between lots of the other people who have won the award. Again, I'm honored to be recognized for helping to bring the industry forward and transforming the organization to help make the group what it is today.

Goldman: What do you see coming down the pike at IPC and elsewhere?

Pudles: There are a lot of programs that are in place today that are going to continue to strengthen the international presence of IPC. We've always been a very strong organization in North America. We now have a very strong presence in Asia, particularly our training and certification activities. We've always had a good membership group in Europe, and we've recently added capability in that area; hopefully, we're going to continue to provide for our customers and constituents in Europe as well. I see the continued emergence of IPC as a strong international organization.

IPC is also emphasizing getting participation from colleges and universities. We want to encourage people, who didn't even know that we existed as an industry, to join local chapters and understand things about the industry that most don't learn until five or 10 years after graduating from college. There's a nice opportunity to bring students in and create the next generation of EMS and PCB employees.

Goldman: How much longer do you think you're going to stay involved? I mean, you were already retired once, but now you're out of retirement, so that's all over.

Pudles: I am not going to be as quick to go back into retirement. As far as IPC is concerned, I'm on the board of directors, and I hope to be reelected for another four-year term. Because of term limits, it has to be my last term on the board, but I will continue to stay involved with the EMS Management Council and other activities as long as they'll have me.

As long as I'm working in the industry, one of the things that I've always felt very strongly about is the more you put into IPC programs and the EMS industry, the more you get out of it—whether it's people you meet, other companies you're exposed to, or processes and procedures that you learn about that other people

are doing that would work better than things you're doing at your company. As long as I'm employed in the industry, I'll remain involved with IPC in one aspect or another. I have no short-term plans on leaving the industry again, so I will be there for at least the next five to 10 years, hopefully. I couldn't imagine being part of the industry and not being part of IPC in one situation or another.

Goldman: As you said, I've always felt that with your involvement, you learn so much. It's hard to explain to somebody until they've been involved how much you learn from everybody else.



Pudles: That's right. I've had the opportunity over my career to visit hundreds of other facilities around the U.S. and the world. That has helped me to see the way things are done very well, and not so well, and understand the types of things that I'd like to take the best in class and try to build the organization I'm involved in, whatever company I'm with at that point in time. It has provided a great education, on top of everything else.

Goldman: And as much as you've seen and learned over the years, there's always something else out there.

Pudles: One of the tough things, as we keep going, is to involve companies that haven't participated, especially in the IPC EMS Management Council. You find that the same people come back year after year, and there may be one or two new companies, but some don't come back at all. Infusing new ideas comes from infusing new companies with their own experiences and backgrounds into the group to see the way other people do things differently. I always encourage people to come to the meeting and see if they pick up one or two things that you can take back to their own company. The more you put into this business, the more you get out of it.

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to meet. He's very thoughtful. One of my major accomplishments was participating in the search for him and participating in bringing him on. I'm pleased to have been part of the transformation of the organization.

Goldman: We have all benefited from that quite a bit. Thank you for your time, and again, congratulations.

Pudles: Thank you. **s&t**

Steve Pudles has over 35 years of comprehensive EMS industry knowledge and executive-level experience. He is currently president and CEO of Zentech Manufacturing Inc., a milaero/medical/high-reliability EMS company based in Baltimore, Maryland. He has previously held senior-level positions at Spectral Response, API Technologies, NuVisions/OnCore, IEC, and Tanon/EAI.

Steve attended his first IPC EMS Management Council meeting in 1987 and has spent the past 33 years serving the IPC in a variety of roles:

- IPC Chairman of the Board
- Vice-Chairman
- Secretary/Treasurer
- Board Member for 19 years
- EMS Management Council Steering Committee Chairman and Member
- Technology Market Research Council (TMRC)
- Assembly Market Research Council (AMRC)
- Member/Chairman of multiple standards committees, including IPC-D-326 and IPC-610, representing respectively the least and most purchased IPC standards of all time
- Original working group member, developer, and co-creator of EMS Programs, including EMS Program Management Certification Program, EMSI-TC2 Master Ordering Agreement, IPC-1720 Company Profile, and EMS XS

Steve has been heavily involved in shaping the IPC's Certification, Validation, and QML Programs that exist today. He has also helped steer the positioning of IPC-610 and IPC-620 Workmanship Standards replacement of the historical military standards for work performed for U.S. Government Contractors.

Steve holds a bachelor's of engineering and a master's of science in management from Stevens Institute of Technology.

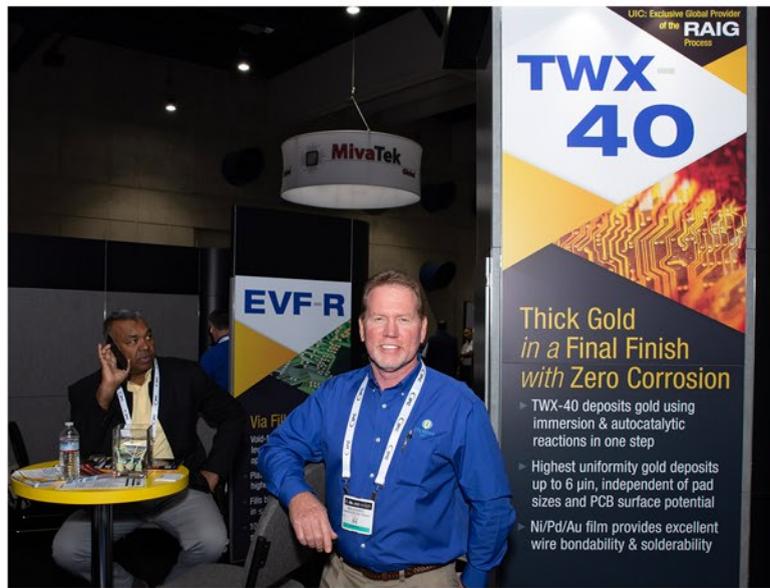
Goldman: That is so true. I also have a philosophy that if a person is a volunteer, they will do so regardless of which company they work for. There's a lot to be said for people that volunteer and contribute.

Pudles: And it's not only the person volunteering. When someone volunteers, whether it's a standards committee or one of the councils, generally, the company you work makes an economic investment. Zentech still pays me while I'm sitting in a meeting and traveling, in some cases. The bottom line is it's not only the people that are volunteering, but it's their companies as well.

Also, we are very fortunate to have Dr. John Mitchell as the leader of IPC, along with the complete staff. We have one of the best working management groups that I've ever seen in this organization today, and that's really something that John has put together very thoughtfully through his tenure. It has made the growth and idea of expansion a lot easier to know that we have a competent group managing the day-to-day business.

Goldman: He has breathed some nice life into IPC.

Pudles: He's a brilliant man, and he's one of the hardest working people you're ever going



The Success of IPC's STEM Student Outreach Program

by Charlene Gunter du Plessis
IPC EDUCATION FOUNDATION

The IPC Education Foundation (IPCEF) hosted its STEM Student Outreach Event on February 6 at IPC APEX EXPO in San Diego. Nine local high schools attended bringing 193 students and 30 educators from Mission Hills High School, Morse High School, North County Trade Tech High School, Saint Marcos High School, E3 Civic High School, Point Loma High School, Otay Ranch High School, Mount Miguel High School, Otay Ranch High School—Girls in STEM.

Twice as many students were able to participate this year, and each participating high school received a \$1,000 grant and soldering station to enhance STEM-related learning at their school. The student participation and

awards were made possible through the generous support of our event sponsors: Foxconn Interconnect Industries, Nordson, Panasonic, TTM Technologies, Weller Apex Tools, and I-Connect007. We are truly grateful for their support and participation in the day's activities.

The day was packed with several hands-on technical activities, career exploration, and industry engagement. The students participated in educational tracks with a focus on soldering, PCB design, and building circuits with breadboards. The IPC Education Foundation believes that these kinds of activities raise awareness of the skills needed and opportunities available in the electronics manufacturing industry.

Perhaps even more impactful, the students were able to engage with industry professionals during the career panel discussion and tour



Each participating high school received a \$1,000 grant from the IPCEF.

Team Zentech congratulates our CEO Steve Pudles on his induction into the IPC Hall of Fame at APEX 2020!



*Steve and Dr. John Mitchell,
CEO of IPC*



*Steve and family: Jen, Melanie,
Lisa and Zoe – left to right*

**Also announced at APEX 2020:
Zentech has acquired Trilogy Circuits of Richardson, TX!**

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Four of the 23 IPC Student Member Scholarship Winners.

of the IPC APEX EXPO show floor. The career panel discussion was moderated by Dr. John Mitchell, IPC president and CEO. Several students asked questions to a diverse group of industry professionals who provided answers, often prompting other professionals in the room to share their experiences. Lam Tse, business development manager at Panasonic, said, “When you are in high school, it’s sometimes hard to see what a STEM education translates to in the real world, but IPC does a great job at showing the students what is possible with a STEM-related education by connecting the students with people in the industry.”

Kathy Schulze, an engineering teacher at Point Loma High School, shared, “I can’t thank you enough for the wonderful event that IPC APEX EXPO put on for the students of San Diego County. My students really enjoyed the event and learned a lot about the industry. I was fascinated by the show floor and all the AI products currently on the market. The whole affair was exceptionally well-organized and very educational.”

It was wonderful to recognize four of the 23 IPC Student Member Scholarship Winners

in person at the event. Fernando Galvez from the California State Polytechnic University, Pomona; Deepak Bondre from the University of Maryland; and Mohamed El Amine Belhadi and Mohammed Abueed from Auburn University attended IPC APEX EXPO 2020 for the event. Belhadi serves as the president of his IPC Student Chapter and shared, “IPC scholarship inspired and boosted me to accomplish further advanced research in electronics reliability for future applications. I will use the funds to acquire more research materials and pay for the PCB design training.”

The students and teachers left feeling inspired. We believe that we planted the seeds of the possibility for an emerging workforce to consider the electronics manufacturing industry a viable career path. **S&T**



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





Inspiring Next-generation Engineers Through STEM

by **Barry Matties**
I-CONNECT007

Through the STEM Student Outreach Program, IPC invites high school students to visit IPC APEX EXPO for a day. Last year, they had about 100 participating students, and this year, it doubled. The program is designed to introduce students to our industry at a younger age.

During one event planned for them, the students had a chance to participate in a hands-on soldering track, creating wearable buttons to take home with them. Students then toured the show floor, where they rotated through various education tracks, receiving real-world technical skills training in soldering and coding, designing, and assembling PCBs. They also enjoyed a career panel during lunch and a presentation by Dr. John Mitchell, IPC president and CEO. This event is organized by the IPC Education Foundation.

Participating groups this year included Mission Hills High School, Morse High School, North County Trade Tech High School, Saint Marcos High School, E3 Civic High School,

Point Loma High School, Otay Ranch High School, Mount Miguel High School, Otay Ranch High School—Girls in STEM. Sponsors of this year's event included Foxconn Interconnect Industries, Nordson, Panasonic, TTM Technologies, Weller Apex Tools, and I-Connect007.

One STEM Teacher's Perspective

During the event, I had a chance to interview Kathy Schultz, a teacher from Point Loma High School, who accompanied her engineering students to IPC APEX EXPO as part of the STEM Student Outreach Program.

Barry Matties: Kathy, you're here with your school. How many students do you have attending the STEM Student Outreach Program today?

Kathy Schultz: I brought about 20.

Matties: What was the inspiration to bring your students?

Schultz: Most of my students are in an engineering class at school, and one of the classes that I teach is digital electronics. Through that class, the students have been exposed to a lot of the activities that they're going to be doing here, but I thought it would be good to get it from a professional standpoint.

Matties: It is. That's wonderful. Tell me a little bit about the digital class you're teaching.

Schultz: The students learn mostly about the basic concepts, such as logic and breadboards. We use a program called MultiSENSE, which is a circuit program. They can simulate their circuits before they build them. We don't use real PCBs, but we do a little bit of soldering, so it covers the basics of electronics.

Matties: And, of course, this is an elective program that they're choosing to be in.

Schultz: Correct. The school has four engineering classes that they can take all four years. The digital electronics class is an honors class, so it's like taking an AP or weighted credit for it.

Matties: Nice. And when your students are in the class, what do they expect to get out of that?

Schultz: It provides a lot of general knowledge. Most of them are interested in attending college or pursuing a career in an engineering field or related STEM field.

Matties: It's exciting to have you all here. What advice would you give to a young student who's looking at moving into electronics?

Schultz: Be patient.

Matties: That's good advice for life.



Kathy Schultz with STEM students from her class.

Schultz: Troubleshooting can be a difficult thing for the students, but it teaches them a lesson in perseverance and patience. I think it's a fun field. We have done a couple of outside activities where they can see the types of applications. It's a nice-paying job if that's something that they're interested in.

Matties: It's great that you are committed to teaching this type of curriculum at such a young age, too, because it gives students a great advantage in life. When I was going through high school, I took electrical trades. We didn't have the digital age. That let me come out of high school and earn a great wage, and I built my career into the electronics industry from that. I'm so happy to hear that this is going on. That warms my heart.

Schultz: Me too.

Matties: The world needs more teachers like you. What's your background?

Schultz: I was a mechanical engineer before I went into teaching. When I went to school,

they didn't have digital electronics, so I had to go back and take a course to be able to teach the curriculum.

Matties: Thank you for doing this.

Schultz: Thanks.

An Emerging Engineer Helps STEM Students

Another cool connection with the STEM Student Outreach Program is that IPC recruits the participants in the emerging engineers program to assist in the STEM day activities. I had a chance to speak with Ph.D. student Arvind Karthikeyan, who is part of IPC's Emerging Engineer Program.

Barry Matties: Hi, Arvind. What school do you attend?

Arvind Karthikeyan: I'm from Auburn University. I'm a Ph.D. student in the industrial engineering and systems program.

Matties: Great. You're part of the Emerging Engineer Program.

Karthikeyan: That's right.

Matties: This is the third day of the IPC APEX EXPO, but you have been here for the whole conference. What does it mean for you to be a part of IPC's Emerging Engineer Program?

Karthikeyan: That's a tough question because this is my first year. I wanted to gain as much experience as possible, and the program went way beyond my expectations. I will cherish this week for the rest of my life. I have enjoyed meeting great people, gaining knowledge while being part of standards committee meetings. Now I know where I should be going next year.

Matties: Today, you're helping the high school students through the STEM Student Outreach



Arvind Karthikeyan

Program, who are a few years younger than you. What's that experience like for you?

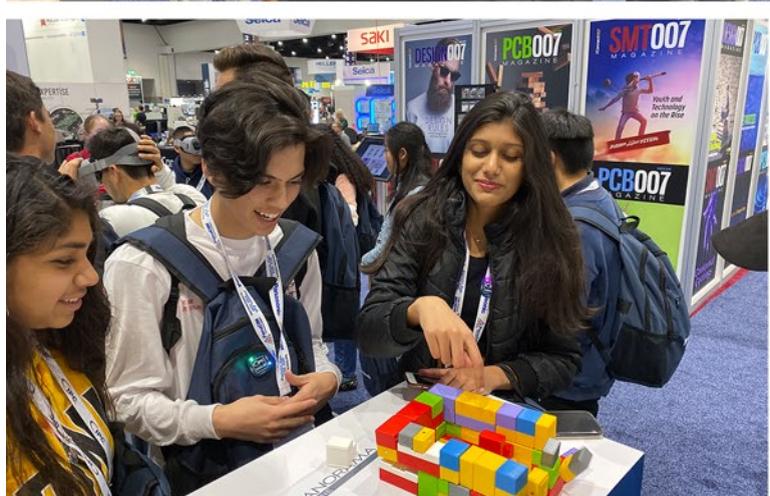
Karthikeyan: It's not only about teaching them, but I see myself in some of them. It's all about encouraging people to be future engineers and company owners. It's not only about just giving because I'm learning from them too.

Matties: What advice would you give to a young student or engineer?

Karthikeyan: Pursue your interests. Don't restrict yourself to a particular sector. Try to explore whatever you can because there is no limitation for exploration. You will never know where your interests lie until you explore that particular area or field.

Matties: That's great advice. Thank you.

Karthikeyan: Thank you so much. **SET**



Best Technical Papers and Honorable Mentions

The IPC APEX EXPO 2020 best technical conference papers in the domestic and international categories were evaluated and selected by the IPC APEX EXPO Technical Program Committee and judged on their technical content, originality, test procedures, and data used to deduce conclusions; the quality of illustrations; the clarity and professionalism of writing; as well as the value to the industry.

Taking top honors in the domestic paper category, the winning paper was “Reliable Nickel-Free Surface Finish Solution for High-Frequency HDI PCB Applications” by Kunal Shah, Ph.D., LiloTree. Dr. Shah presented his paper on February 5.

Honorable mention went to “Comparative Corrosion: Engineered Aqueous Cleaner vs. pH Neutral, Round 1” by David Lober, Kyzen Corporation. His co-author was Mike Bixenman, DBA, Kyzen Corporation. They presented their paper on February 6.

The winning paper in the international paper category was “High-Density PCB Technology Assessment for Space Applications” by Maarten Cauwe, Ph.D., IMEC-Cmst. Dr. Cauwe’s co-authors were Erwin Bosman, ACB NV; Alexia Coulon, Thales Alenia Space; Stan Heltzel, European Space Agency; Chinmay Nawghane, IMEC; Marnix Van De Slyeke, ACB NV; Bart Vandeveld, IMEC; and Joachim Verhegge, ACB. This paper was presented on February 4.

Honorable mention went to “Optimization of PCB SI Coupon Design That Minimizes Discontinuity Through Via-In-Pad Plated Over (VIPPO) Technique” by Juhee Lee, ISU Petasys. His co-authors were Kyeongsoo Kim, Kyungsoo Lee, and Namdong Lee, ISU Petasys. This paper was presented on February 6.

The paper authors received their awards during the opening keynote on February 4, 2020. **S&T**



Dr. Kunal Shah, LiloTree, accepting the Best Technical Paper Award.



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I-Connect007 Announces 2020 **GOOD FOR THE INDUSTRY AWARD** Recipients

At a special event in San Diego, California, on February 3, 2020, I-Connect007 was pleased to announce the recipients of this year's prestigious Good for the Industry Award. The following I-Connect007 columnists from various industry segments—including Design007, PCB007, SMT007, and Flex007—were recognized and celebrated for sharing their knowledge and expertise with the industry. This year's recipients each had 50 or more contributions since becoming I-Connect007 columnists.

Publisher Barry Matties said, "At I-Connect007, we believe being good for the industry means helping the industry improve cycle time, lower cost, increase yields, build better products, increase

profitability, reduce waste, become overall more efficient, do things differently, and motivate and inspire others to do the same—all things that are good for the industry. These are things that we strive to do in our own business every day."

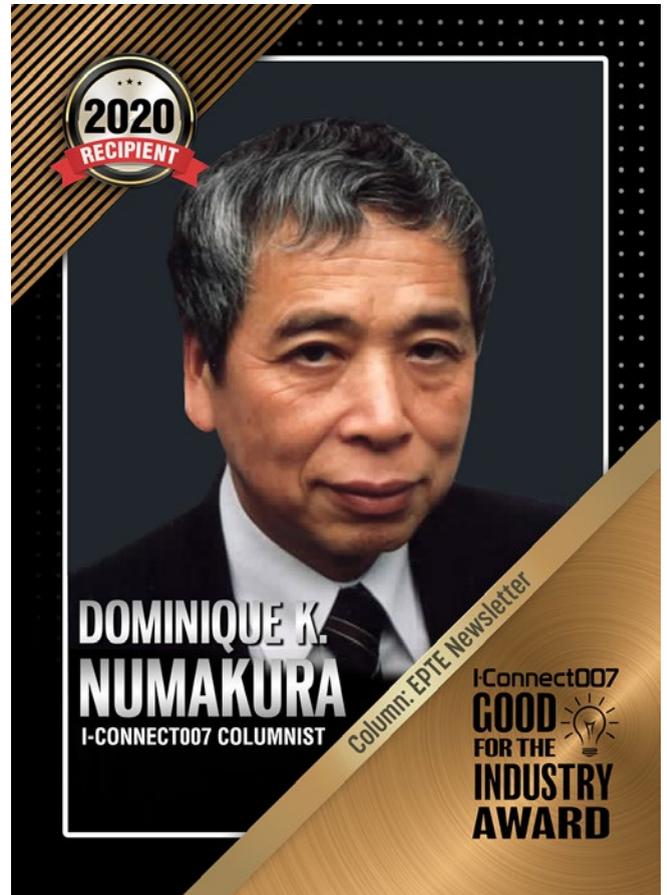
Kiersten Rohde, I-Connect007 editor and columnist coordinator, stated, "It was an honor to recognize these columnists and all the work they have contributed to the industry over many years. They're an incredible group of industry experts and I greatly respect their commitment to education and knowledge-sharing."

The entire I-Connect007 team congratulates these recipients and thanks them for being good for the industry.

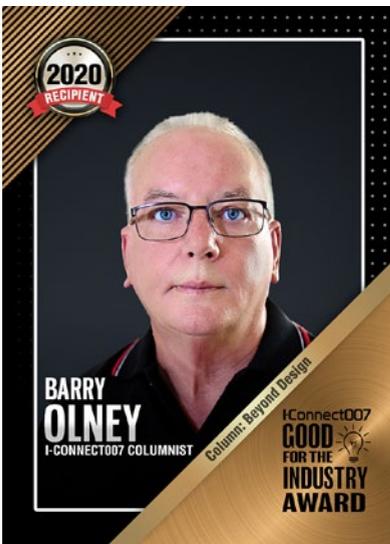




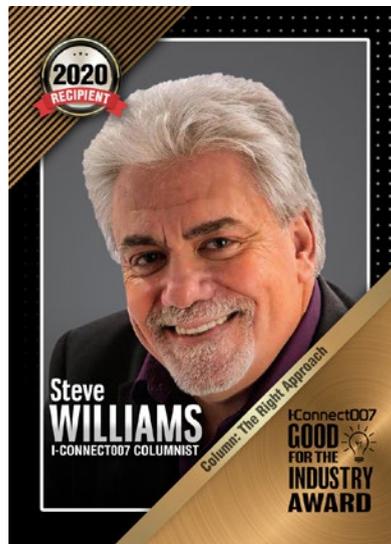
800+ Contributions
Dan Beaulieu
 "It's Only Common Sense"
 D.B. Management Group-PCB007



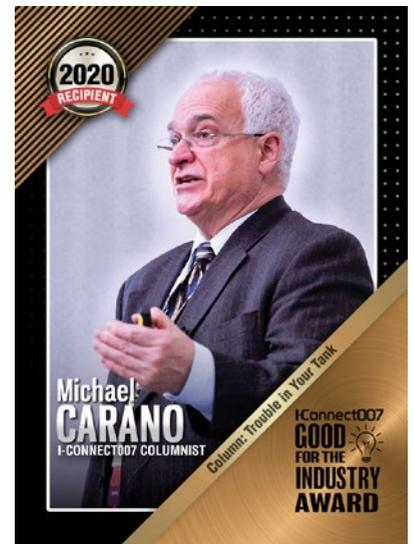
150+ Contributions
Dominique K. Numakura
 "EPTE Newsletter"
 DKN Research-Flex007/PCB007



100+ Contributions
Barry Olney
 "Beyond Design"
 In-Circuit Design (iCD)-Design007



100+ Contributions
Steve Williams
 "The Right Approach"
 The Right Approach Consulting-PCB007



50+ Contributions
Michael Carano
 "Trouble in Your Tank"
 RBP Chemical Technology-PCB007

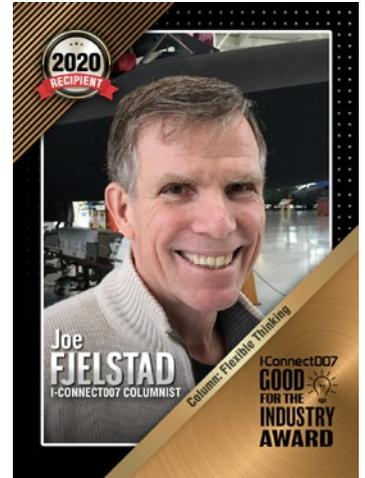
50+ Contributions



John Coonrod
"Lightning Speed Laminates"
 Rogers Corporation-Design007



Tara Dunn
"Flex Talk"
 Omni PCB-Flex007/PCB007



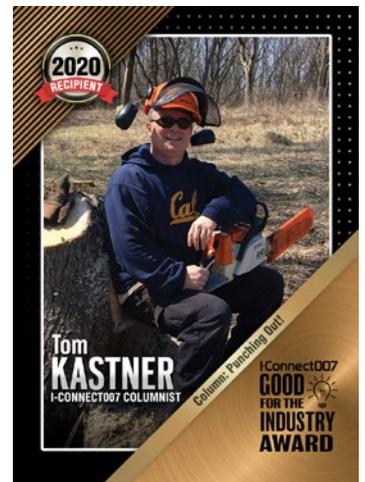
Joe Fjelstad
"Flexible Thinking"
 Verdant Electronics-Flex007



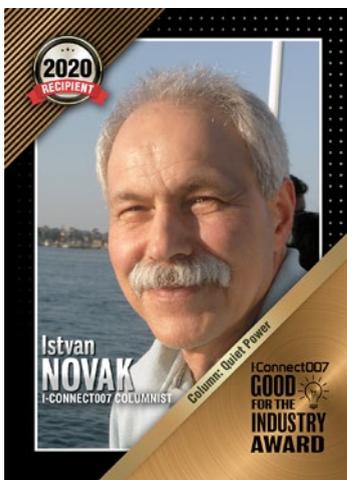
Michael Ford
"Smart Factory Insights"
 Aegis Software-SMT007



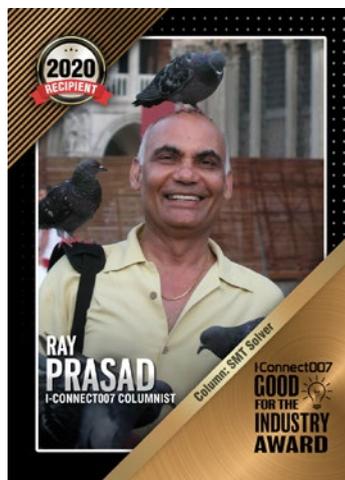
Jennie S. Hwang
"SMT Perspectives and Prospects"
 H-Technologies Group-SMT007



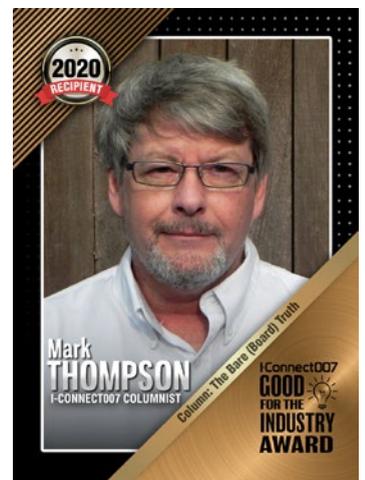
Tom Kastner
"Punching Out!"
 GP Ventures-PCB007



Istvan Novak
"Quiet Power"
 Samtec-Design007



Ray Prasad
"SMT Solver"
 Ray Prasad Consultancy Group-SMT007



Mark Thompson
"The Bare (Board) Truth"
 Prototron Circuits-Design007

Rogers' Laminates: Paving the way for tomorrow's Autonomous Vehicles

Autonomous “self-driving” vehicles are heading our way guided by a variety of sensors, such as short and long range radar, LIDAR, ultrasound and camera. Vehicles will be connected by vehicle-to-everything (V2X) technology. The electronic systems in autonomous vehicles will have high-performance RF antennas. Both radar and RF communication antennas will depend on performance possible with circuit materials from Rogers Corporation.

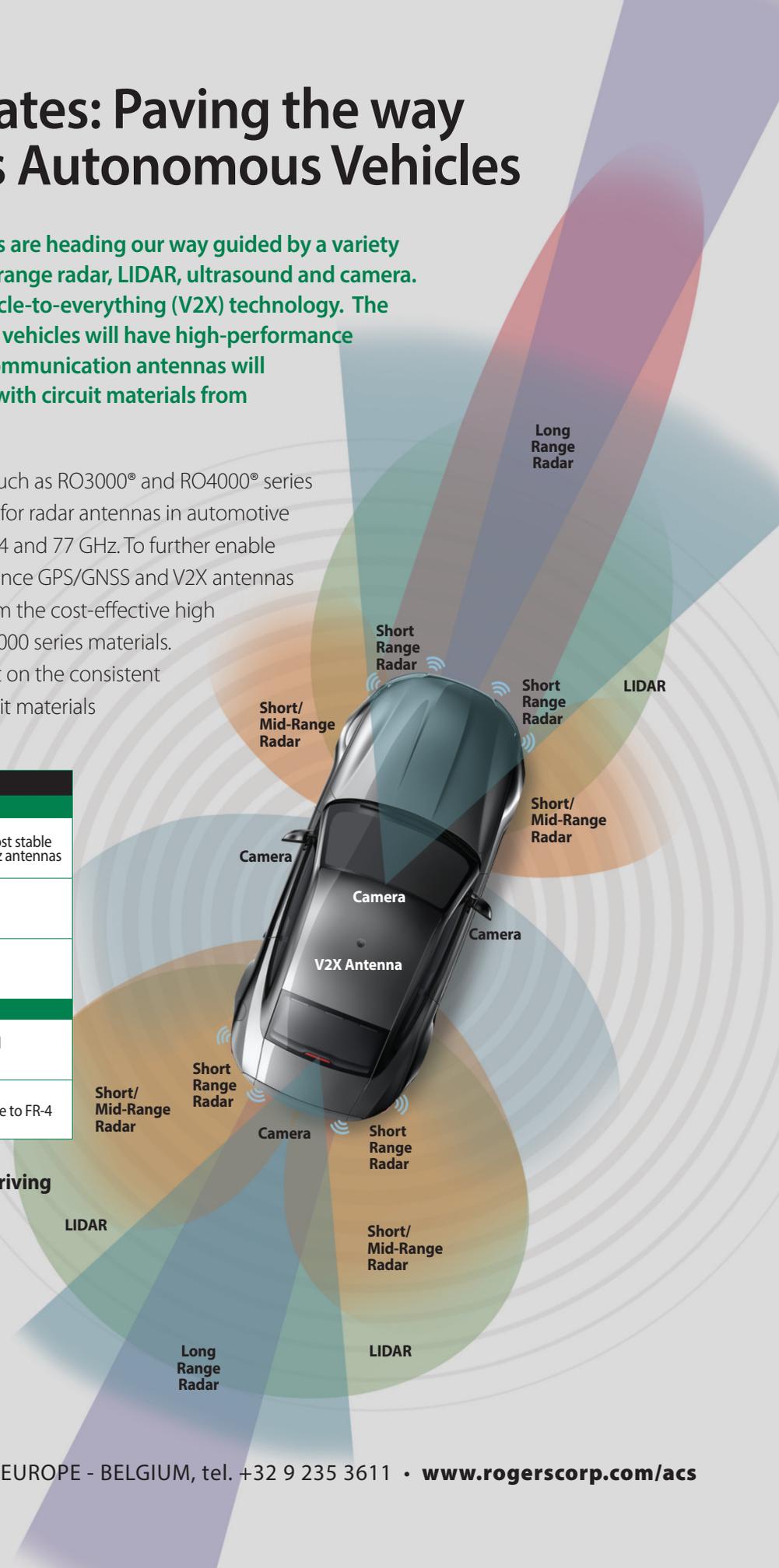
High-performance circuit laminates, such as RO3000® and RO4000® series materials, are already well established for radar antennas in automotive collision-avoidance radar systems at 24 and 77 GHz. To further enable autonomous driving, higher performance GPS/GNSS and V2X antennas will be needed, which can benefit from the cost-effective high performance of Kappa™ 438 and RO4000 series materials. These antennas and circuits will count on the consistent quality and high performance of circuit materials from Rogers.

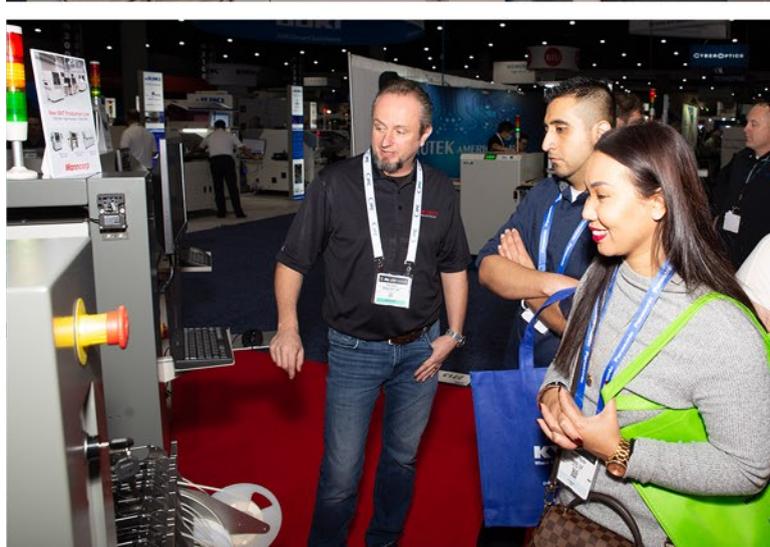
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ANTENNA	
RO4000 Series Circuit Materials	Low loss, FR-4 processable and UL 94 V-0 rated materials
Kappa™ 438 Laminates	Higher performance alternative to FR-4

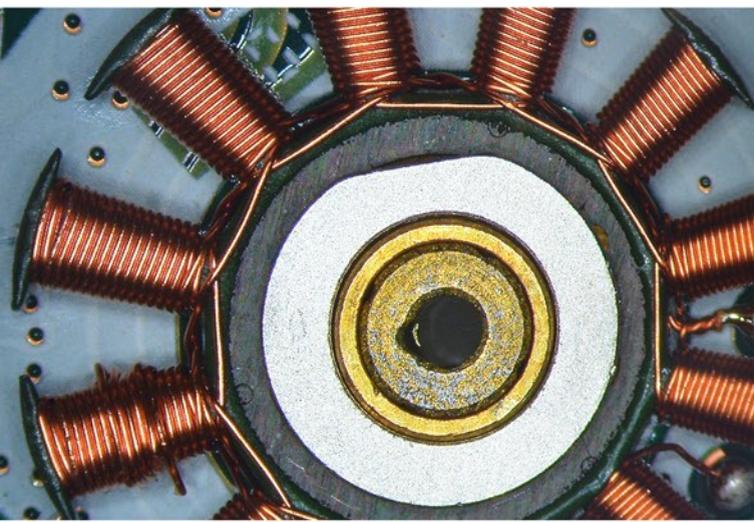
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Congratulations to Mike Carano!

Dieter Bergman IPC Fellowship Award Recipient

by Patty Goldman
I-CONNECT007

Patty Goldman spoke with Mike Carano about being awarded the Dieter Bergman IPC Fellowship Award, what that means to him as someone who was inspired by Dieter, and after 40 years in the industry, what keeps him excited going forward. Talking with Mike, one can feel his enthusiasm for IPC and the industry, which is contagious.

Patty Goldman: Mike, you received the Dieter Bergman IPC Fellowship Award. Congratulations.

Mike Carano: Thanks, Patty. I really appreciate it.

Goldman: Let's start with some background on yourself and your involvement with IPC.

Carano: I've been involved in the surface finishing/PCB/semiconductor industry since I left graduate school in 1979 after completing a master's degree while working for a small company in Youngstown, Ohio—Electrochemicals. I came there as a chemist and tech service person. I learned about metal finishing, and we were just beginning to get into the PCB industry. Over the years, the company evolved more and more into the circuit board technol-

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chance to know him. We don't do this for the awards, as you know. You are in the IPC Hall of Fame and have received many awards over the years from your involvement as a volunteer. My first, and most important, impression of Dieter, happened when I was working Youngstown, Ohio, which was the best opportunity in the world. I was a few months into the business and assigned to micro-sections. Again, this is a fledgling circuit board part of our business, so I had no idea what a micro-section was. Of course, no one at Electrochemicals did either, so it fell on me. As I did that job, grinding away, I thought, "Who would want to do this for the rest of their life?"

I was getting kind of worried, thinking, "My master's degree is going to be granted in a couple of months. Maybe

I'll do something else." Then, my boss decides sent me to an IPC training course in Thousand Oaks, California, in February, which was great. It was a two-and-a-half-day training seminar on micro-sections and evaluation, which was appropriate, and the instructor was Dieter Bergman. When I met Dieter, my whole outlook on this industry changed. I caught his incredible enthusiasm and saw what he did for the industry. He didn't know me from a lump of coal, but he didn't care. He was there to teach and have fun. I left there not only much better educated in doing micro-sections but also with a whole new perspective on IPC and the electronics industry.

After that, I didn't know Dieter well, but everybody else did. For years, I got to know him better by being involved in the IPC Technology Roadmap, which he and I co-chaired until his passing as well as a few other committees. I got to also teach some professional development courses with him. Those were some of the most fun times for me, as a professional teaching a course with Dieter for a few days on various aspects of electronics, circuit boards, designs, and processes. It means a lot to me that his name is associated with this award. I've always admired Dieter, and he

ogy side of the business, and I became more involved with that. At RBP Chemical Technology, we are active members of IPC—the global standard-setting certification organization with over 5,500 member companies worldwide.

I first became involved with IPC on some of the standards committees, which I'm still involved with today. Eventually, I joined other areas, including the Suppliers Council and IPC board of directors, while also serving on many committees and subcommittees, etc. I've been very active in IPC, with at least two committees per year, plus board memberships and the Suppliers Council since around 1986. I've had almost 34 years of active participation in the association as a volunteer. Also, I have developed a number of technical professional development courses for IPC that I've taught over the years and continue to teach.

Goldman: That's pretty extensive, which is an understatement, and certainly explains why the Dieter Bergman Fellowship Award is for those that emulate Dieter. You sure do, and I know your involvement is worldwide as well.

Carano: No one could ever emulate Dieter. He was an incredible individual, and I had a

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had a major influence on me. I feel humbled to accept this award.

Goldman: That is great to hear. I know you also travel worldwide for IPC and are involved with flex, as well as additional seminars, meetings, etc. How do you fit it all in with your regular job?

Carano: My father used to say, “Don’t worry. Busy people get things done. They’ll find a way to balance it all.” He taught me about volunteering. He and my mom were community volunteers and had full lives, raising the family, and working. They always gave back and imparted on me the need to help others, no matter what. He always said, “There’s nothing better than helping someone with no expectation of ever receiving anything in return.” He believed it would be great if no one remembered his name, so long as he helped people and made an impact on somebody’s life and

helped somebody; that was all that mattered. They weren’t rich or anything, but they shared their time and talent, which is important.

Again, I got involved in volunteering with IPC, even before I graduated from college, because I recognized how much I enjoyed this industry and sharing that, especially by teaching others. My mom and dad are educators by degree, so teaching and volunteering were big aspects of their life, and I’ve taken that on in my own way. Teaching helps people stay in the industry and learn more about it, and it helps others in this industry do better. My troubleshooting courses were designed to help others solve problems so that they could eliminate defects, help their companies, and increase yield.

Those are the kinds of things that I work toward, and it boils down to our everyday business at RBP to do that as well. I’m very fortunate to be working with a great company. RBP has been doing business since 1954 with just two owners. The current owner is our CEO, Mark Kannenberg, who’s a West Point graduate and a Harvard MBA, and he has been at the helm for 30 years. I’m able to find the time because he and the company support me. And when you’re doing something cool at IPC, that means other colleagues in your organization help carry the responsibilities. We’re all in it together.

To make this industry better every day, we all strive to do that because this is where we make our living. I enjoy it. It’s a great opportunity to reach out to younger people and see how IPC is attracting younger people into our industry. The IPC Education Foundation is offering a great legacy and reaching out to high schools and technical schools, helping to build our workforce in the future because that’s so important. This is a great time for RBP, IPC, and our industry, and I’m glad to be part of it.

Goldman: There are a good number of PCB facilities where you’re located in Minneapolis, Minnesota. Are you and those companies able to reach out to local high schools and universities?

Carano: There's a lot of interest. There are a couple of technical schools that IPC is reaching out to right now. They have doubled the number of student chapters at universities from last year at this time, and Minneapolis is on their target list. When we look at where IPC members are located, there's a large database in the Minneapolis-St. Paul, Minnesota, and Western Wisconsin areas. There's a lot of circuit board assembly and OEMs.

Another part of our RBP business is a specialty process line of chemicals technically formulated for the medical device industry. I'm heavily involved in working with the medical device companies, particularly the large, embedded medical device companies. There are also a lot of smaller ones, including startups, improving lives medically through implantable devices, such as stents, pumps, and pacemakers. A lot of circuit boards are being used in medical devices, both internally and externally. One group is heavily involved in circuit boards because they have to buy the insert those components into devices, etc., so it's exciting.

IBM Rochester is in the area, and there are major influences from companies such as Medtronic, St. Jude Medical, and many others. It's a great area, and we're in the beginnings of this expansion, if you will, into the high schools, technical schools, universities, establishing chapters. IPC is doing a great job with that student outreach. It's phenomenal, and it's going to make our industry stronger going forward, as well as help the U.S. and North America be more competitive with a well-educated, well-trained workforce. I can't say enough about what IPC is doing, and I was very fortunate to be a part of it in some way.

Goldman: I'm happy to hear that there are finally going to be some courses on IPC EDGE for PCB manufacturing people, which has been largely assembly-related to this point.

Carano: Right. They're transitioning to IPC EDGE in February, which will be a computer-compatible learning system; it's not your everyday PowerPoint. It's going to create a richer,

more meaningful educational experience. One of my IPC courses on advanced troubleshooting for PCB defects will be six two-hour sessions, which offers 12 hours of contact time complete with case histories and quizzes, but we've already talked about adding another week of two-hour slots; eventually, it will be a 16-hour course or longer.

There has been a big demand for online education; people don't necessarily have time during the workday, or they want to work on something in their leisure. This will be an opportunity for many young engineers, chemists, designers, and those involved in circuit board assembly to get involved with that. IPC has made these investments, which shows great leadership. We all see the need for more education. The committees need you. Get involved.

Goldman: When you volunteer and get involved, you learn as much as you teach. You get as much as you give.

Carano: You hit the nail right on the head. Sometimes, you get back more than you give. You're reaching someone who maybe had doubts like I did when I met Dieter Bergman, wondering what I was doing in the industry doing micro-sections. You have the chance to impact someone just like you have been. Everyone has one or two special teachers that cared, reached out, and made a difference in their life. I have fond memories of my physics and chemistry teachers, even in high school, because they got interested in the sciences and engineering. When your students or colleagues know you care, they get it, and they respond.

Goldman: And they see your enthusiasm, as do I. You've been doing this for 40 years. How long are you going to keep doing it?

Carano: As long as it keeps being fun, and that's what I like about it. It is fun, and as you said, you learn something every day. I learn a lot, particularly when I travel to see fabricators, assemblers, and OEMs to hear about where they want to take their products and the indus-

try, whether it's Intel, IBM, General Motors, or Lockheed Martin.

It all starts with electronics because, at the end of the day, whatever their final product is that they're building, it's the electronics inside that will make it work—the circuit board, semi-conductors, flexes, cables, wire harnesses, etc. That's why being part of IPC is such a great opportunity to learn and be part of this. People don't realize what electronics do. They buy a smartphone and think it's great, but they don't know what's inside. It's mind-boggling for those of us who remember having flip phones. I asked a young kid next to me about phones on an airplane, and he said, "What is a flip phone?"

Goldman: I bet it would be similar if you mentioned something like dial-up or a dial tone, they would say, "What on earth are you talking about?"

Carano: That's exactly right. It's almost comical, but look at what has happened. I see this great opportunity going forward for everybody to make the world better. We can find ways to put electronics in the hands of the world's poorest people to raise their living standards. Electronics create jobs. Imagine that you're in an area without wiring for electricity. How about ways of purifying water so that they drink in those areas by using electricity generated through a special filter from a solar cell? Those are the beginnings of what can be done, which is why I'm excited. IPC has done a lot and had a major impact over the past 10 years since Dr. John Mitchell has come on board with his team; it has been an incredible transformation. I'm happy to have a front-row seat to it as a member, volunteer, and also someone who makes his living in this industry.

Goldman: Part of the IPC Fellowship Award is a Dieter Bergman Memorial Scholarship to the university or college of your choice. Where did you choose?

Carano: Youngstown State University, my alma mater.

Goldman: Mike, thanks so much. Congratulations, following in the footsteps, shall we say, of Dieter.

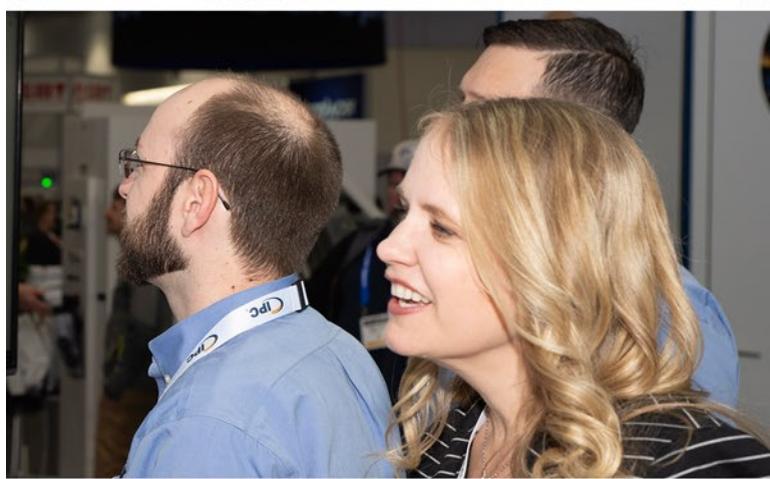
Carano: Thank you. It takes quite a few shoes to fill his. Again, I'm honored to get an award with his name on it, knowing what he has meant to the industry and everybody else. It has been important for all of us. **S&T**

Michael Carano is the vice president of technology and business development for RBP Chemical Technology, where he directs global business development and R&D for the company's electronics, mining, and medical chemicals businesses. Carano has published over 190 technical articles and is the holder of nine U.S. and 22 foreign patents. Carano has a B.S. in chemistry and an MBA in marketing and business strategy.

An active member in IPC since 1992, Carano serves on several other committees. He previously served as a member of the IPC Board of Directors for 14 years. Carano is a strong supporter of technical education and training and has developed seven separate professional development courses for IPC and its members.

Carano is currently the co-chairman of the IPC Technology Roadmap Executive Committee and Chairs the IPC Process Effects committee and IPC Technology Solutions committee. He was elected into the IPC Hall of Fame in 2014.



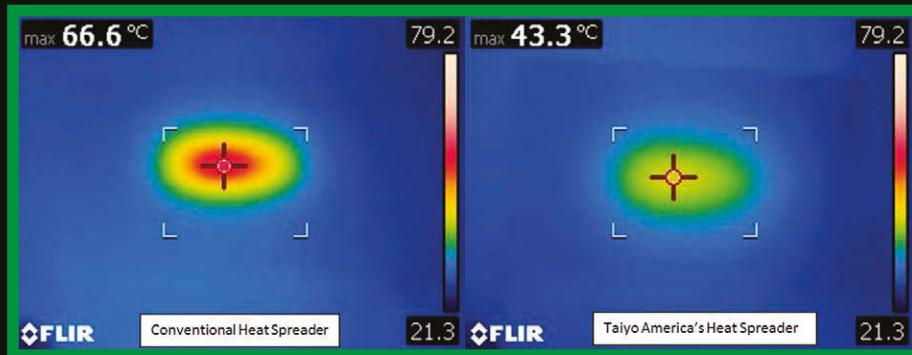


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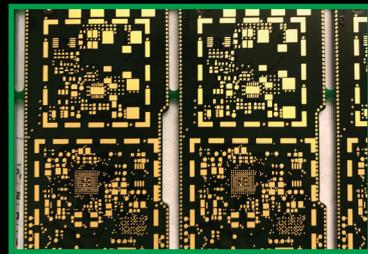
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IJR-4000 FW100





Congratulations to Udo Welzel!

Dieter Bergman IPC Fellowship Award Recipient

by **Patty Goldman**
I-CONNECT007

Patty Goldman talks with Udo Welzel, Dieter Bergman IPC Fellowship Award recipient, about how he became involved with IPC and the standardization business, his time spent working with Dieter Bergman, and why it's important to stay involved.

Patty Goldman: Congratulations, Udo. You're a recipient of the Dieter Bergman IPC Fellowship Award. Let's start with a little bit about yourself. How did you get in the industry, and what are you doing now?

Udo Welzel: My career is a little bit untypical. I was working at the Institute of the Max Planck Society in Germany for quite a long time, but, at that time, we were already collaborating with Bosch on soldering. That is how the contact with Bosch came up. At some point, I asked myself, "Would I spend my entire life in academia, or would I also like to try out a career in the industry?" Shortly before my 40th birthday, I decided to try out a career in industry. Due to the contact with Bosch, it was an obvious choice to have an application there, which worked out well.

I joined Bosch's automotive electronics business unit. In the department where I'm work-

ing, we are responsible for technology development for industrialization. That means we provide our plants with the necessary technologies to do the mass production of electronic control units. We wrote the process specification and selected materials like solder alloys, fluxes, etc. That's the department where I'm working, and I'm an interface to our internal customers, the business units in Bosch, which develop the hardware. Our business unit builds the hardware. In this context, I also came into the standardization business because there are many standards available that are relevant for electronic control units or electronic assemblies in general.

More or less from the beginning, when I joined Bosch, I got the task of taking care of the standardization activities. That was also the time when I met Dieter Bergman and had the pleasure of working with him for some time. We met a couple of times personally, so I knew him quite well. I'm very honored now to receive this reward. He was always dedicated to the standardization aspects of electronic assembly technology. He also focused on harmonization between different standards to make sure that there are no conflicts between them. That's how I got into the standardization business.

Goldman: How long have you been involved with IPC as far as standardization and committee work?

Welzel: I've been involved since about 2013.

Goldman: Since you're up for this award, and I know you've received past awards for your contributions, you must be very involved as a contributor. Plus, I know you're also involved with other organizations on standardization. I'm sure Bosch wants you involved, but what drives you to do it?

Welzel: I see lots of benefits in our daily work. I spend 25–30% of my time on standardization. Standardization has become important for various reasons. You can accelerate innovation, improve the quality of your product, and sim-

plify discussions throughout the supply chain through standardization, thereby saving a lot of effort discussing the direction with your customers and suppliers. If you can say, "Let's work according to the accepted standards," it's something that everybody can agree on. That's why I'm dedicated.

The other important aspect—and this is why I appreciate IPC—is you also have lots of contacts with experienced colleagues, and no matter what question comes up, you always know someone you can discuss it with. Networking goes along the standardization, which I find to be a very important side aspect that cannot be overemphasized, particularly for young colleagues. You can make useful contacts in these types of meetings, and they open up a lot of resources. That is an additional aspect.

I have learned a lot through standardization. In the beginning, you may think, "Writing standards is boring. It doesn't seem to be a very rewarding task," but don't forget about all the other advantages, such as networking and getting to know different colleagues, viewpoints, and business models. There's always a lot to learn in these meetings.

Goldman: Yes, you learn so much when you're involved in it. Your opinion and data count for something. The standards aren't made in a vacuum. You and your colleagues had a significant contribution to the standard and developed it from the ground up.

Welzel: It's very rewarding to develop a new standard. There are standards out there, like IPC's A-610 or the J-STD-001, that have evolved over a very long period of time. This is also reflected by the high quality of these documents. If you start with a new document from scratch, like with our automotive addenda to 610 or 001, in the very first shot, you don't get that level of quality and consistency. In this process, you learn a lot about how to write standards as well as how the industry works and how different industries in the field of electronics assembly technology work.

Goldman: And how they're related.

Welzel: Right, and how they can profit from each other. That is why in the very beginning, it was a task I got, but now, it's among my favorite tasks.

Goldman: Tell me about your relationship with Dieter.

Welzel: I met him at the IEC meetings, where he was the chair of Technical Committee 91, and of which I am the chair now. As you mentioned earlier, I'm also involved in IEC, and I'm very focused on harmonization between different organizations as well as getting the best of the different organizations because you don't have the same level of expertise among experts in all fields now. Some organizations are very strong in one field, while others are strong in other fields, and you have to make the best out of it. It's not a competition; instead, it's about making documents that are complementary and harmonized. This was very much at the heart of Dieter Bergman too.

I remember when he organized a meeting in Richardson, Texas, where we met for an IEC meeting, and after that, we went together to an IPC meeting. I learned a lot from him, and it always surprised me that despite his considerable age at that time, he was very much fluent with modern technology. Laptops were no problem for him at all. You noticed that all his involvement in these activities kept him engaged and up to date with the many ongoing developments.

Goldman: I've never seen anyone embrace things as he did. He embraced everything. Let's talk about what you see. Are you working on another revision? I know you said it wasn't perfect, and usually, as soon as something comes out, everybody starts to work on the next version. How's that going?

Welzel: That's the story and what I learned from Jan Pedersen [Elmatica]. He was a pio-



neer regarding the automotive addenda and made an automotive addendum to the 6012; also, his credo was to put out the first version quickly so that people have something to work with and to improve. In principle, the first version didn't necessarily have to be 100% perfect. It's better to get out the first version and then start working on the second revision immediately. That's the spirit we followed with the automotive addendum for

A-610 and 001. We created these from scratch. You have the base documents, of course, but the addenda did not exist before. I always say that it's a matter of entropy. There needs to be some hours put into fixing the document. The first version is never perfect. You can't avoid it. You don't get a document after one revision with the maturity level of the A-610 or J-STD-001 documents, which have evolved over decades.

Goldman: A lot of blood, sweat, and tears went into those, which is well-known.

Welzel: Sometimes, with these base documents, we spend an hour discussing only one sentence in the committee meetings.

Goldman: It has to be right, and the meaning clear.

Welzel: And if you work at the same pace and create a document from scratch, you would never get to a finished document. You have to make some compromises in the beginning, but then the document can become more mature with the next revisions.

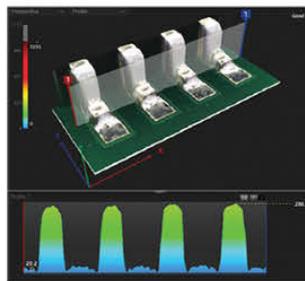
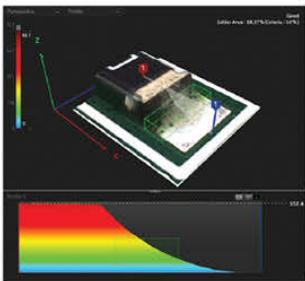
Goldman: Things are changing fast in our industry, so I'm sure if your task group is working on a revision, you're going to get that out and start right away on another one.

Welzel: Exactly. For quite some time, automotive was not so strong in standards develop-

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ment, but over the past few years, it has evolved and become a very important topic. The industry is facing revolutionary changes. On the one side, we are going from internal combustion engines to hybrid or fully electrified cars. This is a major change that also impacts electronic assemblies. At the same time, we have connectivity, which is becoming very prominent in automotive electronics.

Goldman: The car is your computer.

Welzel: And lots of connected services have arisen, which means we now have to go use high-speed communications and high-performance computing cars, which we haven't done in the past because, frankly speaking, the electronic control unit for a combustion engine, in terms of computational power and complexity, is not on a very high level. In this context, it's more challenging meeting the reliability requirements and making it smaller at a good price. But in terms of computational power and data transmission, it's not very difficult.

Going into higher levels of automated driving with the ultimate challenge of having a driverless car in an urban environment, we are also moving into a regime where we get new types of components, interfaces, and data transmission rates. At the same time, reliability is paramount. These are the challenges we have to master. To support this evolution, we can develop standards, which will accelerate innovation and help us to harmonize our activities throughout the supply chain.

Goldman: Do you have any final thoughts?

Welzel: I would like to thank all my peers. I have learned so much during the standardization meetings from them and other experts who attend the meetings. I would also like to thank IPC for supporting the experts in their endeavor to develop these standards and making a good environment to foster these interactions among the experts.

Last but not least, I cannot overemphasize thanking my employer because, in other companies, there's not always such a high level of

acceptance for jobs or tasks where it is more difficult to calculate the benefits in terms of cost. You can do it, of course, and I'm regularly asked to do that, but it's not always as easy to calculate the financial benefits of standardization, such as increased quality, accelerated innovation, and simplified discussions along the supply chain. Also, you need good support in terms of providing data to get something standardized. Bosch is willing to provide data to get standardization tasks accomplished, which is something I really like about the company.

Goldman: Part of this award is offering a scholarship to the university or college of your choice. Have you chosen?

Welzel: I chose the Technical University (TU) in Darmstadt, Germany, as the recipient of the scholarship.

Goldman: Again, congratulations, Udo.

Welzel: Thank you. **SET**

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 the Robert Bosch GmbH on lead-free soldering. That was also the year he joined the Automotive Electronics Division of the Robert Bosch GmbH, where he now serves as a senior expert and leads a team in the Engineering Assembly and Interconnect Technology Department responsible for assembly and interconnect technology integration for automotive electronic control units for driving assistance and autonomous driving systems.

Welzel is also responsible for standardization activities and contacts with IPC and IEC. At IPC, he acts as co-chair of the 5-21M (cold joining press fit) and 7-31BV (A610/J001 automotive addenda) Task Groups. At IEC, he is the chair of Technical Committee TC91 (electronics assembly technology). His support and leadership in standardization have been recognized by the IEC 1906 Award in 2014, the IPC Rising Star Award in 2018, and the IPC President's Award in 2019.





Congratulations to Bhanu Sood!

Dieter Bergman IPC Fellowship Award Recipient

by **Patty Goldman**
I-CONNECT007

Patty Goldman speaks with Dr. Bhanu Sood of NASA, Dieter Bergman IPC Fellowship Award recipient, about his extensive involvement with IPC on many committees developing standards to his work teaching professional development courses and mentoring young engineers.

Patty Goldman: Congratulations, Bhanu, on the Dieter Bergman IPC Fellowship Award.

Bhanu Sood: It was a very pleasant surprise

when I found out. I received a call from John Mitchell's personal administrator, and I said, "I wonder why he wants to speak with me." I'm very pleased. Thank you.

Goldman: It's quite an honor. Let's start with your background, how you got into the industry, and then we can talk about your involvement with IPC. Tell us about yourself.

Sood: Soon after I finished my engineering graduate degree at George Washington University, I started working at the Naval Research Lab on electronics materials and microfabrication. That was about two decades ago when I

started with NRL. I wasn't doing anything that you would call traditional PCB fabrication; it was more of R&D work for the Navy. But I gained a good understanding of how we fundamentally work with materials for electronics applications, such as different interactions and how they get processed.

In 2005, I switched jobs and started working with the CALCE Center at the University of Maryland. Soon after I joined CALCE, I was so glad that I had spent the previous four or so years at the NRL because CALCE was a fast interstate moving at such a very different pace. At the Center, they work with all imaginable sorts of electronics, including medical devices, automotive (even electronics from the Indy 500 race cars), aerospace/avionics, telecommunications, downhole oil drilling, etc.

In a sense, the NRL work and my graduate education provided me with a fundamental understanding of electronics materials and material processing, which I applied in a reliability and test context at CALCE for 11 years. That's where it took off. Then, I moved to NASA close to five years ago, where I kept up on working with electronics. I don't do as much hands-on work as CALCE, which was kind of a bummer for me at the beginning.

When I came to NASA Goddard, I thought, "Am I going to sit in my office all day?" But I found out that there's so much more than working in a lab. There are risk assessments and reviews, complex decision-making, our spaceflight projects, and watching how these pieces of complex electronics that I work with so closely fit into the overall instrument or flight systems. We fly these spacecraft and instruments to achieve the Agency's goals. That, in a nutshell, has been the progression of my career.

Goldman: How did your involvement with IPC start?

Sood: I was a user of standards at the Naval Research Lab. Of course, they're a research organization, being in the Navy, and did not use IPC standards as much. However, I did look at some of my old notes and saw that I used IPC

standards for reliability testing and characterization, like some of the TM-650 test methods. But when I got to CALCE, that's when the relevance of standards came around. I believe I attended my first IPC APEX EXPO in 2007. Even then, standards-making was new to me, but I did know that I was a user of the standards that were being flowed down to the supply chain. I was impressed with how that process worked. I said, "This is where it all gets done."

I accompanied certain people to committee meetings. I met Dieter Bergman and Werner Engelmaier in the committee meetings and others who we all respect in the industry. I said, "If you want to voice your opinion and think something needs to be changed in the standard, we need to raise our hands to bring forth the data and make a good technical case for it." I have only missed one IPC APEX EXPO since 2007 (because of the government shutdown in 2019), but I've managed to stay involved in committees. 2010 was the first time I developed a professional development course at IPC, so IPC started getting a good understanding of where I'm coming from.

They appreciated the professional courses I developed and delivered for them at IPC APEX EXPO. I am involved in numerous committees, including the TM-650 and several standards committees. I've lost count, but I think I'm part of 40 committees. I chair one, and I am on several A teams. My involvement started out by being a user, and then IPC APEX EXPO was the first face-to-face encounter I had where I got a good sense of how standards were developed, and it was fascinating to be involved. I took it from both a learning perspective and a knowledge-sharing perspective that perhaps what I know and understand about materials reliability, quality, and electronics would benefit the committee in general.

And there are the awards. My friend Bev Christian and I joke. Bev says the plaque is \$30 (laughs), and I probably have 12 committee distinguished membership plaques, but I'll say, "It's not about the \$30 plaque; it's the honor, recognition, and satisfaction that comes with what I developed and how I took a leadership role in developing a standard." I have always liked that.

I have been teaching IPC professional development courses for eight years now. I've taught in many other IPC conferences, including in Europe, and have given keynote speeches at the IPC Asia Aerospace Summits. IPC has been very respectful. They've asked me and appreciated the knowledge and perspective I offer, and I've been honored to present my unique perspective on the electronics industry, as we as that of my employer's, at all of these events.

Goldman: That's a lot of committee and teaching involvement.

Sood: I'm not one of the 40-year veterans of the industry. All of my time is compressed in terms of my involvement. I have so much more to learn, but I'm thankful for what I have learned in my 20 years of involvement with industry.

Goldman: Since you work for NASA, that makes you a rocket scientist (laughs).

Sood: Well, an aerospace engineer, but yes (laughs).

Goldman: I'm kidding. Of course. You have taught a lot of classes, but it is with volunteers, so you put in a lot of your own time. What drives you and inspires you to do that?

Sood: What I have valued the most is the opportunities for learning and interaction. Those are unparalleled. Even when I'm teaching a professional development course, I do not claim to be a know-it-all. I'm there to share what I've learned. I start with, "I'm going to provide my perspective, and I'm willing to dig as deep as you'd like me to go. If you'd like to go to the molecular interaction level, then that's what we will discuss, but I'm also here to learn from your experiences." It's an honor to share what I know and make a good case for whatever I'm sharing.

Over time, you develop a certain philosophy, and one of the things which I flag is rules of thumb. When I hear somebody say, "Well, as



a rule of thumb...," I'll challenge where they got that. In reality, most generalized rules of thumb might hold true within a certain constrained set of circumstances, such as a 10°C or 20°C range of temperature, but does not hold beyond that specific range. My suggestion is rather than looking at rules of thumb, we need to look at it from a fundamental physics perspective.

Attending a standards meeting with peers around the table and listening to their experiences is invaluable. For any organization to invest in this activity and send engineers to those types of meetings is important for them to learn how to do things differently and more efficiently and to get that high reliability and quality that we're all trying to achieve.

Goldman: What do you see happening with IPC and the industry down the road? What do you see coming up that's exciting or interesting?

Sood: My day job is to look for the implementation of new technologies in our NASA missions. We do not claim to have the most cutting-edge technology out there, but we do take a lot of risks in implanting new technology. When we talk about the latest technologies, very quickly, we get into the fastest, smallest, lightest processors and electronics. Looking at those three metrics, there are a lot of electronics involved when we're talking about newer processes. From a NASA perspective, I want to see how we can use some of the newer technologies in our missions. How can we start doing fine-pitch area array packages like ball grid arrays? How can we start using higher layer count boards with microvias?

From an IPC perspective, there's a lot of knowledge and experience out there. I see folks from my background—including from aerospace, defense, and telecommunications—so there are a lot of knowledge-sharing opportunities. What I find to be the most exciting are the over-the-horizon technologies that are still in the R&D phase, such as the confluence of 3D printing with artificial intelligence. How are we going to implement that in a PCB?

Further, how are PCB fabricators going to use a lot of the data that's available? How are end-users going to use a lot of the quality and reliability data? I see a number of opportunities for developing guidelines or developing standards around those. I know IPC has the Industry 4.0 initiative going, which is a step in the right direction for factories of the future. But there are also more opportunities for AI and looking at these newer technologies, such as the 3D printing of electronics.

From an assessment and test standpoint, another opportunity that excites me is looking at quality and reliability testing from a fresh perspective. Do we have to start making coupons and start doing full-blown DOE to get that reliability metric? How can we run these DOEs in a very efficient manner using some of the virtual qualification tools with AI? In other words, how can I run a test more efficiently without going through the whole nine yards of coupons and fabrication preconditioning and testing and data analysis and all that?

From IPC committees, we've all seen the general trend in the industry where the average or mean age of committee members is older. But when you go into the meetings, I see a lot of our young professionals coming up. I'm starting to mentor an emerging engineer from Calumet Electronics through the IPC Emerging Engineer Program because I believe in enhancing the workforce and bringing in the younger generation and sharing the excitement of being involved in this industry with them.

Goldman: That's neat. I'm sure you'll enjoy that.

Sood: I'm excited. I've mentored students and interns for the last 17 years. In fact, I was out taking my last intern to lunch the other day, and he asked me how many students I have mentored. I've been doing this for 17 years, and I've made it my priority everywhere I go to share what I've learned. I think I've probably mentored around 100 interns over the past 17 years consistently. I'm happy that IPC started the Emerging Engineer Program a few years ago; they're kind of following along the same path. I jumped in when Teresa asked me if I would sign up. I'm happy to do that.



Goldman: The Fellowship Award comes with the Dieter Bergman Memorial Scholarship to be awarded to the university of your choice. What school did you choose?

Sood: I chose the Aeroclub within the Aerospace Engineering Department of the University of Petroleum and Energy Studies (UPES) in India. During a recent outreach event, I met with UPES students, including some from this club. I was very impressed with what I saw. The Aeroclub was initially created by a group of students with a passion for airplanes, but over the years, it has diversified itself into various other aerodynamic machinery like miniature hovercrafts and drones. The club organizes various events, the latest being a national drone competition, an event planned at the college.

Goldman: That's great to hear. Again, congratulations, and thanks so much for your time.

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

Dr. Bhanu Sood serves as the Goddard Space Flight Center Lead Engineer and NASA specialist managing the

overall risk assessment, reliability, and assurance efforts pertaining to printed circuit boards and microelectronics packaging used in NASA Goddard's flight missions. Dr. Sood manages the development efforts for the JPSS Program, GOES, JWST, Landsat-9, WFIRST, LUCY, PACE/OCI, Restore-LEO, and a number of CubeSat missions.

Before joining NASA, Dr. Sood was most recently the Laboratory Director at the CALCE Center at UMD, where his lab provided reliability and supply chain risk consultation to companies in the avionics, medical devices, telecommunications, down-hole drilling, and automotive sectors. At UMD, Dr. Sood patented a technique for ultrasonic inspection and health monitoring of lithium batteries. Before UMD, he developed laser-based 3D printing and embedding processes at the U.S. Naval Research Laboratory. He patented a process for embedding circuits for surveillance applications.

Dr. Sood has authored several hundred conference papers, presentations, and technical reports, five book chapters, and 32 peer-reviewed scholarly and technical manuscripts. He is a member of the editorial board of SMT Journal and actively volunteers in a leadership role in technical program committees and standards development activities within SAE, IEEE, and IPC. He holds a doctorate in electronics reliability, a master's degree in metallurgy and materials science, and a bachelor's degree in mechanical engineering.





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Trends From the Show: Solder and Software

by Nolan Johnson
I-CONNECT007

In my role as a media representative, my perspective on IPC APEX EXPO may be a bit different from that of many attendees. Since the I-Connect007 team had the opportunity to talk to many attendees and exhibitors and listen to their stories over the course of the week, our view can be particularly wide. When I reflected on all the conversations, pieces from all throughout the week coalesced and provided a different understanding of and take-away from the show.

To that end, I noted two distinct themes across all my conversations in San Diego: the first was iterative innovation over technological disruption, and the second was improved decision-making tools. I come to these themes

after a process of distillation. Automotive, medical, and IoT were all hot topics, and OEMs are demanding higher densities and increased throughput (those two requirements are at odds with each other). In addition, semiconductor companies continue to shrink the silicon into smaller and smaller packages, and higher speed requirements are changing even the plating and manufacturing processes. In this Venn diagram of driving forces, what sits in the very center that's an overlap of all the circles? Connecting the components to the board and getting smarter about the build processes.

Interestingly, this is where I saw the most activity in development. In the area of solder and soldering technologies, we heard about new developments in solder paste formulations, as well as new methods for application. The equipment manufacturers are finding

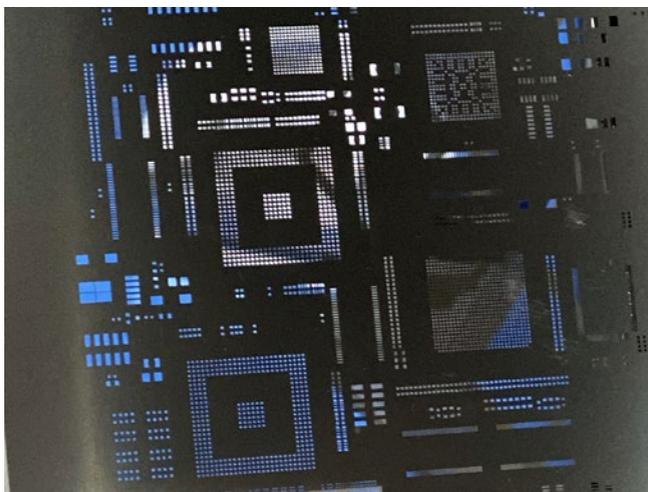
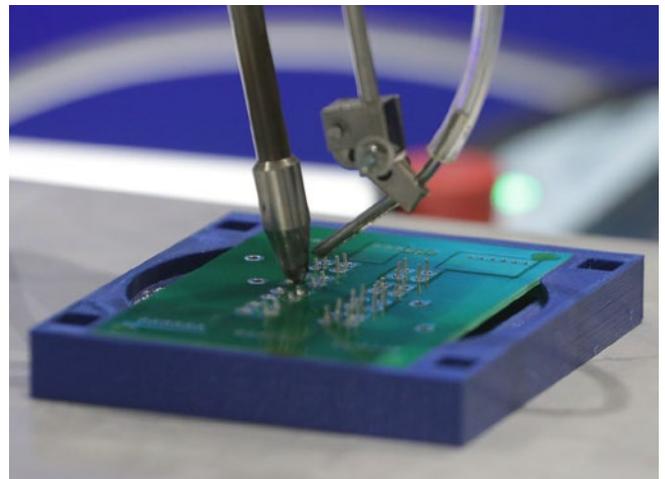
plenty of opportunities to optimize throughput and precision in the applications, while solder paste manufacturers are working hand-in-hand to deliver a product that allows the new machinery to run at its best. Jetting seems to have found its time in the market, and work across the industry is underway to mature that technology. production managers can, at a minimum, wire up the critical equipment. Even the lowly flux needs to do more with less as components get smaller.

If there was an area of development that displayed some disruption, it was in the control software space. I talked to established vendors, as well as new startups, all developing smart factory software solutions for process monitoring and operational optimization. With a variety of process data sharing protocols now in place in the market, production floors have choices of how to build their data pipeline.

With a variety of companies offering affordable hardware solutions to retrofit even older machinery for Industry 4.0 data collection, production managers can, at a minimum, wire up the critical equipment.

What's new is the greenfield opportunity to start using this data in new and powerful ways. I saw numerous AI offerings being demonstrated and discussed on the show floor. Tying together the MES, ERP, and production floor is in our near future. In my opinion, this is where our industry will see the next "killer app" for electronics manufacturing, but these apps have not yet made themselves known to the marketplace. You can bet that I'll be watching for it.

The pace of development on the control software side is accelerating. I'm already excited to see what all the development over the coming year will produce for IPC APEX EXPO 2021. **S&T**



Burt Rutan's Keynote: SpaceShipOne

by Pete Starkey
I-CONNECT007

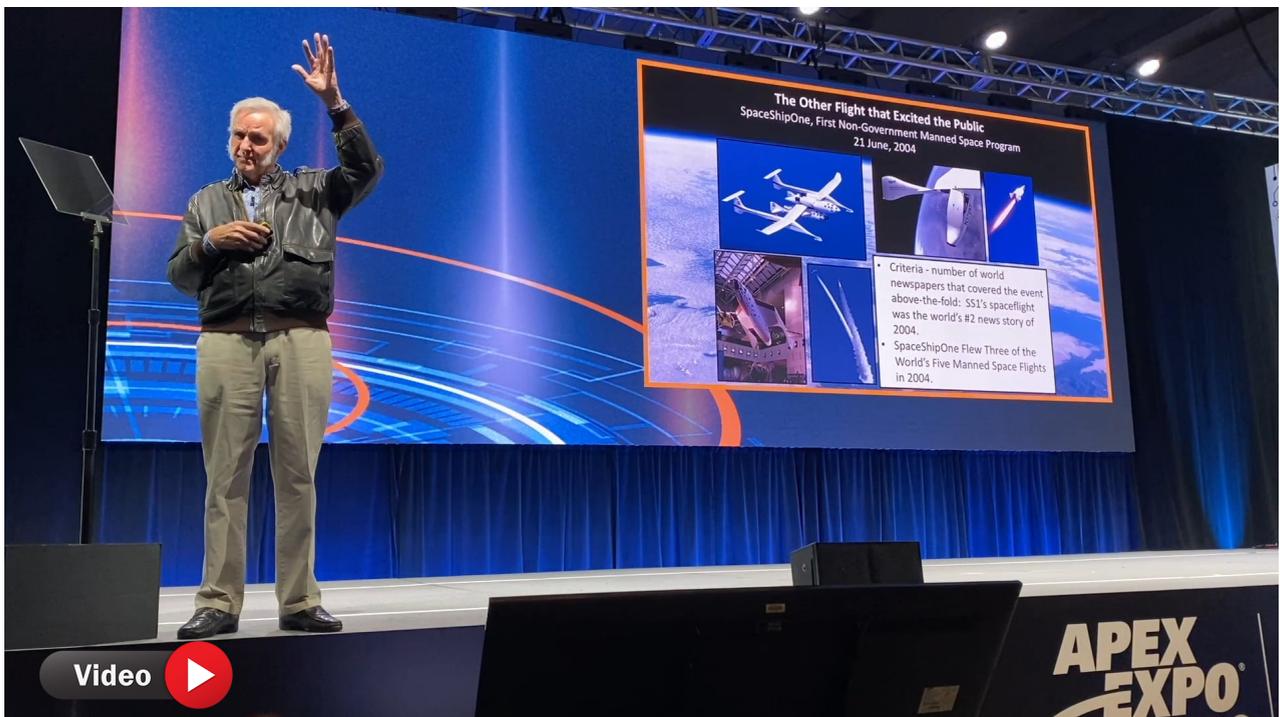
Introduced by IPC president John Mitchell, IPC APEX Expo 2020 keynote speaker Burt Rutan addressed the attentive audience in a full-to-standing-room-only ballroom at the San Diego Convention Center in the friendly and relaxed style of a benevolent uncle with mut-ton-chop whiskers. "I'm an old man; I developed airplanes with a slide rule. The invention of the floppy disc was a revolution!"

Rutan, clearly a courageous idealist with a passion for the advancement of technology, enthusiastically shared his experience and his vision in his keynote presentation "SpaceShipOne: A New Era in Commercial Space Travel and the New Race for Space." During the following hour-and-a-half, he gave a struc-

tured account of his time at college, his first job, his ideas on inspiration for innovation, his research companies, the two "big flights," managing innovators, his predictions, the four Space Billionaires, urban air transport, cars without drivers and planes without pilots, concluding with the lessons he had learned.

Looking back over his early career, Rutan had wanted to design aircraft ever since his first job as a flight test engineer in 1965. In his opinion, the beginnings of aviation aircraft design had been by natural selection, and "every aircraft was stealth before we invented radar."

He further discussed the foundation of his two research companies in the mid-1970s: the Rutan Aircraft Factory to develop light aircraft and market technical and educational documents, and Scaled Composites to develop



Click image above to view an excerpt from Burt Rutan's keynote address.

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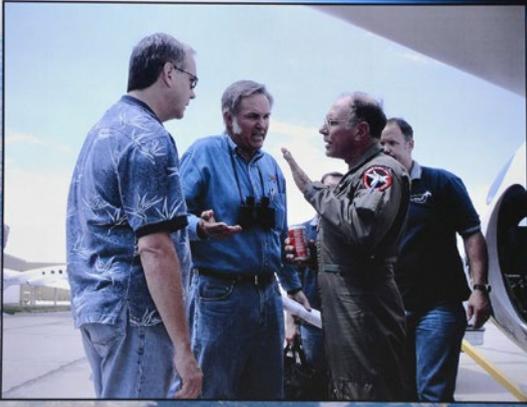
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Lesson Learned:

Informal chats are more effective than formal meetings



research aircraft. And there had been two significant milestones: in 1986, the Voyager flight around the world without stopping or refuelling, and in 2004, the suborbital flight of SpaceShipOne.

The Rutan Model 76 Voyager was designed in 1981 by a team led by Burt Rutan at the Rutan Aircraft Company and built largely by volunteers over the following five years, using space-age materials, without government support and with minimal corporate sponsorship. For its round-the-world flight, it was piloted by Burt's brother Dick Rutan and Jeana Yeager.

SpaceShipOne was financed by Microsoft co-founder Paul Allen, built at Scaled Composites, and won the \$10 million Ansari-X prize for being the first privately-developed spacecraft to carry a pilot into suborbital space. Rutan made it clear that SpaceShipOne was a personal goal rather than a customer request.

Rutan reviewed the irregular progression of manned space launch systems from 1960 to the present day. During the 1960s, there had been nine in eight years, but from 1970 to 2020, only three new manned launch systems had flown, of which the Shuttle was one and SpaceShipOne was another. Rutan had little respect for NASA, which he considered risk-averse, and in 50 years, had never had a consistent goal. He saw it as a failure.

"Small teams can accomplish big goals," was a Rutan maxim. One of his photographs showed the entire project team that had worked on SpaceShipOne, standing in front

of their creation at the presentation of the \$10-million Ansari X-Prize. I counted 26 people! "An engineer in a normal company structure gets to work on two or three airplanes in their whole career. We have done 23 airplanes in 20 years." His Scaled Composites engineering team had already designed and was starting to build two new craft: an enlarged version of SpaceShipOne, together with a new mother ship for launching it.

What good was a private suborbital space industry? Was it just for fun? Rutan drew a parallel with the home computer—which, in his view, was "just for fun"

before the internet. In 2004, he had predicted that commercial suborbital space flight would be big business, a successful flight would demonstrate the capability and attract investment, and even small companies like his could send people into space. But he had now changed his mind because he believed that it might never be profitable and would need some breakthroughs for affordability and safety.

"Entrepreneurs are the future of space flight," said Rutan. He also remarked that four billionaires were leading the space race of the moment: Jeff Bezos, Richard Branson, Elon Musk, and Paul Allen. All four were of an age that they could have taken their original inspiration from the Apollo programme as impressionable kids. He considered that the approaches taken by Musk and Bezos to employ reusable rather than expendable rocket boosters would make orbital flight more cost-effective, and that ongoing development would increase safety.

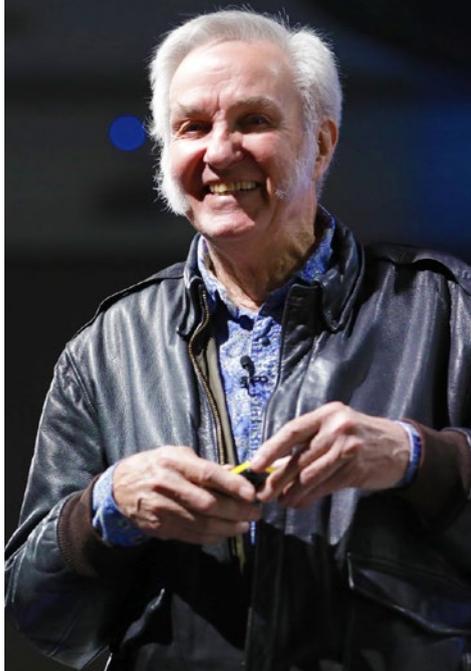
A little closer to the ground, Rutan debated the practicalities of urban air transport, using New York City as his example. Could 2000 eVTOL aircraft replace 4500 taxicabs? Transit time wasn't the issue; it was access to realistic pick-up and drop-off points. In his estimation, there were 400,000 curbsides available on the street compared with 1,000 ports on the tops of buildings. Whereas passengers could board or leave a taxi in about 15 seconds, it could take five minutes to reach the top of a building to similarly board or leave an eVTOL aircraft. Rutan calculated that the total throughput

capability of the eVTOL fleet would be 0.01% of the taxi fleet; therefore, it would not be a realistic proposition.

The concept of driverless cars presented an ethics dilemma: in an emergency situation, should the machine intelligence controlling the vehicle choose the lesser of two evils, such as killing two passengers or five pedestrians? Rutan asked whether a software writer should be ultimately responsible for making that ethical decision and left the audience to ponder the question. From a practical point of view, the concept of the pilotless aircraft was easier than the driverless car, and the technology was already available, but in context, the proportionate cost of the pilot was relatively small, and the ethical questions remained.

Listening to Burt Rutan was a truly educational and motivational experience. He was an inspiration to those with a strong desire to accomplish a technical objective and the determination to achieve it, even if it meant bending the rules of convention more than a little. Rutan had strong views on building and running a successful business, especially one requiring scientific innovation, believing that the best ideas resulted from the collaborative efforts of small closely-knit project teams working in an environment not restricted or confined by risk-aversity. He understood the value of seeking-out the experienced and learning from them, and was convinced that informal chats were far more effective than formal meetings.

And when it came to managing innovators, his list continued: “Set difficult goals, reward the achievement of a goal, let the innovators decide what risk to take, then leave them alone and keep others out.” The tasks of the manager were to set the goal, communicate, and get fund-



ing. It was important never to focus on just improving on “normal” because an easy goal would result in a useless success. The manager should learn from the historic examples of the most aggressive, courageous technical accomplishments, challenge the team to do what they think is not possible, and define the difference between research and development (there are several definitions, but in general, it can be said that research is

an open-ended investigation, a learning process, whereas development is work toward an end-product and deliverable). It helped if the manager had strong nerves and was not easily disturbed or upset.

A pertinent quote that Rutan used in the context of inspirational leadership was attributed to French journalist and pioneering aviator Antoine de Saint-Exupery (1900–1944): “If you wish to build a ship, don’t drum up people to collect wood and don’t assign them tasks and work, but rather teach them to long for the endless immensity of the sea.”

No one in the audience could have failed to be impressed by Burt Rutan’s enthusiasm for what individuals with vision can achieve. An appropriate subtitle for his presentation would be “Lessons in Motivational Management.” **S&T**

Manager tasks: Set goal, communicate and get funding

- Set difficult goal (50% should say impossible)
- Reward achievement of goal (power of a prize)
- Let the innovator decide what risks to take
- Leave them alone and keep others out
- Applaud courage and expect multiple failures

Standout Conversations

From IPC APEX EXPO 2020

by **Steve Williams**

THE RIGHT APPROACH CONSULTING

The annual IPC APEX EXPO presents the opportunity to keep up with what's new in the industry and stay abreast of exciting, upcoming technology. For me, it is also a time to catch up with many old friends and colleagues from my over 40 years in the business. Here are some of those conversations. You can also view the [full library](#) to see other interviews from IPC APEX EXPO 2020.

Anaya Vardya

President and CEO, American Standard Circuits

I have known Anaya for almost seven years, and I always look forward to talking with him about the latest in technology. American Standard Circuits is one of the premier manufacturers of advanced-technology PCBs in the industry. I spent the first 22 years of my career building PCBs, and every time I talk to Anaya, I realize just how little I know about today's technology. Anaya mentioned a number of pieces of new equipment recently installed that allow the company to continue to push the limits of manufacturability. Aside from participating in a number of IPC meetings, the show provides Anaya the opportunity to look for his next equipment purchase that will continue to keep American Standard Circuits at the forefront of industry technology.



Kurt Palmer

President and CEO, Burkle North America

As we were talking, we started counting the years and realized that we had known each other for nearly 40 years! How did that happen? Most of that time was when Kurt was with Tapco as a supplier, and later as a friend. We discussed his recent career move to Burkle, and how that is going. Kurt indicated that the move to the lamination systems maker was a logical progression from being a supplier of raw laminate to the industry to now being a multilayer lamination OEM. We also discussed some of the new technology offerings Burkle is making, such as special presses for flex and rigid-flex products. Kurt said that IPC APEX EXPO is a great venue to showcase their equipment and new technology.



Aaron Birney

**Education program manager,
IPC Education Foundation**

This was a particularly interesting discussion, as one of the existential threats facing our industry is the bench strength of trained employees ready to take the baton from the seasoned veterans leaving the business. Aaron discussed the foundation's focus on STEM and growth over the past



year after launching at IPC APEX EXPO 2019 and how IPC members can get involved and sponsor student chapters. The IPC Education Foundation identifies potential schools for new chapters, but individual companies can also come to Aaron with a school and pledge to be a sponsor. Since launching last year with seven chapters, it has expanded to 26 currently, and Aaron hopes to see the same growth by IPC APEX EXPO 2021.

Mark Goodwin
COO, Ventec International Group USA

Jack Pattie
CEO, Ventec International Group, Europe and the Americas

The 2020 technology focus for Ventec International Group is in three areas for advanced laminate materials: thermal management, metal core PCBs (MPCBs), and signal integrity. Of course, Ventec provides standard laminates, but these three areas are driving the company to quickly become one of the top manufacturers of advanced laminate to the PCB industry. As with everyone I spoke with, one of the factors influencing technology is the advent of 5G applications beginning to hit the industry.

In Mark’s video interview, he commented on the importance of Ventec participating in the many IPC specification meetings and committees to ensure that the company has a voice in the standards and specifications that impact their product. When I talked with Jack at the show, he discussed the core values of the organization, starting with Ventec’s mission: To create enabling technologies and innovative solutions to meet the future technology requirements of their customers and achieve ultimate customer satisfaction through continuous attention to



cost, quality, improvement, and local service support.

Oren Manor
Director of business development, Mentor, a Siemens Business

I think everyone in the industry knows Mentor and the front-end CAD/CAM software solutions they bring to the table. What was interesting when talking with Oren is the integration of the Mentor suite of software with the mechanical solutions made available with the recent acquisition by Siemens. One of the main points Oren made was that they now can offer a complete solution to customers, starting with front-end CAD/CAM outputs to the mechanical process of manufacturing products, including guidance on workflow optimization and use of robotics. This “total product” solution gives the customer much more accuracy in planning, production, and quoting/costing over utilizing multiple providers to achieve the same solution. Oren stated that the total product solution enables companies to develop better electronic products faster and more cost-effectively. **S&T**



Steve Williams is the president of The Right Approach Consulting.

The Impact of IPC's Emerging Engineer Program

by **Barry Matties**
I-CONNECT007

Time and time again, I hear about how the industry needs to attract young engineers. Now, I am seeing not only how the IPC is attracting but also engaging them into being active in professional development and IPC standards development through the Emerging Engineer Program.

According to IPC's website, the Emerging Engineer Program launched in 2016 to provide professionals early in their careers an opportunity to learn from the dedicated industry

volunteers who participate in standards development. Through this sharing, IPC's valued leaders mentor emerging engineers and provide them with the tools they need to continue standards development for many years to come. Mentors have the opportunity to ensure their projects carry forward while they help build the future.

IPC's Emerging Engineer Program might be one of the most important programs the IPC offers, especially when they couple it with their STEM Student Outreach Program. Engaging young minds and getting them to take part in standards meetings and professional



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11. Cycle Time Constrains Coverage
12. The Next Generation: 2K Conformal Coatings

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*each part approximately 4-7 minutes



development courses and providing opportunities to connect with mentors and network with other industry experts ensures a strong future for our industry. In this program, the emerging engineer is not on their own, but are paired up with a mentor. Read what one Emerging Engineer Program mentor, Karen McConnell, said in a 2019 interview [here](#).

When you're a new college graduate, you have an ideal version of what design really is. You typically do not have manufacturing experience—such as how to build, what is needed to build, and how to navigate the requirements of manufacturing, including government requirements, EPA, foreign trade requirements, etc.—all the things that can get a less experienced engineer in trouble. These concerns can be minimized when you have a mentor. When you have a problem and need a reference, you can go to your mentor for resources and connections within your corporation. The same goes for IPC standards and information about committees. Who is the right person to talk to? Without a mentor, it can take at least five years to figure out just how IPC works and have the connections to resolve your issue.

IPC mentors are there to guide emerging engineers through the process of learning the ropes, getting on the right path, and advising them along the way. To deepen the reach into our future workforce, the IPC's growing STEM Student Outreach Program introduces high school students to our industry with the help of the emerging engineer participants. At IPC APEX EXPO 2020, approximately 200 STEM students took part in the event.

Currently, there are approximately 30 engineers enrolled in IPC's Emerging Engineer Program. That number has more than doubled over the last year. Being enrolled in the program not only provides the young engineer a great platform to develop skills, network, and grow, but it is also great for the company that employs them, as it will reap the benefits in many ways. Of course, they are making an investment into their employees, and like any investment, there must be an ROI. In this case, they are investing in the training and devel-

opment of their engineers. Since this program has specific requirements, it should be a clear measure of success.



Jesse Vaughan's Experience

Jesse Vaughan of Zentech is enrolled in IPC's Emerging Engineer Program. In this interview, he reflects on his time in the program and how the industry connections he made are already proving to be beneficial.

Barry Matties: First, can you tell us what IPC's Emerging Engineer Program is about?

Jesse Vaughan: This is the program's sixth year. At its inception, there were three engineers. This year, there are approximately 30 in the first-year program. As a participant, we are paired with a mentor. Mine is Kevin Kusiak from Lockheed Martin Space System. We receive a "passport" for the program, and we have to check off certain tasks, such as attending committee meetings or professional development courses. We also have to attend several networking events to meet people, get your name out there, and see like-minded folks in the industry who are on the same path, as

well as cross-pollinate across different aspects of the industry.

It's all about getting linked with somebody who has walked the path before you, can show you the ropes, and get you involved with IPC. As you get more involved in the committees, then you have readability into the standards, can give more input, and are able to see how the standards are developed, approved, and sent out to industry to apply to products.

Matties: Do you already have your engineering degree?

Vaughan: Yes, I graduated and have been in the field now for three years as a manufacturing engineer. The requirement to be elected are five years or below in an engineering role and/or still in university on the track to be in engineering.

Matties: Why did you sign up to be in this program?

Vaughan: Being the third generation in the business—including my grandfather, my father, and me—I've always had an interest because I've been around it my whole life. I know that IPC, being the governing body for electronics, is a great way to become involved in the industry. I wanted to understand the establishment of standards and what holds it all together.

I saw that you could submit an application for the program, and then they go through a selection process. I was really excited when I received the email that said I would be a participant in the program because you get ground-level access, while somebody else in the same tenure of time in their career may not have that opportunity. It's cool that IPC created this program to provide an avenue for folks so that they can grow along with the standardization of the industry.

Matties: This is the first year that you're in the program. Did the program start at the show or before?

Vaughan: It started beforehand. I chose to come out early and did my first session Saturday. I attended some of the J-Standard Committee meetings, and on Sunday, I did the professional development courses. The program and passport don't require you to max out your calendar; they leave it up to you, but I took advantage of having the all-access pass. I wanted to do more than the few things that they require for program acceptance. I filled my calendar with as many items as possible to take full advantage of what was available. The meetings started on Saturday, and my first requirement wasn't until Sunday, so I had an extra day to gain more information.

Matties: Is there something that carries beyond the show in this program, or is it just for this window of IPC APEX EXPO?

Vaughan: That depends on how much effort you put into the networking aspect of it. In terms of structure, it ends with the STEM Student Outreach Program on the floor at 2:00 p.m. All of the emerging engineers have a role of one of four stages that they provided, where they split a group of 200 high school students into groups of 50 and then rotate through different tracks.

Then, we have to write a detailed report, covering all the activities that we did. We were required to take selfies all along the way to show that we were really there and didn't just come to San Diego and hang out for seven days. As far as I know, for the next year, you continue with your normal business, continue networking based on who you met at IPC APEX EXPO 2020, and then come back again next year. As the years evolve, your program requirements change, and they gear you toward becoming a mentor so that with the next group, you can have somebody under your wing and pass on what you learned in prior years.

Matties: What has struck you the most in the program?

Vaughan: The visibility into the committees and being able to sign up. I had to provide a list of

the committees that I was interested in so that they could share the detailed agendas, meeting minutes, drafts that they're working on, etc. It was a tremendous opportunity because I deal with bare boards, we populate the boards, and do full box build from the front to back. IPC touches every industry niche.

Matties: In the committee meetings, are you an observer or an active participant?

Vaughan: I was an observer for the first two. The third one that I went to was 74D, which addresses PCB processes and assembly defects. Under that umbrella is 1911, which is the assembly process defects. They're going through some appendices, but they want to do a full revision. Part of this full revision is to add a lot of graphics because what they're missing in the current standard is graphical representation next to the wording of how these defects come about and what they look like so that you can spot them.

I took it upon myself to get an action item, so I raised my hand and decided to review two different sections for the content as it is. If there's any kind of input or anything like that, I'll comment on that. In a contract manufacturing world, every day is different. We build so many products, and manufacturing is not perfect. There are opportunities to capture different types of defects based on your processes. It was a drop-in fit for me to grab images and be able to share them in certain sections of the book, as allowable by customer set, obviously.

I was excited to immediately contribute because my knowledge base may not be as deep. Some of the people in that room are very knowledgeable in their areas of expertise. I'm not at that level, but it was interesting to contribute where I'm able, knowing it's a gradual approach.

Matties: Are these committees something that you'll continue to be involved with?

Vaughan: It depends on my bandwidth. They allow you to join as many committees as you want to, but I don't want to sign up for

a bunch if I'm not contributing. I'm going to start at a slower pace because some of these standards are so mature that there's really not a lot of input. On those committees, it's good to help with minor edits here and there; others, such as the CFX committee, have 400 members because the IPC-CFX rollout is huge this year. It will depend on what's mature, what's new and upcoming, and where I think I can interject the most of my personal knowledge base.

Matties: But, once you're in, it's your choice to continue, and you're welcomed and encouraged to do so.

Vaughan: Absolutely.

Matties: What do you feel like the overall benefit of the program has been?

Vaughan: It's all-encompassing. I enjoy the connection part of it as well. The professional development courses and technical conferences are great because you learn a lot of information. Also, my mentor is not much older than I am. We're about the same age, but he has catapulted his career path from being in this program, and those lifelong connections are important, in addition to the knowledge base I'm gaining.

Matties: Of course, IPC wins because they bring bright young minds like you into the fold and nurture your path forward, ensuring that there's a deep knowledge base to carry these missions forward. What professional development courses did you attend?

Vaughan: I did design for assembly and design for manufacturing, both for the bare board and the CCSI.

Matties: Some on the design of the circuit board.

Vaughan: Yes. Because I'm building and populating boards, and coming from a different approach, if I'm troubleshooting, not only do you look at the commonalities and the variables that are typical within that process, but

you also look at it from the perspective of when the person put it together. Maybe there were some things that they overlooked that are now causing these types of defects in the manufacturing line. I don't have much to do with design other than inputting data and visualizing it, but I have to deal with it to understand where that individual was coming from, what they did, and how they routed things out. It always has an effect because it's all about thermal mass, which will affect your assembly.

I stayed on that track and then did intermetallic formation as it pertains to the reliability of solder joints. Some of it was hard to grasp. I got the gist of it, but it was more of a deep dive than I was anticipating. At Zentech, we're 80% concentrated in milaero, which is Class 3 and high-reliability, so those things really matter when we're processing.

Matties: Where is your career path headed?

Vaughan: I have a variety of experiences. I've been in the industry 10 years and in manufacturing engineering three years. I've done some direct customer program management. I've done some manufacturer representative sales, too. On the path that I'm going, with adding in the manufacturing engineering and the roll-out of the smart factory, there's a talent gap from the demographic that's aging out of the industry. That's a big reason for the IPC STEM Student Outreach Program and the Emerging Engineering Program.

My career is going to mold all that together into a technical process role, perhaps, or something where you interface with your customer base, instead of having a liaison like a program manager. It may be all-encompassing, such as technical application. There are so many different titles out there that mean the same thing—it's semantics—but I'm thinking something in that area.



Matties: Having the knowledge that you're pursuing gives you the opportunity to be an application engineer. It's interesting because, at that level, you can work with your customers before it's even in manufacturing to help them make a better product.

Vaughan: Correct.

Matties: In the end, that increases quality, throughput, and customer retention, which is a valuable asset. What advice would you give to a young engineer who's setting out on their career path?

Vaughan: Get involved with as many industry organizations as you can, such as IPC, SMTA, IEEE, etc. Get involved at the grassroots level with these organizations that are pushing these initiatives for standardization, growing industry talent, networking, and grabbing hold of folks who have been where you are and are where you want to go. It's about strength in numbers and engaging with like-minded individuals who are all on the same path or have walked that path and can show you how to navigate better.

Matties: Is there anything that we haven't talked about that you feel like we should include in this conversation?

Vaughan: I want to thank IPC for creating this program and allowing me the opportunity to participate. I also want to thank the CEO and VP of technology at my company for signing off so that I can do this for the next few years if it matures into a mentorship. Further, I want to thank my mentor, Kevin Kusiak, who's helping me out, as well as I-Connect007. I look forward to your publications every month and have been reading them for years, even before I was in engineering. You provide great content, and I appreciate everything you put out there for the industry.

Matties: I appreciate you sharing your thoughts today. It's going to be inspiring for others. Thank you very much.

Vaughan: You're welcome.

Are You Eligible?

According to IPC's website, to be an emerging engineer, you must have worked in the industry for less than five years or be a university student. To be an IPC mentor, you must have worked in the industry for a minimum of seven years and have worked on an IPC Standards Committee for at least five years. Learn more [here](#).

Emerging engineers receive:

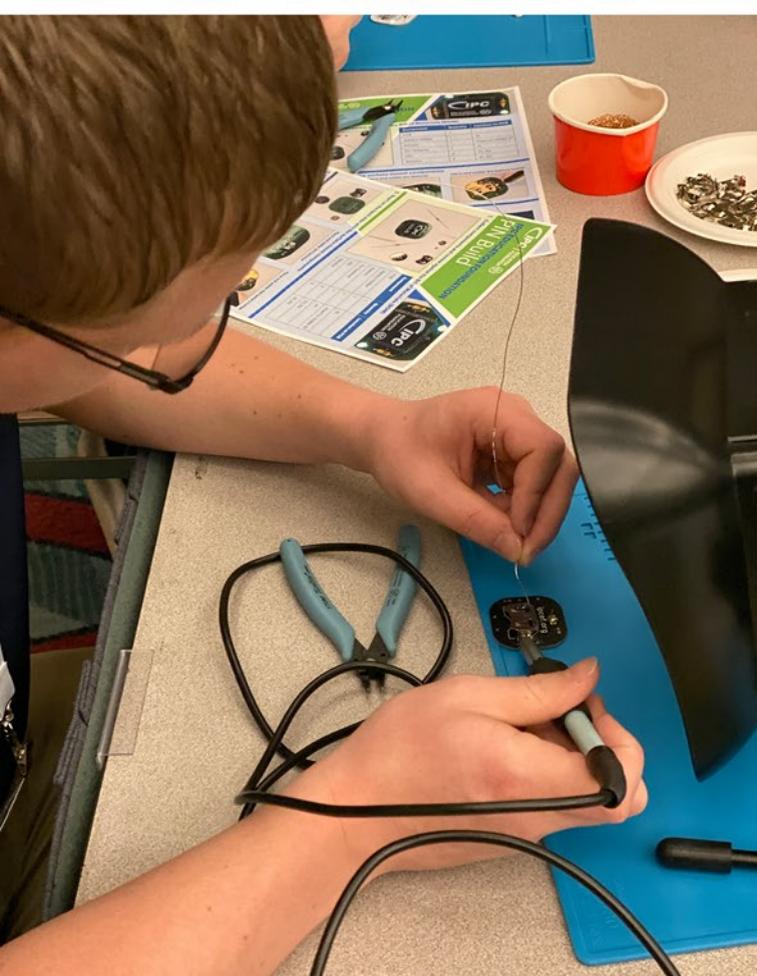
- Education and mentoring for professional development
- Recognition for the program participant and his/her company, as well as industry awareness
- Complimentary, all-access package registration to IPC APEX EXPO for three years (attendance required)
- Complimentary registration to IPC SummerCom, featuring Panelpalooza (attendance not required)
- A limited number of university student emerging engineers are eligible to receive reimbursement for travel, room, and incidentals

Mentors receive:

- Experiences and connections for career enrichment
- Opportunity to demonstrate leadership skills and technical expertise
- Recognition for program participant and his/her company, as well as industry awareness
- Registration to recognition luncheons

The commitment involves:

- Participation in IPC APEX EXPO for three years
- Participants and/or their employers are responsible for travel arrangements and expenses **S&T**



The Evolution of IPC APEX EXPO

by Dan Feinberg
FEIN-LINE ASSOCIATES

History

It has been about 23 years since the first IPC show (called IPC EXPO) combined with a global meeting and was held in Boston, and just 20 years since the first APEX was held. It did not take long before it became apparent that if the two modest shows combined into one event, it would bring greater value to IPC members and the industry.

Ever since then, IPC APEX EXPO has grown, both in the number of exhibitors and attendees. It has also expanded greatly, covering so much more than just the latest printer, laminator, drill, or wave solder machine. It's not that those are unimportant, because they are, but if your com-

pany is looking for new or increased capacity, IPC APEX EXPO is the place to be. In addition, it is, and always has been, the best place to be to renew relationships and catch up with colleagues and friends, as well as meet new people.

Overview and Keynote

Let's fast forward to 2020, and we are one-fifth of the way through the 21st century. This year's IPC APEX EXPO has evolved into a "micro CES," focusing on high-tech device manufacturing. The show included a plethora of the latest PCB fabrication, inspection, and assembly equipment. It also included discussions and standards meetings regarding the latest smart factory evolution, some great [interviews](#) by the I-Connect007 team, and an amazing keynote presentation.





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This year's keynote was by Burt Rutan, the famous American aerospace engineer and entrepreneur noted for his originality in designing light, strong, unusual-looking, and energy-efficient aircraft. Burt designed the record-breaking Voyager, which, in 1986, was the first plane to fly around the world without stopping or refueling. He also designed the Virgin Atlantic GlobalFlyer; in 2006, it set the world record for the fastest (342 mph or 551 km/h in 67 hours) and longest (25,766 miles or 41,466 km) non-stop, non-refueled circumnavigation flight in history.

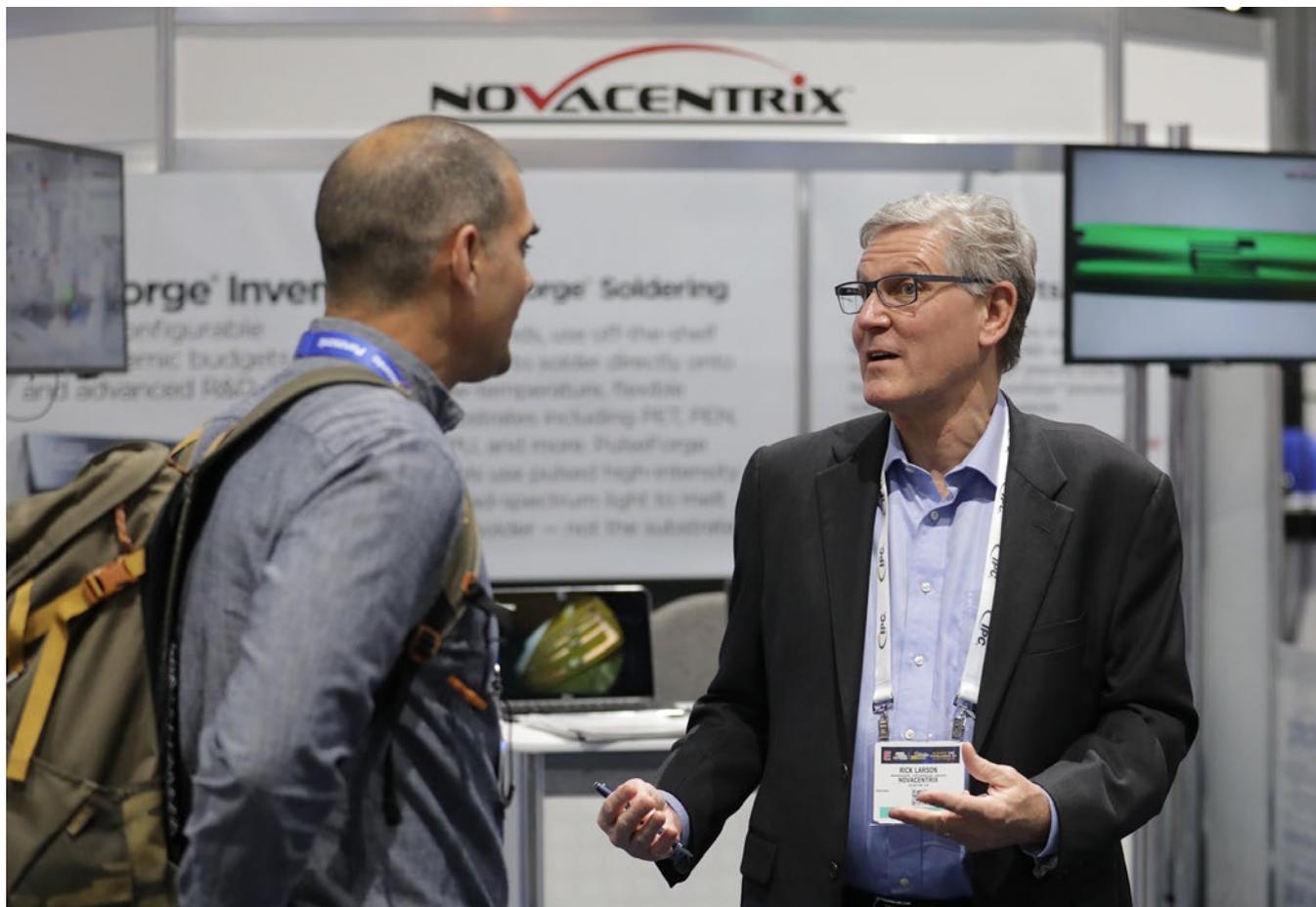
In 2004, Rutan's sub-orbital spaceplane design, SpaceShipOne became the first privately funded spacecraft to enter the realm of space. As someone who has heard nearly every IPC APEX EXPO keynote, as well as dozens at CES and other trade shows, this was absolutely the best of the best. Burt was kind enough to spend a great deal of time with us after his presentation, so stay tuned for that very interesting interview.

Two New Standouts

So, what makes IPC APEX EXPO so much more valuable than the previous generations of events? And what makes it a micro CES? I believe it is due to the increasing number of new processes and equipment, some of which may not be fully available yet; however, if successful, they will potentially have a significant and lasting impact on the industry. We will be covering more of these new devices and processes, and I am sure there were many more that I did not have a chance to see, but two stood out to me.

1. PulseForge Soldering by Novacentrix

We all expect that when soldering, we not only heat the solder to its eutectic point, but we also heat the substrate, which is not always desirable. According to their website, "PulseForge soldering enables the soldering of standard lead-free solder pastes on low-cost, temperature-sensitive substrates, such as paper and PEN, in milliseconds." It does

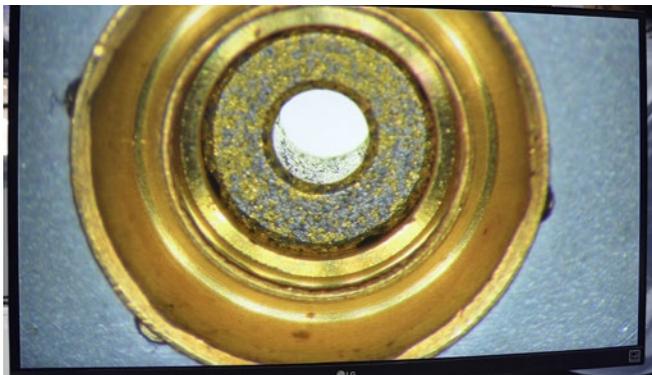




so without damaging the underlying substrate and is so fast that the substrate does not even get warm. In addition, I was informed and observed that solder that had already been melted previously would not be affected, but new solder joints would flow immediately with no evidence of heat.

2. DRV-Z1 by Vision Engineering

DRV-71 claims to be the world's first digital 3D, high-definition (HD) viewer with a wide-screen digital display that allows remote viewing, capturing, and sharing of the same 3D image across networks. Specifically designed for inspection and manufacturing applications.

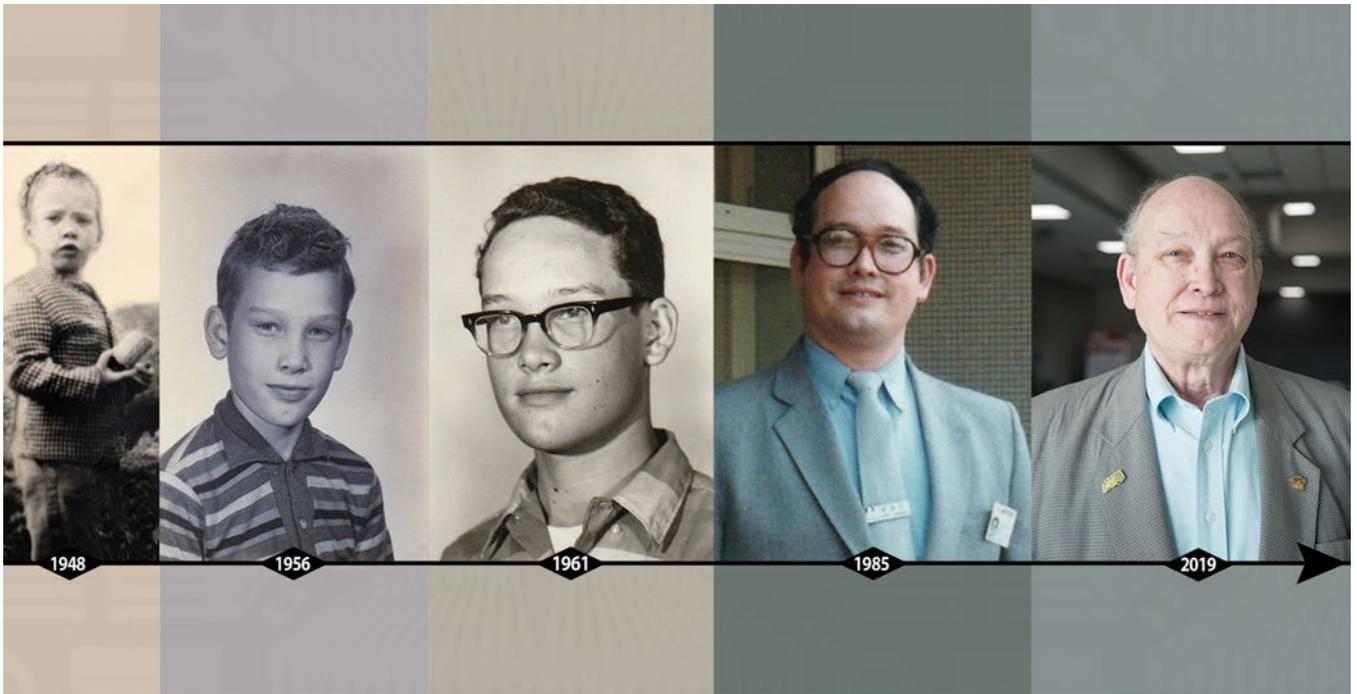


DRV-71 allows you to see a greatly magnified image in 3D HD just by observing the unit's display with no headset or glasses—just your two eyes. It combines optical stereo microscopy and digital technology into a single, unique system.

Speaking as someone who has been following XR (virtual reality and extended reality) for a while, the display was amazing. I was able to magnify a plated hole and then delve down into it to inspect the hole wall in true 3D with extremely high magnification and resolution. The photo does not do justice to the real image that I saw on display in 3D, but remember that no 3D headset or glasses are required, which stands out.

Conclusion

At IPC APEX EXPO 2020, I wandered the show floor some, but also caught up with friends and colleagues. I still look forward to seeing people, but next year, I will dedicate more time to seeing and learning about all the new advances in devices, processes, and technologies being shown at the “micro CES” show. **SGT**



Pure 'Happy-ness': An Evening With Happy Holden

by **Pete Starkey**
I-CONNECT007

“The Evolution of Happy-ness” was the legend on the posters and flyers, which showed five successive images of the guest of honour from a small child in 1948 to a young boy, handsome young man, to the figure now familiar to the global printed circuit industry—Happy Holden, “Father of HDI,” acclaimed industry expert, prolific author, and contributing technical editor with I-Connect007. Always extremely generous in sharing his vast knowledge and experience, Happy Holden, the principal guest of honour, held the audience enthralled with fascinating stories, shrewd observations, and knowledgeable predictions, interlaced with reminiscences of milestones in the progress of electronics technology.

It was Monday evening at the start of the 20th anniversary IPC APEX EXPO. The Regal Ballroom at the Horton Hotel in downtown San Diego had been transformed by the I-Connect007 team into a deluxe lecture theatre, complete with rostrum, lectern, big-screen video projectors, and stereo sound system. Long tables with white tablecloths, comfy chairs, an open bar, and an elegant buffet completed the set-up. Subtle lighting and classical-style guitar music from Brent Feinberg created a wonderful ambience during the social hour.

The room was soon bustling with activity as an invited crowd of industry dignitaries, luminaries, and celebrities, together with a group of young professionals from the IPC Emerging Engineer Program gathered, networked, and enjoyed the refreshments. It must also be noted that there were five IPC Hall of Fame



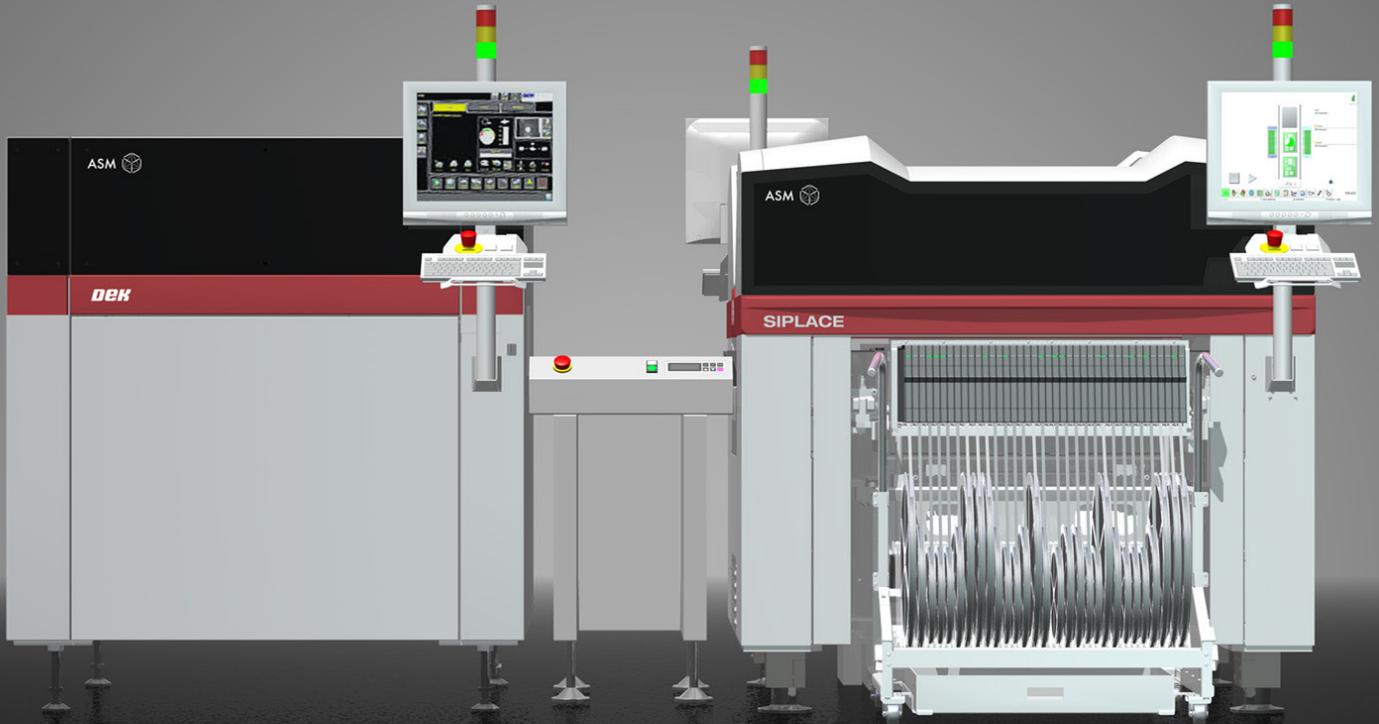
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members were in attendance, which demonstrates the amount of knowledge, experience, and expertise within the room.

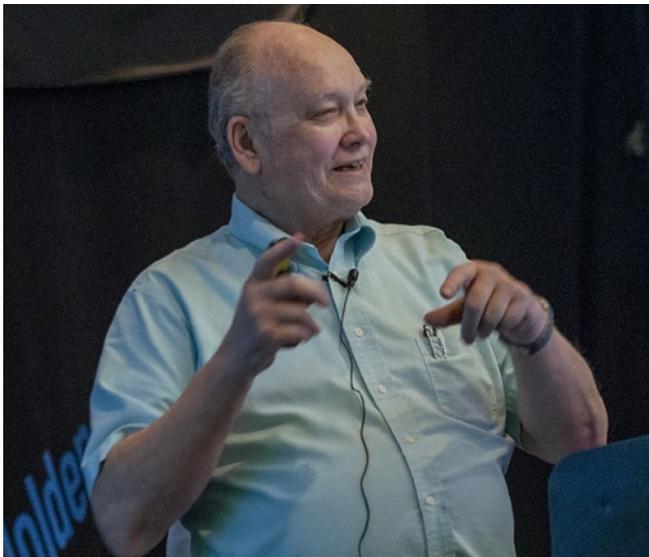
I-Connect007 publisher Barry Matties hosted the celebration, explaining that its purposes were to present this year's I-Connect007 "Good for the Industry" award, to acknowledge the contribution of the columnists and the commitment and dedication of the I-Connect007 team, and above all, to honour the career of Happy Holden and all of his achievements in the industry and the technology.

Barry reminisced briefly on the origin and progress of his publications, from his first venture into desktop publishing in 1987, "California CircuiTree"—confessing that he didn't know the rules, so he didn't know how to break them—to the extensive global source of news and original content which I-Connect007 presently encompasses. He sincerely thanked the people that had worked with him to achieve it, calling them to step up to the platform so that guests could see who was who and proudly commenting that the I-Connect007 editorial team alone includes three IPC Hall-of-Famers.

Personalised plaques, ingeniously mounted on illuminated bases, were presented by Kirsten Rohde, I-Connect007's columnist coordinator, to Dan Beaulieu, Mike Carano, John Coonrod, Tara Dunn, Joe Fjelstad, Michael Ford, Jennie Hwang, Tom Kastner, Istvan Novak, Dominique Numakura, Barry Olney, Ray Prasad, Mark Thompson, and Steve Williams, most of whom were able to collect them in person. (More on this elsewhere in this publication.)

Happy, having genially accepted his "Good for the Industry" award a few years ago, was invited to take the stage "and tell us some stories." And what a stockpile of stories he had to choose from! Happy could have (and probably would have) kept us entertained, amused, enthralled, and informed for the best part of a week if he had the opportunity. But he was selective and sequential and gave us a fascinating account of his life and career from the late 1940s until the 21st century.

Happy covered chemistry sets, model aircraft, goat's milk cheese, paleomagnetic studies, oceanographic patrols, rat behaviour, his recruitment by Hewlett-Packard, the difference



commissioning high-volume manufacturing facilities for fine-line multilayer PCBs—being offered opportunities to be part of the Apple computer business, being appointed chief technical officer for Foxconn and manufacturing hundreds of millions of iPhones, and eventually retiring from the position of director of electronics and innovations for GEN-TEX Corporation. However, he still used an old LG flip-phone!

Barry Matties called for questions, and Happy responded spontaneously and informatively to everything he was asked, particularly about his predictions for the future of the PCB industry. It was his opinion that new technologies—like Joe Fjelstad’s Occam process and Joan Tourne’s VeCS—would become popular and that the achievement of development goals would become increasingly dependent on artificial intelligence. “Anyone with a good crystal ball will end up wealthy.”

Barry brought proceedings to a close and thanked everyone for their participation. It had been a splendid evening for all involved and set a precedent for future “Good for the Industry” awards. Any crystal ball owners care to speculate on who future recipients might be? **S&T**

between research and development, 64-bit computers called “calculators” to avoid upsetting the system, the HP35 calculator project and trying to find the capacity to manufacture 3000 units per hour, touring Europe in 1973 to visit automated OEM PCB shops, and then gaining permission to automate PCB manufacturing at HP.

Happy continued with his series of autobiographical anecdotes: trout fishing with Mr. Packard in Monterey Bay, spending time in Taiwan and Hong Kong—installing and



Six IPC APEX EXPO Exhibitors Earn 2020 Innovation Awards

IPC announced the winners of the IPC APEX EXPO 2020 Innovation Awards, a celebration of the innovators who are changing the technological landscape of the electronics industry. These winners are pushing technology boundaries with innovative product submissions.

A panel of industry experts reviewed each product's submission and chose winners in each category 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 Innovation Awards recognize outstanding products and services in the electronics industry," said John Mitchell, IPC president and CEO, "and we had a tough time choosing among the many excellent submissions we received this year. It's exciting to see the creativity and innovation in our industry, along with the enthusiastic response to our yearly challenge."

The Innovation Awards were presented to the following companies at IPC APEX EXPO 2020.



1. ASM

ASM DEK TQ

Category: Assembly equipment

A new printing platform for the electronics industry that increases speed and accuracy while decreasing factory footprint. The DEK TQ platform offers future-proof integration into the ASM integrated smart factory concept via open interfaces (IPC-HERMES-9852, close-loop-to-SPI, ASM OIB, IPC-CFX).



2. GreenSource Fabrication LLC

InduBond X-Press

Category: PCB fabrication

A concept in multilayer press technology utilizing electromagnetic energy to heat stainless steel separator plates using induction heating that yields minimal delay in heat transfer, high heat-up rates, extremely high temperatures with high-temperature balance on any direction of the press stack on the X, Y, and Z axes.



3. Nihon Superior Co. Ltd.
TipSave N Flux-Cored Solder Wire
Category: Assembly materials

A wire that slows the reaction and erosion of the iron from a soldering tip, especially when using lead-free solders rich in tin, increasing the tip life by three times.



4. Rogers Corporation
TC350™ Plus Laminate
Category: PCB materials

A thermally enhanced laminate, suited for higher power microwave and industrial heating applications, requiring higher maximum operating temperatures, low circuit losses, and excellent thermal dissipation within the circuit board.



5. Test Research Inc.
TR7700Q SII
Category: Test and inspection

An Industry 4.0-ready solution that performs high-speed inspection of large PCBs up to 510 mm x 460 mm, fit for multiple applications, ranging from the telecommunications industry to the automotive industry and supporting the upcoming and innovative protocols such as IPC-CFX and IPC-HERMES-9852.



6. ViTrox Technologies Sdn. Bhd.
V9i Advanced Robotic Vision System (ARV) or Collaborative Robotic Arm (Cobot)
Category: Test and inspection

Specializing in conformal coating inspection and thickness measurement and designed for safety and quality ensured inspection that involves co-work between a human and a robot.



Alumni Week at IPC APEX EXPO 2020

by **Patty Goldman**
I-CONNECT007

When you see friends and colleagues just once a year, you would think there would be a lot of catching up to do. Will you recognize them, and vice versa? Maybe they have changed quite a bit. Are they still in electronics? Gosh, are you still friends?

That's not the case at IPC APEX EXPO. Greeting friends and colleagues is always like picking up a conversation you had with them yesterday. Everyone looks the same, acts the same (we age well and lightly!), and we talk about the same things with just slight modification—like a daily conversation would evolve.

Why is that? Is it like Brigadoon, where the residents wake up for a single day every 100 years (okay, we're not talking that long) and carry on as usual? Sometimes, it feels that way. We catch up on jobs, family, and the like. However, what I am talking about is fitting right into the group, conversation, and meetings.

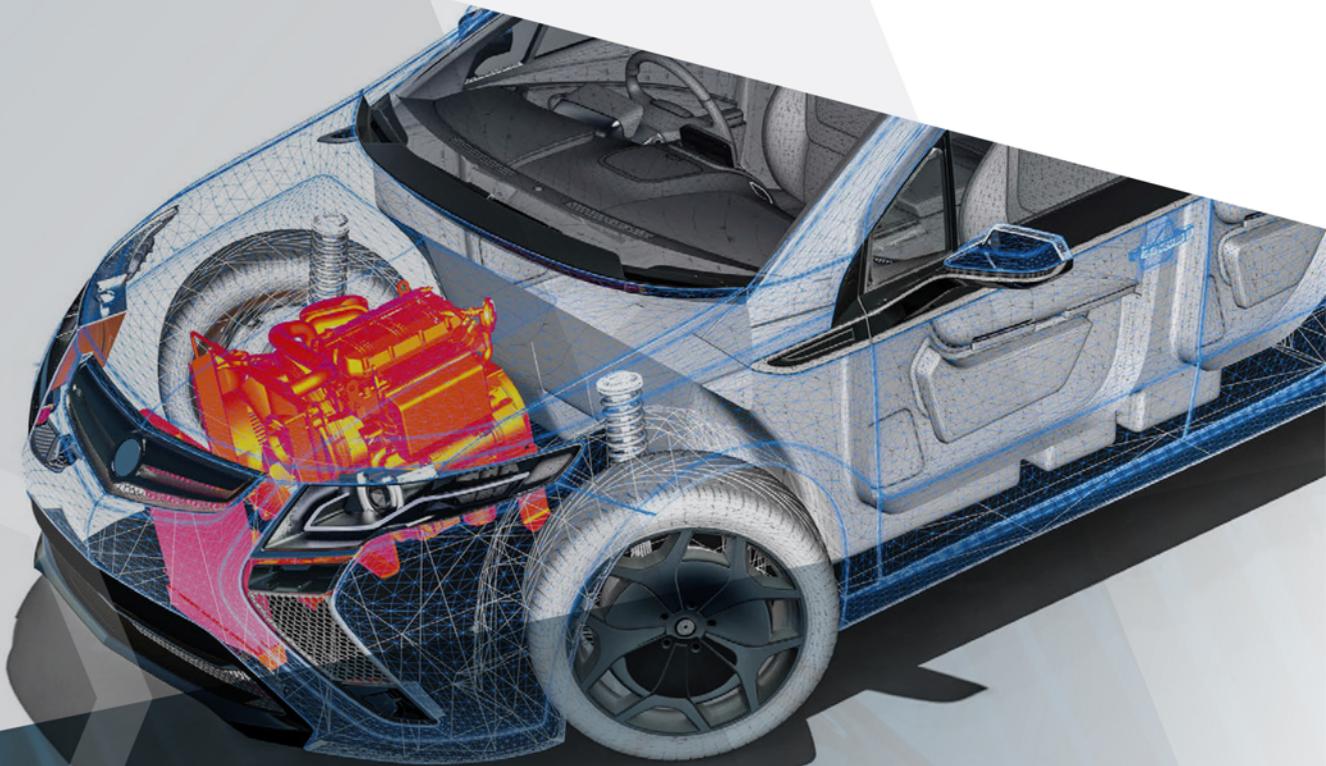
Having said all that, it wasn't the same old, same old meetings. There was more energy, as well as an upbeat feeling. People were animated and bustling about. The subcommittees and task groups were busy as members discussed the issues involved. Technical paper sessions were overflowing, as were some of the professional development classes (Vern Solberg's was standing room only). The committee luncheons were full (usually a good indication of the level of work going on). Further evidence could be found at the luncheon awards, where IPC recognized roughly 300 (wow!) committee worker bees for completed documents and other achievements.

I've said it before, and I'll say it again: Volunteer and get involved! Working on the committee of your choice on a specification or standard that means something to you and your company is the best way ever to learn and make those ever-important networking contacts. Speak up, make your point, and then raise your hand and say, "I'll do it." You'll have



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to do some work, but it will be well worth it. Plus, those contacts can be invaluable when you are back at your job and need advice, help, or anything else.

It's always hard for me to judge the activity on the show floor, but from what I heard, there weren't too many tire kickers—those walking around were serious and doing actual business. If I have one beef about the show floor, it was the several large booths that had two-story walls that effectively blocked those unfortunate to be behind them. Wasn't there a rule against that?

Some not-so-serious attendees were the STEM high school students. This was IPC's third year of inviting local (San Diego area) high schools to attend IPC APEX EXPO for the STEM Student Outreach Program. This year, I believe the number of students nearly doubled to 200 from nine participating schools. Upon arriving, the students lined up for a buffet breakfast and picked up a backpack and T-shirt on their way to their seats. IPC had the day's activities divided into four tracks that involved some classroom time, soldering time, and a show floor tour. It was very well-organized; herding that many high schoolers can't be easy! IPC was smart to put the emerging engineers (another initiative that has grown exponentially) to work as the herders—actually, leaders.

The one frustrating thing about the STEM program is that it hits such a small area of the

country. Hopefully, IPC and other organizations are expanding it in some way (though it won't include the show floor, which always impresses the students) across the country. I know SMTA is making an effort at the small regional shows, though mostly focusing on college students. And I see more frequent news items from all sorts of companies that are sponsoring STEM or STEAM events in their areas. Yay!

As always, the IPC conference and show was refreshing, renewing, and uplifting—a good shot in the arm. We have to be in the most interesting, challenging, and exciting industry in the world! **S&T**





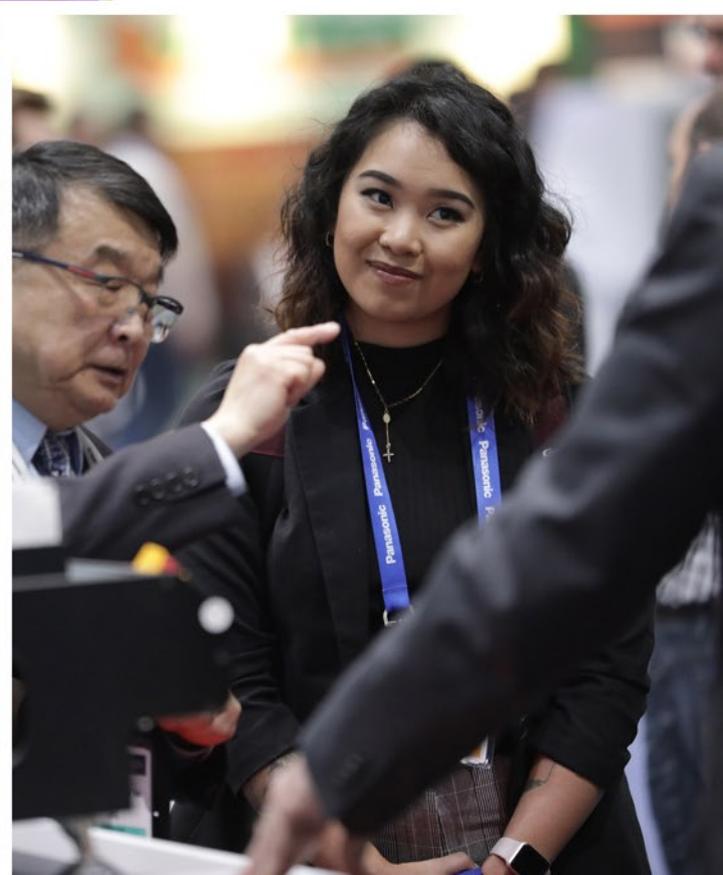
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A photograph of Brook Sandy-Smith, IPC's technical education program manager, speaking at a podium. She is wearing a blue patterned top and glasses, with her hands raised in a gesture. The podium has several water bottles on it. In the top right corner of the image, there is a text box with her name and title.

Brook Sandy-Smith, IPC's
technical education
program manager.

New Developments and Opportunities

by Tara Dunn
OMNI PCB

“Elevate the Excellence of Electronics” was the theme for this year’s IPC APEX EXPO. As expected, the show set the bar high with technical sessions, professional development sessions, committee meetings, numerous networking opportunities, and an exhibitor list that included all aspects of the electronics supply chain. I repeatedly found myself interested in multiple sessions being hosted at the same time, and had to pick and choose where to be!

Among all this great technical content, I had the opportunity to attend two events, hosting their inaugural session. IPC APEX EXPO can be overwhelming, even to an industry veteran that has attended many years. Realizing that this can be a bit intimidating, Brook Sandy-Smith hosted The Fundamentals Program

on Monday, which brought together expert speakers providing a broad view of the industry, important terminology, and background to help those new to the industry or new to IPC APEX EXPO get an overview of the industry before jumping into the fray of the conference.

The concept resonated with attendees, as all seats were taken, and there was lively discussion throughout the session. The discussion was so engaging that rather than having the scheduled break for lunch, attendees came back to their seats while eating for continued discussion and content.

Brook Sandy-Smith, IPC’s technical conference program manager, said, “What I found most surprising about the first Fundamentals Program at IPC APEX EXPO 2020 was how diverse the backgrounds of the attendees were. There were people from many engineering disciplines at different stages of their careers,

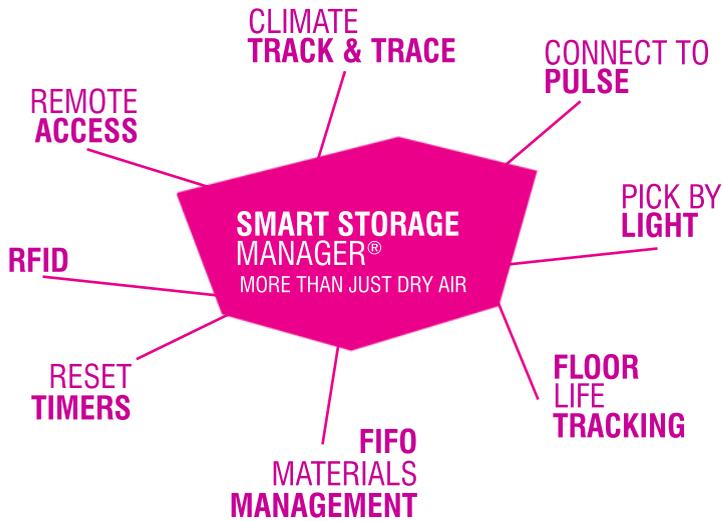


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representing varied specialties in the industry. It will be exciting to continue offering this program and seeing it grow.”

I was also involved with the community of interest meetings discussing semi-additive PCB processes. This session was by invitation and included a cross-section from all areas of the electronics supply chain: OEMs, designers, fabricators, EMS companies, and materials suppliers. This semi-additive PCB process is enabling PCB fabricators to provide previously unattainable line width and space of 25 microns and below, effectively resetting the technology curve. And, as with any new emerging technology, this has impacts and opportunities throughout the supply chain.

The format for this session was a bit unique. The first 20 minutes featured an overview of the technology itself, the industrialization progress, and a discussion of the need for these capabilities from the DoD Executive Agent for PCBs and a large DoD prime contractor. Following this technology introduction, the group was broken into smaller topic groups to facilitate discussion. Although you could see that the concept of smaller group discussion was a little unexpected, the chatter in the room was quickly evident as everyone was actively involved in their discussion groups. In fact, it was challenging to cut off that chatter to finish the session with a large group discussion.

Two primary discussion areas emerged. First, there is a definite need for this technology for next-generation electronics. Today’s complex pinouts are pushing PCB technology to stacked microvias and multiple lamination cycles. This drives up the complexity of the PCB fabrication, which drives cost, but perhaps as importantly, the continued microvia reliability issues are of considerable concern throughout the industry. The semi-additive process enables much finer feature sizes and opens design opportunities previously unavailable. Just scratching the surface on application potential, the resulting reduction in layer count and lamination cycles is garnering much attention, and the opportunities for improved RF performance are being reviewed and considered.

Second, there is a need for rapid industri-

alization. There were four PCB fabricators in attendance who are actively implementing this technology within their facilities: Calumet Electronics, American Standard Circuits, Firan Technology Group (FTG), and the PCB fabrication facility at NSWC Crane. The message from OEMs in attendance to accelerate this industrialization process was clear. They are ready and willing to investigate and invest in the development of this technology. Although changing the way the copper traces are created, this process integrates well with traditional subtractive etch processes such as electroless and electroless copper tanks. The fabricators in attendance were also clear that they were searching for designs to build and utilize to gather reliability test data throughout the implementation process. All welcomed conversation and the opportunity to work collaboratively with designers to navigate this learning curve and develop best practices.

Flying home from the IPC APEX EXPO, I found myself excited about the new things I have learned, the time spent with industry friends, and introductions to new friends with the promise of continued discussion. Thanks to IPC for all the hard work and effort that goes into creating this content-rich technical program, hosting and coordinating standards committee sessions, and providing networking opportunities for the electronics supply chain. **S&T**

Tara Dunn is the president of Omni PCB, a manufacturer’s rep firm specializing in the PCB industry.





Best Practices Highlighted at the 2020 IPC EMS Management Meeting

by Tracy Riggan

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

EMS leaders gathered for a jam-packed agenda at the EMS Management Meeting on February 3 at IPC APEX EXPO 2020 and highlighted workforce, policy, economic, and technology best practices. John Mitchell, IPC president and CEO, welcomed the group, introducing key IPC team and resource additions for EMS leaders, including Shawn DuBravac, chief economist, and Matt Kelly, chief technologist. The day proceeded with presenters on topics from the economy and process technology to cybersecurity and workforce issues and included two EMS member spotlights highlighting best practices from peers.

Mark Wolfe, director of supply management at John Deere Electronic Solutions, said, “Throughout a fast-moving day that covered a

broad range of topics, it was great to see the high level of energy among a healthy mix of repeat and new attendees.” He continued, “The willingness of the group to openly share experiences—whether through organized roundtable sessions, speaker Q&A sessions, or informal conversations—is always one of the things that I am impressed with meeting after meeting. It is a pleasure to host a group of EMS leaders who are clearly passionate about the success of their own companies but still so committed to improving the overall industry.”

Workforce Challenges: A Top Priority

The key challenge at the top of EMS leaders’ minds during roundtable discussions was the lack of skilled workers. Leaders brainstormed solutions like creative identification and sourcing of talent outside of the manu-



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facturing sphere, leveraging the flexibility of smaller businesses to make changes attractive to potential employees as well as cooperation with IPC and other talent development programs. John Mitchell updated the group on the IPC Education Foundation (IPCEF) and workforce initiatives to build and support workforce needs. The group welcomed Andy Marris of MRA, who discussed motivating and engaging an existing workforce to create a competitive advantage.

Economic and Policy Impacts

Shawn DuBravac provided an economic assessment and outlook, projecting slowing but continued growth even amidst global economic and geopolitical volatility. Chris Mitchell, IPC's vice president of global government relations, updated the group on trade-related issues with an emphasis on USMCA and the tariff war with China. On USMCA, he highlighted the collaborative role that IPC played in pressing Congress for legislative action. Congress passed the implementation legislation in December and January, and now attention turns to Canada, where the parliament expected to approve the deal by the end of March. Chris Mitchell also welcomed the pause in the U.S.-China trade war but warned that the phase one deal does little to provide relief to the industry and that a phase two deal is not expected before next year.

Matt Turpin, former Zentech CEO and current advisor to IPC, offered participants an update on IPC's successful efforts to secure appropriations for lead-free electronics research and previewed steps that IPC will be taking to strengthen its relationship with key Department of Defense (DoD) offices that focus on reliable and trusted electronics. Roger Smith, representative of the Executive Agent to the DoD, spoke on military spending expectations, an expanding concern for electronics assembly by the Executive Agent, and allocation plan for the \$5M in funding secured by IPC for lead-free electronics.

Cybersecurity Certification Changes Impact Future Bids on DoD Contracts

Roger Smith also contextualized other topics of the day, like skilled workforce shortage impacts on the DoD and expectations surrounding the transition from NIST 800-171 to Cybersecurity Maturity Model Certification (CMMC). With the latest version of CMMC just having been confirmed on January 31, the group received up-to-the-minute information on compliance details from Ken Michael, president of Dox Electronics, including the nature of 20 new practices. Michael's key advice was to maintain compliance with NIST 800-171 to be ready for level 3 of CMMC and be ready to seek CMMC certification as soon as that path becomes available to bid on any new DoD contracts.

The participants challenged IPC on being more ahead of the issue and questioned how IPC would accommodate the CMMC in its programs. Randy Cherry, director of IPC Validation Services, addressed these questions, providing an overview of the IPC Trusted Supplier Program and speaking to related updates being planned on by the committee for IPC-1791: Trusted Electronic Designer, Fabricator, and Assembler Requirement.

Technology and Process Best Practices

The EMS Steering Committee is continually on the search for industry peers who have unique or proven approaches to solving process or business challenges. This year, the

group welcomed guests on predictive maintenance, Lean manufacturing, IPC-CFX, and electronics components' lifecycle and obsolescence. Additionally, semi-additive manufacturing's potential future impact was discussed.

Paul Jarski, John Deere Electronic Solutions, laid out John Deere's electronics components lifecycle and obsolescence strategy to address customer expectations of part delivery. Jarski told a compelling story of the need to ensure that the company will be able to deliver electronic parts in 2100 to maintain equipment purchased in 2005 like they support a mechanical part replacement for equipment manufactured in 1965. A key tip provided by Jarski was reduced single-source dependency. He also stressed that communication is more important than ever, data integrity is critical, and that new opportunities for improvement are emerging every day.

Industry 4.0 is a current buzzword. Michael Ford, Aegis Software U.K., dispelled the myths of Industry 4.0, breaking down the true status of smart factory technology and its impact on the EMS segment. David Rogers of Siemens educated the leaders on equipment maintenance strategy and walked them through what predictive maintenance is and how to decide what is right for their facility. Dan Radler revealed how Tempo Automation leverages in-house created software to optimize PCBA manufacturing by significantly reducing the number of steps through simulation and a single thread of data. He also explained how Tempo leans on the front end of the process, building relationships and making the strong business case, to get the file types they need to significantly improve turnaround times.

New in 2020, the EMS Management Meeting hosted an Emerging Technology Spotlight intended to bring to the forefront any new or emerging technologies poised to impact contract manufacturing and electronics assembly in the near term. In this segment, Haris Basit of Averatek argued the impacts semi-additive processing will have on the industry and asked for leaders to join an industry-wide conversation.



Tracy Riggan

More EMS/CM Content Planned

Steve Pudles, president and CEO of Zentech Manufacturing, said, "Having attended EMS Management meetings for more than 30 years, these things never get old." He added, "The APEX EXPO 2020 EMS agenda included a great range of topics from the relationship of EMS companies doing business with the DoD to IPC-CFX standards, cybersecurity, and the impact of the CMMC changes on our industry. It also featured a fantastic member roundtable discussion on employee hiring, retention, and education. There always seems to be a relevance to our meetings that keeps me coming back!"

To keep the industry up to date on the CMMC requirements, build on discussions, and address timely issues, the EMS Steering Committee is planning updates throughout the year. To stay informed, opt in for updates by managing your preferences at <http://www.ipc.org/opt-in>. **S&T**

Tracy Riggan is IPC's senior director of business development.



Dr. Kunal Shah, LiloTree, accepting the Best Technical Paper Award.

Dr. Kunal Shah's Award-winning Technical Paper

by Nolan Johnson
I-CONNECT007

Nolan Johnson caught up with Dr. Kunal Shah, CEO of LiloTree, to discuss his technical paper, which took top honors in the domestic paper category and was awarded “Best of Show” at the 2020 IPC APEX EXPO technical conference. Dr. Shah received his award during the opening keynote on February 4 and presented his paper on February 5.

Nolan Johnson: Congratulations on receiving the Best Technical Paper Award at IPC APEX EXPO 2020! Tell us about your topic.

Dr. Kunal Shah: My paper is titled “Reliable Nickel-Free Surface Finish Solution for High-Frequency HDI PCB Applications.” The selection of materials used to fabricate PCBs is critical if you want to realize the optimum performance for high-speed, high frequency, high-density applications. The role of surface finish

is critical for realizing the best performance and alleviating any signal loss. The paper discusses an innovative nickel-less approach involving a proprietary nano-engineered barrier designed to coat copper contacts, then finished with an outermost gold layer. This new technique has shown superior results in realizing the optimum performance and in providing better reliability for electronic assemblies. Right away, I would also like to thank and acknowledge John Coonrod and his team at Rogers Corporation for their assistance with insertion loss testing and invaluable technical discussions.

Johnson: In your paper, you detail a nano-coating to create a nickel-less process. How does that work?

Shah: The nano-engineered barrier layer is designed to passivate the copper substrate. This prevents diffusion through the gold layer to the surface and ensures wettability, even in harsh environmental conditions or through multiple reflow cycles. Moreover, the barrier layer prevents diffusion of copper atoms into the solder during the reflow process to ensure a thin intermetallic layer. This results in robust solder joints for better reliability of electronic assemblies overall.

Johnson: How did you come up with this particular coating?

Shah: My background involves nano-engineering of interfaces and materials. I have been involved in the electronics materials area for more than two decades. Because I understood the challenges faced in the area of electronics reliability, we knew the solution to improve electrical performance/signal integrity and improve reliability was essential. We have been working on developing these solutions for a few years now, along with the support of a U.S. federal agency, the National Science Foundation. It will be interesting to see how PCB manufacturers, assemblers, and OEMs put this technology to work.

Johnson: What motivated you to do this research? Were you responding to pain points?

Shah: Currently, there are two main pain points. As the electronic industry overall moves toward high-speed, high-frequency applications (i.e., 5G, automotive, aerospace, medical electronics), one pain point is signal loss as the frequency increases. Another pain point is reliability concerns, especially brittle solder joint failures. We have addressed both of these issues with this technology. It provides optimum signal integrity as well as offering better reliability with robust solder joints.

Johnson: What were your test methods?

Shah: Our test methods included insertion loss testing (conducted in conjunction with Rogers Corporation), contact resistance testing to evaluate for copper diffusion, solder joint evaluation through cross-section and electron microscopy, and shear test-pull test (according to JEDEC standards) to evaluate the robustness of solder joints. I encourage readers to access the paper to learn more details.

Johnson: What do you see as the most important industry implications from what you've published?

Shah: This technology has direct implications for high-frequency applications; mobile devices/networks (e.g., 5G, 6G, and onward), automotive electronics, RF/microwave applications, space/aerospace applications, etc.

Johnson: Will there be further research?

Shah: Yes, there will be. Our ongoing research involves fine-tuning the solution to cater to specific applications and the industry. We will continue to explore next-generation surface finish solutions for better performance and reliability of electronic assemblies, which are also cost-effective.

Johnson: Thank you, Kunal.

Shah: Thanks for the opportunity. **S&T**

Attendees Speak!

by Kelly Dack and the I-Connect007 Team

IPC APEX EXPO 2020 featured new products and materials and the latest technologies and solutions aimed at improving PCB design, fabrication, and assembly processes. Kelly Dack and the I-Connect007 team roamed the show floor, recorders in hand, and asked various attendees to tell us their impressions of the show, what caught their attention, and what their customers are saying. Here are the highlights.

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

Dr. Martin Anselm CEMA Lab, Director



Andy Shaughnessy: What is the biggest challenge that you or your customers are facing in the industry?

Dr. Martin Anselm: The biggest challenge I've encountered a number of different times is the migration to much larger packaging. Devices are getting much larger, and with the thousands of I/O of solder joints, and they are not just single-die, multi-chip modules in different forms or 2.5D technologies. Further, there are challenges associated with soldering. How do we go away from traditional soldering technologies or methodologies where these devices are so complex that warpage or alloy or reliability is driving us into unknown territories with soldering methodologies? To give you good yields and 100% interconnects, you can't necessarily go with the traditional methods.

Shaughnessy: Everybody talks about miniaturization, but on the other hand, sometimes, you see things getting bigger and bigger.

Dr. Anselm: Right. Miniaturization is happening in the context of finer pitch, and closer interconnect spacing. But to create functionality, the number of interconnects is increasing. The devices are getting larger, but the density of interconnects is getting smaller.

Shaughnessy: Designers are having a hard time fanning out from these 5,000-pin BGAs. It's kind of a nightmare.

Dr. Anselm: Exactly. It will be interesting to see where the industry goes in the next two to three years. There's a lot of active R&D work to overcome some of these specific challenges, and these are for products that are consumer electronics and going into millions of units per year. There has to be a solution that's repeatable, reliable, and fast and gives good yields, but that's very difficult to do.

Caleb Buck EaglePicher Technologies, Electrical Engineer



Kelly Dack: What has the show been like for you, Caleb?

Caleb Buck: This is my first time attending IPC APEX EXPO. You talked me into coming here. I am a PCB designer and an electrical engineer. I'm not involved in the manufacturing, but I tell manufacturers what to do via my drawings. I had an interest in learning more about the IPC standards, my manufacturer's capabilities, and some of the tools they use.

Some of what I saw was not terribly relevant to what we do. The automated equipment is not something I'm going to use, but seeing how it works helps me understand what I'm asking manufacturers to do with that equipment,

as well as the limitations. There are also some suppliers here, so I'm shopping for suppliers to build my stuff for me. My boss likes to say, "We like the 'one throat to choke' approach." We're shopping for more companies that can be a one-stop shop for us and have good test equipment.

Lauren Byrge
Marquis Exhibits,
Account Executive



Nolan Johnson: What does your company do, Lauren?

Lauren Byrge: We design and fabricate group spaces for various clients on the show floor, so we're just visiting clients and checking out what IPC APEX EXPO is offering this year.

Johnson: As an industry outsider, looking at this show and our industry, what are your impressions?

Byrge: It's a lot quieter than I was expecting. I was thinking it would be really loud and in your face as an electronics show with lots of noise and loud machinery, but it's not like that. I feel like the crowd is pretty good. Every booth looks like it's buzzing. My impression of the electronics industry is good. The people are friendly and nice, and we enjoy working in this space.

Katie Carl
Mission Hills
High School, Teacher



Kelly Dack: You're the teacher of about 30 students who are here for the IPC STEM Student Outreach Program, touring the show floor. We're doing a walking interview because we have to keep an eye on the students (laughs). What have the reactions of your students been?

Katie Carl: They're all really interested. We have a wide range of students, so some have heard about and seen these types of technologies, but others have not. It's really neat to see their responses.

Dack: What are their ages and grades?

Carl: Most of them are grades 10 through 12, so they're about 15-18 years old.

Dack: Do you think you're planting any seeds of technology? Are we looking at future Elon Musks?

Carl: Definitely. Again, we have a wide range of kids. All of them have some sort of interest in technology, which is why they wanted to come in general. It's neat when they start seeing how these technologies are created because a lot of them have seen robotics or have done a tiny bit of soldering with little circuits, but when they can see how those things are built and created in the industry, it makes it more applicable for them.

Dack: Thanks for all you do as a teacher.

Carl: Thank you.

Lance Davies
Acroname,
Director of Sales



Nolan Johnson: So what are your impressions of the show?

Davies: I think it's a fantastic show. The attendees walking the show are very representative of the electronics manufacturing industry and are from all different levels. It's fantastic.

Johnson: What have you learned from talking to the customers this week?

Davies: That we need to talk to more customers, but that we are on the right path. I think

we always have room to improve in terms of our booth and showing, but otherwise, what we have shown here has been well-received.

Johnson: And what does your company do?

Davies: We are a test instrumentation manufacturer. We provide tools for manufacturing test engineers to help them reduce the size and cost of their functional testers. We make test instrumentation that's optimized for manufacturing test right in the middle for manufacturing and use—not high-end instrumentation that is optimized for validation tests, and not very low-end instrumentation that handles hobbyist-type applications.

Andy Shaughnessy: What are some of the biggest challenges in this segment?

Davies: Test engineers are always being pressed to be agile and reduce costs all the time. It's a challenge that they face every single day. They're getting compressed in the amount of time that they have to develop a test fundamentally. Acroname helps test engineers by removing traditional barriers to their ability to develop testers and by changing the paradigm of the size, space, and complexity of what functional testers have been traditionally. We are creating elegant architectures for test engineers to quickly create solutions that scale for their customer's needs.

Johnson: It's always good to get out there and make sure that you're talking to the customers to find what they're looking for. What seems to be the hot button for your customers?

Davies: Our customers are always looking for ways to miniaturize their manufacture and functional test. They're excited to have an option for instrumentation and for functional circuit tests that's outside of the norm. They can finally create a new expectation for the size and speed of their testers.

Hector Hernandez
Koh Young,
Sales Partner



Kelly Dack: What have you seen on the show floor?

Hector Hernandez: I'm from Mexico, and my company is Koh Young. We do 3D AOI and SPI. The show this year is amazing. A lot of people are here, looking for new technologies related to Industry 4.0 and the smart factory, and it has been a great show. We can improve a lot of things to make next year's show better, but we have had a great show so far.

Dack: Have you seen anything really new that stood out?

Hernandez: Many companies are focused on the smart factory and the connection between their own equipment and other brands and competitors. IPC APEX EXPO has been a great opportunity to see the new CFX line, which is one of the better things right now. The new communication between equipment is amazing. Every company is focused on that part.

Ryan Herrmann
Heraeus Electronics,
Marketing Communications Specialist



Dack: How has this show been different than past years?

Herrmann: The show is a lot more positive than it was last year. It's a great industry event, celebrating 20 years of APEX. It's a great experience. Heraeus has also been committed to IPC and APEX for the last 20 years. We're enjoying this event and the weather in San Diego.

Dack: How's the traffic for you?

Herrmann: We definitely expected it to be better than last year, but we weren't sure coming into this year with the coronavirus going around; it changed the dynamic at the event. However, it was still a great showing, and we still had a lot of traffic, especially with our automotive solutions for SMT. Every day was busy, and people were very interested.

Sheryl Long
Rogers Corporation,
Global Marketing
Communications
Manager



Nolan Johnson: What have your impressions been of IPC APEX EXPO 2020?

Sheryl Long: It's a great place to see our customers and other friendly faces. The traffic has been a little slow this year, but it's a great place to meet everybody at one spot and to get together and talk about what's going on in the industry.

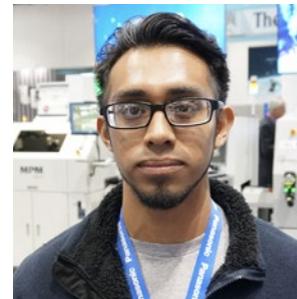
Johnson: What seems to be the attitude of the people attending?

Long: The coronavirus situation has put a lot of people at risk and is affecting some business, but everyone's attitude is good and upbeat. The economy is doing well.

Johnson: What are some of the challenges that IPC APEX EXPO may be facing?

Long: Competition from other trade shows, such as DesignCon. Having competing shows in future years will be tough. Especially for companies that aren't big enough to send people to both of them, they will have to pick and choose which ones they want to be at. And a lot of times, people like to be where the designers are.

Victor Mendez
Sigmatron
International,
Test Engineer



Andy Shaughnessy: Tell me a little bit about your background.

Victor Mendez: My company is from Tijuana, and we do electronics sales services.

Shaughnessy: What's your impression of the show so far?

Mendez: I've seen a lot of new technology that could solve a lot of problems regarding handling and manual soldering. We have a lot of features with parts that are sometimes wrong when the operators load the incorrect part number. We have seen some equipment that scans the barcodes and part numbers to ensure that it is the correct one, as well as make measurements before mounting the components onto the board. We have systems to prevent those kinds of issues, but with this technology, it would be a lot easier, and we could do a lot more production in less time.

Mike Montesi
On Site Gas Systems,
Sales Manager



Andy Shaughnessy: What are some of the biggest challenges that your customers are facing right now?

Mike Montesi: One of the biggest challenges for me selling is educating customers that they can generate oxygen and nitrogen on their own for up to 90% savings versus getting trucked in deliveries. It's all about education because 98–99% of customers are used to the high cost of delivered gases, where we can separate it on-site with their own equipment, and the payback is typically under a year.

Shaughnessy: It's almost like what they do in chemistry class at high school.

Montesi: Yes. Nitrogen is the primary reason we're at IPC APEX EXPO. Nitrogen is just under 80% of breathing air, so we have a system that can take that air and turn it into high-purity nitrogen for customers on-site.

Shaughnessy: That's cool. What segment are your customers in?

Montesi: They're mainly SMT and electronics manufacturers. We are in a variety of industries outside of electronics, but here, any customers that are doing selective solder, wave solder, reflow ovens, and dry boxes all use nitrogen, and they're all potential customers for us.

Gerry Padnos
Juki Automation,
Director of Technology



Kelly Dack: What are your thoughts on IPC APEX EXPO 2020?

Gerry Padnos: This is my 28th year coming to the show if you count NEPCON West, so I've been here quite a few times, but the traffic is down a little bit from previous years. Some people have a theory that the coronavirus had something to do with it because visitors from Asia may not have been able to come. But overall, it has been a successful show for us. We have mainly seen serious shoppers, not just window shoppers. We have done a lot of good work here, and we have a lot of interest in our products.

Jignesh Patel
RBP Chemical
Technology, Technical
Service Specialist



Kelly Dack: How has the show been for you so far?

Jignesh Patel: The show has been great. We had lots of crowds came to our booth, so the traffic was good, and the weather outside is perfect. As far as trends, I see more equipment on the floor now. This is my first show, though, so I don't know how it has been. I was also able to attend one seminar, which was very informative and helpful. It covered PCB manufacturing with new technologies.

Scott Pohlmann
Milwaukee Electronics,
Director of Business
Development



Kelly Dack: What have you seen that has been interesting at this show?

Scott Pohlmann: As a salesman, my job is to make sure I stay on the cutting edge of technology. When our customers ask for certain features that they need on their equipment or performance, I need to know what the state-of-the-art equipment, profiles, and procedures are out there. The SPI process, in particular, is becoming more important. People are realizing how important solder paste deposition is, and looking at that is so much more important than after the oven if you want to get a good paste print.

Dack: Are you looking at it with 3D?

Pohlmann: Five series 3D, so you're looking at up to five different features, not just if the paste is there, but also if it is the proper volume. Does it match the IPC solder paste standard? All those things help to instill confidence in new customers.

Tom Salmon
SEMI, Executive
Director of Fab
Owners Alliance



Nolan Johnson: What are your impressions of the show?

Tom Salmon: I'm impressed by what I've seen and the variety of solutions. Industry 4.0 is still a big thing here. I'm guessing just by the number of attendees that we took a little bit of a hit from the coronavirus. But most of the people I've talked to are happy with the meetings that they're having with folks. Overall, it seems to be positive for everybody.

Johnson: What themes do you see?

Salmon: For us, it's all about connectivity. We're driving toward closed-loop communications within the facilities and on the manufacturing floor. That's why we're presenting with the SMT-ELS suite of standards. We had a user group meeting yesterday and were able to communicate out to a number of key users in the audience. Again, we're just trying to show better connectivity. SMT-ELS is a great replacement for SMEMA. It's a bolt-on application. You don't have to buy new equipment; you can bolt-on DLCs, as well, to get that horizontal machine-to-machine communications.

Johnson: What customers are finding this particularly interesting?

Salmon: We had a mix of people. We got the message out as much as we can to the major EMS companies, but a couple of the EMS companies from Asia were not able to send people because of the coronavirus. We ended up with a few ODMs, in addition to EMS companies, that very interested in machine-to-machine communications.

Joel Scutchfield
Koh Young,
Director of Sales
for the Americas



Kelly Dack: What are your reactions to the show this year?

Joel Scutchfield: Based on traffic and attendance, we have had a great week. We had 40+ more scans than what we did last year at this point, and we're waiting for the final tally today. We're expecting to have 80-100 more booth visitors than last year, and we had a good year last year, too, so that tells me that things are happening. A lot of the traffic has been very high quality. People are planning to invest and do things within the year, which tells me that the industry is growing, and that's what we want. The economy is still strong.

Dack: Have you had a chance to walk the floor very much?

Scutchfield: I'll spend the next couple of hours wandering around and looking at things. We hear a lot of ongoing smart fabrication and Industry 4.0 discussions. Some of the interviews I've been involved with surrounded that, along with the future of manufacturing in the U.S. in general. Each year, there's more connectivity between the partners and systems. CFX is playing a part in that, but that seems to be the common thing as an aggregate specific to inspection through the whole inspection, which seems to be on the forefront. Conformal coding inspection is something that a lot of people are interested in, as well.

Heston Singh
Unitron, Director of
Sales and Business
Development



Nolan Johnson: What has been your exhibitor experience?

Heston Singh: We have been coming here for many years, and had another good experience. If it wasn't good, we wouldn't be coming back. They have products that are needed for this market, so we'll be back every year.

Johnson: What have you seen to be the trends with the people you've been talking to?

Singh: Most of the folks, this year, are coming to see new stuff. Over the past few years, we are finding that because the show is in the same location, we're getting the same people coming annually rather than if the show moves around, you might get a different audience. That is the one drawback. I noticed in three years, IPC will move the show Anaheim. I know these things take a lot of planning, but that is a good move. However, it's in the same state. If it was taken back to Las Vegas, Nevada; Chicago, Illinois; or somewhere in Florida, I think it would draw a lot more new people and interest.

**Travis Smith and
Mindy Sanchez**
Ball Aerospace and
Technologies, Technical
Specialist and
Manufacturing Engineer



Kelly Dack: What are you both seeing here at the show?

Travis Smith: I'm seeing a lot of great manufacturers and different equipment that's available in the market, as well as new, emerging technologies. I'm learning a lot more about some of IPC's standards and committees as well. It has been a fantastic week of educating ourselves for manufacturing processes going forward. And the IPC booth has a wealth of information.

Dack: What do you think about those pictorial examples they have in some of their specifications?

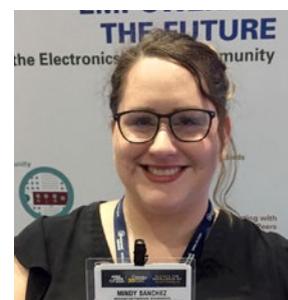
Smith: They're great. I'm an IPC CID for a couple of different standards. I'm very familiar with all their standards. It's nice to get to meet some of their staff, too.

Dack: Did you see any new standards over there or revisions that you weren't familiar with?

Smith: Not yet. I was on a committee that was going over the training material for the next revision on the IPC-610, which is pretty exciting.

Dack: Thank you. There was one on designing for BGAs.

Mindy Sanchez: I love that so much.



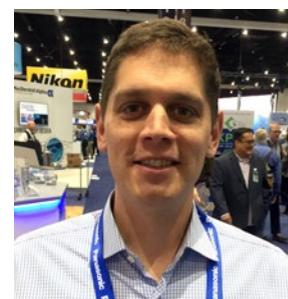
Dack: How did the show go for you, Mindy?

Sanchez: This is my first time attending IPC APEX EXPO. It has been really exciting. I just got back from the Hakko booth, where I built my own Game Boy controller, which was really cool. Seeing all the manufacturers here in one place and getting to see all the technology has also been great.

Dack: Excellent. Did you get to connect with lots of different types of vendors?

Sanchez: I'm in manufacturing, so we design in our shop and do the manufacturing, as well. It's really great to be able to work with that. Seeing all the different manufacturers looking for equipment that we could use to help improve the technologies in our office is huge.

Jered Stoehr
Milwaukee Electronics,
VP of Sales and
Marketing



Kelly Dack: What are your reactions to the show?

Jered Stoehr: I always like seeing the demonstration of the line that they have with all the installations. Last year, it was upstairs. This year, it's right here on the main floor. What I like is the CFX and the Hermes standards and the little flags, showing IPC-CFX supporters. It's nice to see the data standards for how these machines are connecting and communicating. I'm glad to see that moving forward because that's going to be a huge thing for our industry.

Camille Sybert
Nordson Electronics
Solutions, Senior Product
Marketing Engineer



Nolan Johnson: What are your impressions from the show?

Camille Sybert: The show has been great. We've been pretty busy on our end. On the conformal coating side, we've seen a lot of activity. We had a couple of other new products that we brought out, and we've been able to talk about and share those with our customers and get feedback on what application trends they see upcoming, as well. We've had the opportunity for our customers to see our new products, for us to see our existing customers, meet some people that hopefully we can develop fruitful partnerships with as well, and collaborate on solutions. Then, we can get creative with our technologies and see how we can use them to best benefit the industry.

Johnson: What are some of the hot buttons that your customers are sharing with you?

Sybert: There's a need for flexible solutions, so people are trying to make the most of the equipment that they buy, and they want to have the equipment that's able to be flexible in scale with what it is that they're looking for. We have customers asking about future capabilities that they might not be ready for right now, but they want to know that it's something that can be easily integrated into their

processes in the future, as they're in a position to better be able to do so.

Johnson: Based on some of the things you're hearing, what do you think we're going to see in the industry in the next year or two?

Sybert: In general, we're going to continue to see more flexible solutions. We're going to see more of a sophisticated need from our equipment, including more closed-loop process controls and communication between systems where the machines take on more of the responsibility in the process. We see whole-process ownership as opposed to just being an individual contributor within the process.

Guillermo Torres
QxQ Inc., Sales and
Service Support



Kelly Dack: How has the show been for you?

Guillermo Torres: This is my first time, but I've been in the visual business for around two years, so this is a really great experience for me. I've been meeting many people and getting a lot of leads, so that's good for business.

Dack: How is this show different from others you have been to?

Torres: I've been to one in Mexico, but this show is more international. You have people here from the U.S., Mexico, China, Taiwan, etc., so you meet a lot of people from different backgrounds.

David Tuza
I-Source Technical
Services, General
Manager



Kelly Dack: What have you seen at the show this year?

David Tuza: The show wasn't bad. Foot traffic was pretty decent for most of the part. There's a lot of new equipment and products here, and a lot of new equipment manufacturers, so it's very educational.

Dack: Speaking of education, did you see the high school STEM students walking around?

Tuza: Yes. That's the first time I've ever seen a large group of kids touring the show floor, and that's really important for this industry because our pipeline needs to be fed.

Nili Walp
Vision Engineering,
Marketing Manager,
North America



Nolan Johnson: What have been your impressions of IPC APEX EXPO 2020?

Nili Walp: There weren't as many people on the floor, but we exceeded the number of leads. I don't know why. Also, weather-wise, the temperatures have been cold in San Diego. Overall, it didn't feel as busy, but yet we've done well.

Johnson: But you're going home with more than before, so at least the leads are quality. What did you hear customers talking about?

Walp: We're looking for customers with inspection issues, where they want to improve their current process, and a lot of them want something that's more comfortable. This one guy said, "I see my people on the floor, and their necks and backs hurt." Our systems offer that eyepiece that's an ergonomic solution; it's about different methods of inspection.

Johnson: If you had one thing to suggest to make the show better, what would that be?

Walp: The last day is always hard. People leave early, and I don't know how you keep them here. Maybe extend talks throughout the last

day and have it end at 5:00 p.m. instead of 2:00 p.m. to keep people here.

Brian Wojtkiewicz
Taiyo America,
Western Regional
Sales Manager



Nolan Johnson: How has IPC APEX EXPO 2020 gone for you?

Brian Wojtkiewicz: It was pretty good, but I have seen better from this show. It was pretty light on customers this year attendance-wise from what we saw in previous years. That's kind of disappointing, but I'm not sure what the cause is.

Johnson: What are your customers interested in?

Wojtkiewicz: Currently, everyone is looking for a lot of stuff on inkjet solder mask, digital imaging information, and legend inks. It's pretty exciting.

Johnson: If they're looking for that, that usually means they're also looking for new equipment.

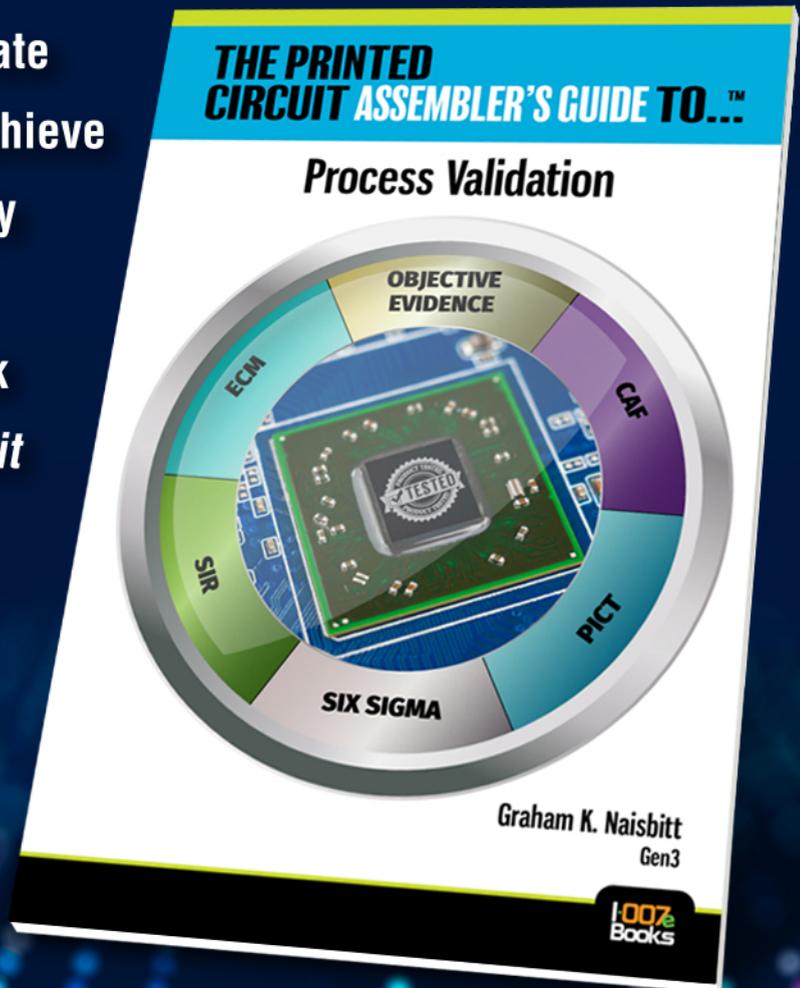
Wojtkiewicz: We're a solder mask manufacturer, so the focus is on the brand new solder masks that come out and the new technology on that.

Johnson: Are you coming away with good feedback as far as what customers are looking for moving forward?

Wojtkiewicz: It seems they are all pursuing digital imaging; whether it's direct imaging exposure or inkjet solder mask, they're all going that direction, and it's not just the big customers; small customers are doing the same. They're investing money, which is good. New investment is what has been lacking for a couple of years. **S&T**

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A Great **BIG** Global Party

by **Dan Beaulieu**
D.B. MANAGEMENT

Some people complain about industry trade shows and compare them to other global events. Others like IPC APEX EXPO and love coming each year. You can count me among those people, and I strongly believe that you get out of it what you put into it. If you're serious about marketing your company and want to get your organization's story out there, this is the show for you.

Personally, I can't get enough of IPC APEX EXPO. By the time Thursday comes around, I'm like that little kid whose parents have told him they have to go home because the carnival is over! Being an industry consultant at this show, as I love to tell people, is like being an insurance salesperson at a Christmas party; everyone attending the show is a potential client for me, so I take full advantage of everything it has to offer.

Some people told me they thought the show was slow this year, but I noticed that people were buying things. The tables in the booths were filled with people having serious discussions and doing business. That's what a show is supposed to be about.

One of the things I really like is hearing all of the different languages and accents, indicating that this has truly become an international event, and as a person who thrives on globalization, I think that's great. People from different cultures, countries, and continents who are interested in doing business together are not interested in wars, fighting each other, calling each other names, and resenting each other. Instead, they are more interested in finding ways to work together, sell each other their products and services, or partner together to do something bigger than either one of them could do alone.

In the end, that is what IPC APEX EXPO is about. I can't wait for next year. **S&T**



Dan Beaulieu is president of D.B. Management Group.

Dan is one of this year's recipients of the I-Connect007 Good for the Industry Award. Dan has submitted 800+ contributions, including his weekly columns.

The I-Connect007 team would like to extend a huge thank you to the following companies for their support!

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And the Award Goes To...

IPC presented important awards to some of the outstanding 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 the Corporate Recognition Awards, the IPC Rising Star Awards, and the IPC President's Awards, as well as new officers and members elected to the IPC Board of Directors.

Corporate Recognition Awards

IPC bestowed its highest corporate honors on two IPC member companies: TTM Technologies Inc. and Continental Automotive. During a luncheon at IPC APEX EXPO 2020, the Peter Sarmanian Corporate Recognition Award was presented to TTM Technologies Inc., and the Stan Plzak Corporate Recognition Award was presented to Continental Automotive.

The Peter Samarian Corporate Recognition award, named for a former IPC Board Chair-

man, recognizes an IPC-member company in the PCB industry that has supported IPC through participation in technical and management programs while providing leadership for the industry.

Members of IPC since 1976, TTM Technologies Inc. is a leading global PCB manufacturer, focusing on quick-turn and volume production of technologically advanced PCBs, backplane assemblies, and electromechanical solutions. Nearly 70 of its staff members participate in approximately 120 technical committees ranging from flexible circuits and fabrication processes to conflict minerals and intellectual property standards. And nearly 1,200 staff members have earned CIT, CIS, CID, CID+, and EMS certifications across all TTM locations. Active in IPC's "Meet the Policymakers" program, TTM locations in the U.S. have played host to seven U.S. policymakers to discuss issues critical to the industry. In addition, TTM President and CEO Tom Edman is a

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TTM President and CEO Tom Edman



Dr. Robert Feuerstein, Continental Automotive

vigorous contributor to IPC's North American government relations committee and currently serves on IPC's Board of Directors.

Named for former IPC Board Chairman and founding member of the IPC Electronics Manufacturing Services Industry Management Council, the IPC Stan Plzak Corporate Recognition Award honors an IPC-member company in the electronics assembly industry that actively contributes to the industry while supporting IPC technical and/or management programs.

A member company since 1995, more than two dozen Continental Automotive employees lend their time and talent on dozens of standards development committees, dedicated to topics ranging from automotive electronics to press-fit technology and lead-free. Staff also take their expertise outside of standards development and have presented at numerous IPC workshops and conferences. When they're not helping educate the industry, they're in IPC's virtual classroom, where they have amassed more than 400 staff certifications. Numerous staff have been honored with awards for their standards contributions; two have earned an IPC Rising Star Award, and Dr. Robert Feuerstein, director and head of manufacturing technology at the Regensburg, Germany facility, serves on IPC's Board of Directors.

"We are privileged to have TTM Technologies Inc. and Continental Automotive as members of IPC," said John Mitchell, IPC president and CEO. "We benefit tremendously from their leadership, knowledge, and expertise. Their involvement in IPC has directly contributed to IPC's global growth in the electronics industry."

IPC Rising Star Awards

In recognition of their leadership roles and support of IPC standards, education, advocacy, and solutions to industry challenges, four of the industry's best and brightest were presented with an IPC Rising Star Award at IPC APEX EXPO 2020. Award recipients were Gaston Hidalgo, Kate Stees, Stephanie Rodgers, and Zhiman Chen.

Hidalgo, a senior industrial engineer at Toyota Motor North America, was honored for his leadership of the IPC-A-610/J-STD-001 Automotive Addendum committee, the J-STD-001 committee, as well as his work as an IPC-A-610 Certified IPC Trainer (CIT).

Rodgers, director of advanced product development at Apex Mills, was honored for her leadership in the development of the first industry consensus standard for e-textiles materials, applications, and requirements—



Gaston Hildago, Toyota Motor, NA



Kate Stees, Lockheed Martin

IPC-8921: Requirements for Woven and Knitted Electronic Textiles (E-Textiles), Integrated With Conductive Fibers, Yarns, and/or Wires.

Stees, a materials and process engineer at Lockheed Martin Missiles and Fire Control—who also recently completed IPC’s Emerging Engineer Program, was honored for her leadership roles on the IPC-A-610 committee.

Chen, an engineer with ZhuZhou CRRC Times Electric Co. Ltd., was honored for her

leadership of the IPC/WHMA-A-620C-R and 7-31 China Task Group and IPC-A-610G-R, as well as her promotion of IPC in China.

“The work that the Rising Star recipients have done to enrich the industry and IPC within the last five years will continue to have a lasting impact for many years to come,” said John Mitchell, IPC president and CEO. “IPC is privileged that Gaston, Kate, Stephanie, and Zhiman have chosen to share their knowledge and expertise with us and with the entire electronics industry.”

IPC President’s Award

In recognition of their significant contributions of time, talent, and ongoing leadership in IPC and the electronics industry, four IPC volunteers were presented with IPC President’s Awards at IPC APEX EXPO 2020. Award recipients were Michael Ford, Aegis Software; Dale Lee, Plexus Corporation; Joe O’Neil, Green Circuits; and S. Manian Ramkumar, Ph.D., Rochester Institute of Technology (RIT).

Ford was honored for his thought leadership on Industry 4.0 and his considerable contributions to IPC industry standards, including the Connected Factory Exchange (CFX) and IPC-1782 traceability standard. An active participant on more than a dozen IPC technical com-



Stephanie Rodgers, Apex Mills



Michael Ford, Aegis



Joe O'Neil, Green Circuits

mittees, and a sought-after speaker on software solutions for assembly manufacturing, Ford helps to promote and position IPC's digital manufacturing best practices by contributing articles, columns, and blogs to several leading industry publications.

Lee was recognized for his extensive knowledge in DFX analysis; root-cause failure analysis related to design and processes; and tooling impacts on manufacturing processes and

yields. He currently serves on more than 10 technical committees, including the PERM council, the land pattern subcommittee, the DFX standards subcommittee, and the BGA task group.

O'Neil, recent immediate past chairman of the IPC Board of Directors, was honored for his work on the V9-20 PCB President's Management Council Steering Committee, the G-10 Government Relations Steering Committee, the



Dale Lee, Plexus Corporation



S. Manian Ramkumar, Ph.D., Rochester Institute of Technology



Mikel Williams, Targus

G-11 IPC Department of Defense Task Force, the G-11A, Defense Road Map Task Group, and the G-12, Government Relations Grassroots Participants committee. An active participant in the IPC Cares program, as well as IPC's Workforce Champions initiative, O'Neil was one of a four-member IPC team presenting the initiative to the U.S. White House in 2019.

Dr. Ramkumar was recognized for his frequent instruction of courses for the electronics packaging industry. A subject-matter expert in robotics, automated manufacturing, and surface-mount electronics assembly education and research, he was instrumental in establishing the advanced manufacturing and electronics packaging laboratories at RIT. An active participant in technical conference sessions at IPC APEX EXPO, Dr. Ramkumar has been a valued instructor on advanced packaging, surface mount, soldering, and assembly process topics since 2002, educating hundreds of his industry peers at various workshops and conferences.

"The contributions that Dale, Michael, Joe, and Ram have made to IPC and the electronics industry cannot be overstated," said John Mitchell, IPC president and CEO. "Their leadership and willingness to share their time and expertise with us has been invaluable." **S&T**

IPC Board of Directors: New Officers and Members

The Nominating and Governance Committee of the IPC Board of Directors presented officer and member candidates for election at the 63rd IPC Annual Meeting on February 4, held in conjunction with IPC APEX EXPO 2020 at the San Diego Convention Center. Officers serve a two-year term, while members serve a four-year term.

The newly elected Board officers are:

- Board chair: Shane Whiteside, president and CEO, Summit Interconnect
- Board vice-chair: Bob Neves, chairman and chief technology officer, Microtek Laboratories China
- Secretary/treasurer: Tom Edman, president and CEO, TTM Technologies

The newly elected Board members are:

- Marc Peo, president, Heller Industries
- Hiroyuki Watanabe, executive vice president, NEC Platforms Ltd.
- Robert Feuerstein, director, head of manufacturing technology, Continental Automotive GmbH
- Steve Pudles, president and CEO, Zentech Manufacturing
- Jeanie Wade, sector vice president, operations and sector quality executive, Northrop Grumman Corporation

"IPC is privileged to have these officers and directors added to our current slate of Board members. All are active contributors to IPC initiatives, and we look forward to their continued contributions to advancing IPC and the electronics industry," said John Mitchell, IPC president and CEO.

In addition to holding Board elections, IPC honored outgoing Board chair, Mikel Williams (Targus), and outgoing members Mike Carano (RBP Chemical Technology) and Joe O'Neil, Green Circuits. All three were honored for many years of service on the IPC Board of Directors.



Seven Takeaways

From IPC APEX EXPO 2020

by **Chris Mitchell**

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

IPC APEX EXPO is always a fascinating kaleidoscope of electronics manufacturing excellence, and this year was no exception. Most of the show's content is relatively technical in nature, but it all comes down to making amazing things possible for the industry's customers.

Here are my top takeaways from IPC APEX EXPO 2020 from the perspective of someone whose job it is to explain our industry and its concerns to non-technical government policymakers.

1. The factory of the future continues to be a priority.

According to a recent McKinsey survey, more than two-thirds of industrial companies are making digitization of their factories their top priority. This trend was reflected at IPC APEX EXPO 2020 in the growing number of participants in the IPC Connected Factory Exchange (CFX) standard, which standardizes machine-to-machine communication and makes possible a range of Industry 4.0 applications. Accelerating the flow of information across equipment and throughout the manufacturing process will improve the economics of manufacturing in all nations that foster the factory of the future. But when will these digital advancements start paying major dividends? And how can we prepare the workforce of the future to manage smarter machines? These

difficult questions continue to loom even as the industry signals that we are on the cusp of radical change in electronics manufacturing.

2. The interest in environmental issues and corporate social responsibility is ever growing.

While the U.S. government is currently focused on reducing the burden of regulation, the European Commission that recently took power in Brussels is pointed in the other direction, seeking ways to gain a global competitive advantage with stricter environmental standards. Perhaps this environmental action in Europe explains the nearly filled meetings of our revitalized Environment, Health, and Safety (EHS) Committee. IPC APEX EXPO attendees were also able to take advantage of sessions on California's Proposition 65 and lead-free electronics. But it's not just regulation driving interest in environmental issues. IPC President and CEO John Mitchell's keynote speech emphasized purpose-driven innovation, and that kind of innovation was well-represented on the floor. One company that caught my eye was InduBond, whose lamination press performs using 10% of the energy of traditional technologies.

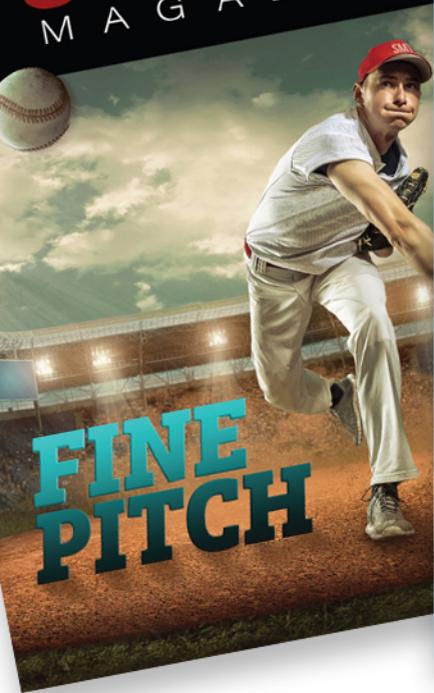
3. New faces reflect IPC's commitment to the industry.

A quartet of new IPC executives attended IPC APEX EXPO for the first time, reflecting the association's commitment to supporting the industry globally. Matt Kelly, formerly of

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IBM, joined IPC in January in the new role of chief technology officer. Matt's mission will be to lead IPC's "factory of the future" standards and technical research, develop a new "industry intelligence" function, and launch an Industry CTO Council. Shawn DuBravac is IPC's new chief economist, expanding IPC's research and member services around the economic trends shaping our industry. Alison James is IPC's new senior director for Europe, working closely with IPC's European members as well as European government officials, institutions, and public policy stakeholders. And Kelly Scanlon is coming up on one year in the role of director of environment, health, and safety (EHS) policy and research. Please reach out to them if you have any questions or suggestions.

4. The IPC Education Foundation continues to expand its outreach.

Last year, the new IPC Education Foundation hosted more than 100 San-Diego-area high school students at IPC APEX EXPO for panel discussions, hands-on training in soldering PCBs, and tours of the expo floor. This year, IPCEF hosted almost 200 high school students from local schools! In its second year, IPCEF is continuing to partner with several organizations to distribute basic electronics curricula to hundreds of high schools and create IPC student chapters at universities and community colleges across the country.

5. An influx of younger engineers is revitalizing IPC's membership.

IPC launched the Emerging Engineer Program in 2016 to provide early-career professionals with an opportunity to learn from the dedicated industry volunteers who participate in IPC standards development. This year at IPC APEX EXPO, they seemed to be everywhere. Younger professionals are also stepping into leadership roles in several key standards groups. John Mitchell's keynote speech highlighted the rise of millennials like Melby Thelakkaden of Raytheon, who has become herself involved in eight technical committees!

6. U.S. manufacturers see opportunities and challenges in defense electronics.

The U.S. Defense Department is devoting increasing attention to the nation's defense industrial base, including the electronics supply chain. Representatives of the DOD's Industrial Base Analysis and Sustainment (IBAS) Program attended IPC APEX EXPO 2020 and focused on several key issues. Cybersecurity and resilience also played a prominent role in discussions, with the DoD's Cybersecurity Maturity Model Certification (CMMC) causing quite a few furrowed brows. IPC is stepping up its member support in these areas and exploring new platforms for industry engagement with the DoD.

7. The coronavirus outbreak is affecting our supply chain.

One of the biggest headlines outside the convention center—the coronavirus epidemic—was also felt inside the building, as dozens of attendees from China stayed home due to the virulent outbreak in that country. People across the industry are worried about the human toll as well as the supply chain disruptions that could arise in this crisis and future crises. IPC is collecting data on the impact of the coronavirus on the industry. To share your insights, please reach out to Shawn DuBravac.

Conclusion

These were my top takeaways from an IPC government relations perspective, but it cannot be said enough: The power of IPC APEX EXPO lies in the thousands of attendees who take part in standards committees, policy committees, executive forums, buzz sessions, and professional development courses. Many thanks to the hundreds of companies who exhibited their goods and services and brought so much excitement to all aspects of the show. **S&T**



Chris Mitchell is IPC's VP of global government affairs.





Volunteers Honored for Contributions to IPC and the Electronics Industry

IPC presented Committee Leadership, Special Recognition, and Distinguished Committee Service Awards on February 3 and 5 at IPC APEX EXPO 2020 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 Committee Leadership Awards for their contribution to the 2-19b Trusted Supplier Task Group that developed IPC-1791—Trusted Electronic Design, Fabricator, and Assembly Requirements—were William May, NSW Crane, and Richard Snogren, Bristlecone LLC.

Receiving Special Recognition Awards for their contribution to developing IPC-1791 were Peter Bigelow, IMI Inc.; Marc Carter; Aeromarc, LLC; Zhiman Chen, CRRC Zhuzhou Institute Co. Ltd.; Don Dupriest, Lockheed Martin Missiles and Fire Control; Michael Ford, Aegis Software; Dennis Fritz, MacDermid Enthone Electronics Solutions; Ife Hsu, Intel Corpora-

tion; Joe Hughes, Hughes Circuits Inc.; Mark Kirkman, SAIC; Mark McMeen, STI Electronics Inc.; Kathy Nargi-Toth, Bowhead; David Reichert, DuPont; Stephanie Richards, Labinal Salisbury; Roger Smith, NSW Crane; John Timler, SAIC; and Stephen Tisdale, Tisdale Environmental Consulting LLC.

Mike Carano, RBP Chemical Technology Inc., earned a Committee Leadership Awards for his outstanding contributions to 7-24 Printed Board Fabrication and Assembly Process Effects Subcommittee that developed IPC-9121—Troubleshooting for Printed Board Fabrication Processes, Amendment 2.

Receiving Special Recognition Awards for their contribution to IPC-9121 were Paul Cooke, FTG Circuits; Tom Fitzgerald, TTM Technologies; Denny Fritz, MacDermid Enthone Electronics Solutions; Gary Hirst, TTM Technologies Inc.; Ife Hsu, Intel Corporation; Mike Jawitz, Raytheon Missile Systems; Sharissa Johns, Lockheed Martin Missiles and Fire Control; Suriyakan Kleitz, Schlumberger Well



Services; Leo Lambert, EPTAC Corporation; Jennifer Ly, BAE Systems; Karen McConnell, Northrop Grumman Corporation; Joey Rios, Raytheon Missile Systems; Robert Roessler, ABB Critical Power; Anjana Shyamsundar, ABB Critical Power; David Sommervold, Henkel Corporation; Steve Tisdale, Tisdale Environmental Consulting LLC; and Miou Yamoaka, Meiko Electronics Co. Ltd.

Earning Special Recognition Awards for their contribution to 4-14 Plating Processes Subcommittee that developed IPC-4552B—Performance Specification for Electroless Nickel/Immersion Gold (ENIG) Plating for Printed Boards—were Scott Bowles, Lockheed Martin Space Systems Company; Denise Charest, Amphenol Printed Circuits Inc.; Don Dupriest, Lockheed Martin Missiles and Fire Control; Joey Rios, Raytheon; David Sommervold, Henkel U.S. Operations Corporation; and Ingrid Swenson, TTM Technologies Inc.

For their leadership of 7-31bv J-STD-001 and IPC-A-610 Automotive Addendum Task Group that developed J-STD-001GA/IPC-A-610GA—Automotive Addendum to IPC J-STD-001G, Requirements for Soldered Electrical and Electronic Assemblies—and IPC-A-610G—Acceptability of Electronic Assemblies—Gaston Hidalgo, Toyota Motor North America; Jose

Servin Olivares, Continental Temic SA de CV; Udo Welzel, Robert Bosch GmbH, received Committee Leadership Awards.

Receiving Distinguished Committee Service Awards for their contributions to the Automotive Addendum Task Group were Thomas Ahrens, Trainalytics GmbH; Mitsuhiro Asaka, Japan Unix Co. Ltd.; Jasbir Bath, Koki Solder America; Tiberiu Baranyi, Flextronics Romania SRL; Javier Cobos, Eaton Corporation; Robert Cooke, NASA Johnson Space Center; Alejandro Cruz, GPV Americas S.A.P. I de C.V.; Miguel Dominguez, Continental Temic SA de CV; Hans-Otto Fickenscher, Continental Automotive GmbH; Gunter Gera, Robert Bosch GmbH; Andrew Goddard, ZF; Robert Kinyanjui, John Deere Electronic Solutions; Yusaku Kono, Japan Unix Co. Ltd.; Alain Le Grand, Continental Automotive France SAS; Patrick Leidich, Robert Bosch GmbH; Stuart Longgood, Delphi Technologies; Walter Montoya, Senju Comtek; Stanton Rak, Continental Automotive Systems; Ivan Roman, Continental Automotive; Manuel Tabarez, Continental Automotive Nogales S.A. de C.V.; Toshiyasu Takei, Japan Unix Co. Ltd.; Wayne Thomas, Nexteer Automotive; Hans-Peter Tranitz, Continental Automotive GmbH; Indira Vazquez, Continental Temic SA de CV; and Thomas Zettner, Continental Automotive GmbH.

Receiving Committee Leadership Awards for their contribution to D-33a Rigid Printed Board Performance Specification Task Group that developed IPC-6012E—Qualification and Performance Specification for Rigid Printed Boards—were Mark Beuchner, BAE Systems, and Randy Reed, R. Reed Consultancy LLC.

Earning Distinguished Committee Service Awards for their dedication to developing IPC-6012E were Lance Auer, Conductor Analysis Technologies Inc.; Scott Bowles, Lockheed Martin Space Systems Company; Denise Charest, Amphenol Printed Circuits Inc.; Don Dupriest, Lockheed Martin Missiles and Fire Control; Gary Ferrari, FTG Circuits; Vicka Hammill, Honeywell Inc. Air Transport Systems; Philip Henault, Raytheon Missile Systems; Nick Koop, TTM Technologies Inc.; Clifford Maddox, Boeing Company; Chris Mahanna, Robisan Laboratory Inc.; Joey Rios, Raytheon Missile Systems; Patrick Smith, Cirexx International; and Marshall Stolstrom, TTM Technologies.

Earning Committee Leadership Awards for their outstanding contributions to the D-11 Flexible Circuits Design Subcommittee that developed IPC-2223E—Sectional Design Standard for Flexible and Rigid-Flexible Printed Boards—were Mark Finstead, Flexible Circuit

Technologies Inc., and Bill Orloff, Raytheon Company. Receiving Distinguished Committee Service Awards were Lance Auer, Conductor Analysis Technologies Inc.; Gary Erickson, Sanmina Corporation; Kevin Kusiak, Lockheed Martin Space Systems Company; and Steven Murray, Northrop Grumman Corporation.

For their leadership of the 5-21m Cold Joining Press-Fit Task Group that developed IPC-9797—Press-Fit Standard for Automotive Requirements and Other High-Reliability Applications—Hans-Peter Tranitz, Continental Automotive GmbH, and Udo Welzel, Robert Bosch GmbH, earned Committee Leadership Awards.

Receiving Distinguished Committee Service Awards for the contributions to developing IPC-9797 were Erika Crandall, TE Connectivity Germany GmbH; Hermann Eicher, EPT Guglhoer GmbH; Philippe Jaeckle, Robert Bosch GmbH; Frank Uibel, Uibel Consulting; and Heike Woldt, Diehl Metal Applications GmbH.

Receiving Committee Leadership Awards for their outstanding contributions to 5-33a Conformal Coating Task Group that developed IPC-CC-830C—Qualification and Performance of Electrical Insulating Compound for Printed Wiring Assemblies—were Brian Chislea, Dow



Conformal coating task group.

Corning, and Jeffrey Sargeant, Humiseal Division of Chase Corporation.

Earning Special Recognition Awards for their dedication to the 5-33a Conformal Coating Task Group were Lloyd Duso, Diamond-MT Inc.; Ben Gumpert, Lockheed Martin Missile and Fire Control; Jason Keeping, Celestica International L.P.; Phil Kinner, Electrolube; Richard Litavis, Paradigm Inc.; Randy McNutt, Northrop Grumman Aerospace Systems; Graham Naisbitt, Gen3 Systems Limited; Doug Pauls, Collins Aerospace; Amanda Rickman, Raytheon Systems Company; Barry Ritchie, Electronics Protection Chemistries Group; Stefan Schroeder, Lackwerke Peters GmbH and Co KG; John Waryold, Humiseal Division of Chase Corporation; Fonda Wu, Raytheon Company; and Lamar Young, Specialty Coating Systems Inc.

Receiving Special Recognition Awards for their contribution to the 2020 Technical Conference Program Committee were Beverly Christian, ABC Electronics Manufacturing Consulting; Martin Goetz, Northrop Grumman Corporation; David Hoover, TTM Technologies; Jason Keeping, Celestica Inc.; Milos Lazi, Indium Corporation; Weifeng Liu, Flex; Sandra Nelle, Atotech Deutschland GmbH; Russell Nowland, Nokia Corporation; Stanton Rak, Continental Automotive Systems; Karl Sauter, Oracle America Inc.; Julie Silk, Keysight Technologies; Bhanu Sood, NASA Goddard Space Flight Center; Brian Toleno, Microsoft Corporation; and Udo Welzel, Robert Bosch GmbH.

Receiving Special Recognition Awards for their service to the Design Community through the Designer Council Executive Board were Stephen Chavez, UTC Aerospace Systems; Soo Lan Cheah, Selangor Human Resources Development Center; Michael Creeden, San Diego PCB Design, LLC; Kelly Dack, I-Connect007; Richard Ellinger, Circuit Source; Gary Ferrari, FTG Circuits; Paul Fleming, Integrity Engineering and Design Solutions; Richard Hartley, Rhartley Enterprises; Lucas Hausherr, San Diego PCB Design, LLC; Cherie Litson, Litson1 Consulting; Bob McCreight, Tesla Motors Inc.;

Scott McCurdy, Freedom CAD Services Inc.; Andrew Pollack, Surface Mount Circuit Board Association; Thomas Romont, IFTEC; Luis Saracho, Yazaki Service, S. de R.L. de C.V. (YSS); Rainier Taube, Taube Electronic GmbH; Rainier Thueringer, Facherband Elektronik Design e.V.; and Suzy Webb, Design Science.

For their leadership of the 2-17 Connected Factory Initiative Subcommittee that developed IPC-2591—Connected Factory Exchange (CFX)—Matt Kelly, IBM Corporation; Marc Peo, Heller Industries Inc.; and Jason Spera, Aegis Software, received a Committee Leadership Award.

For their contribution to developing IPC-2591, Marybeth Allen, KIC; Paul Austen, Electronic Controls Design Inc.; Ruffin Blackard, CBH Solutions, LLC; Zhiman Chen, Zhuzhou CRRC Times Electric Co. Ltd.; Alexis Fouquet, Europlacer; Symon Franklin, Custom Interconnect Ltd; Michele Gray, Aegis Software; Khoo Yak Hua, ViTrox Technologies Sdn. Bhd.; Eric Huang, HaiNa Cognitive Connections; Vincent Levannier, SYNEO, LLC; Michael Lo, HaiNa Cognitive Connections; Karen McConnell, Northrop Grumman Corporation; Jim Monarchio, TTM Technologies; Hoa Nguyen, OK International; Mark Ogden, ASM Assembly Systems; Pat Ortiz, FlexLink Systems Inc.; John Perrotta, Europlacer North America; Florian Ritter, ASYS Group; Neaven Seo, Keysight Technologies; Daniel Stran, Aster Technologies; Liu Suzhong, Shenzhen Hengzhiyuan Technology Corporation Ltd; Siew-Siew Wee, Keysight Technologies; Johann Yang, HaiNa Cognitive Connections; and Ben Zhai, Swissmic, received a Special Recognition Award. Receiving Distinguished Committee Service Awards were Michael Ford, Aegis Software; Nicholas Francheteau, Europlacer; Thomas Marktscheffel, ASM Assembly Systems GmbH and Co. KG; Frank Pruefer, iTAC Software AG; Simon Smith, Pillarhouse International Ltd.; and John Walls, Aegis Software.

For their leadership of D-72 E-Textiles Materials Subcommittee A-Team that developed IPC-8921—Requirements for Woven and Knitted



IPC Designer's Council Executive Board members were honored for their service to the industry.

Electronics Textiles (E-textiles) Integrated With Conductive Fibers, Conductive Yarns and/or Wires—Stephanie Rodgers, Apex Mills Inc., and Diana Wyman, AATCC; received Committee Leadership Awards.

For their contributions to IPC-8921, Ken Araujo, NAMICS Technologies Inc.; Andy Behr, Panasonic Industrial Devices Sales Company of America (PIDSA); Daniel Christe, Drexel University; Cedric Cochrane, ENSAIT GEMTEX Lab; Genvieve Dion, Drexel University-Westphal College of Media Arts and Design; Steve Frierson, V Technical Textiles/Shieldex U.S.; Mary Hakam, Woodlands Textiles; Christopher Hunt, Pireta; Augustus Jones, DuPont; Gwo-Tsuen Jou, Taiwan Textile Research Institute; Chuck Kinzel, Liquid Wire Inc.; Matt Kolmes, Volt Smart Yarns; Vladan Koncar, ENSAIT GEMTEX Lab; Jeffrey Lee, iST—Integrated Service Technology; Eric Lewallen, Wearable Electronics Product Development; Chi-hung Lin, Taiwan Textile Research Institute; Weifeng Liu, FLEX; Satosha Maeda, Toyobo; Kalana Marasinghe,

MAS Holdings PVT LTD; Riccardo Marchesi, Texe Srl; John Niggle, Pelican Wire Company; Jan Obrzut, NIST; Sigrid Rotzler, IZM (Fraunhofer-Institut für Zuverlässigkeit und Mikrointegration); Haridoss Sarma, GO 2 Scout 4 RandT; Arielle Schock, OTEX; Remington Scott, AATCC; Leslie Thomas, Factory 404 LLC; Xing Tong, SAIC; Eisuke Tsuyuzaki, Yuasa System Co. Ltd.; Praneeth Weerasekara, MAS Innovation; and Shahood Zaman, ENSAIT GEMTEX Lab, received Special Recognition Awards.

Receiving Distinguished Committee Service Awards were Zainab Ali, Honda Research and Development Inc.; Ben Cooper, FLEX; Mary-Alice Gill, Jabil Circuit Inc.; Connie Huffa, Fabdesigns Inc.; Anjali Khemani, Propel LLC; Birgit Leitner, Propel LLC; Madison Maxey, Loomia; Oona Oksjarvi, Clothing Plus; Bethany Pollack, Pratyush Rai, Nanowear Inc.; Brian Toleno, Microsoft Corporation, Sharon Tracy, Steelcase Inc.; and Carole Winterhalter, U.S. Army Combat Capabilities Development Command-Soldier Center.

Receiving Special Recognition Awards for their contributions to D-72 E-Textiles Materials Subcommittee that developed IPC-WP-025—IPC White Paper on A Framework for the Engineering and Design of E-Textiles—were MaryAlice Gill, Jabil Circuit Inc.; Birgit Leitner, Propel LLC; Madison Maxey, Loomia; Pratyush Rai, Nanowear Inc.; Stephanie Rodgers, Apex Mills Inc.; and Sharon Tracy, Steelcase Inc.



Receiving a Committee Leadership Award for his contributions to the Technology Solutions that developed IPC-WP-026—IPC Technology Solutions White Paper on Blockchain and the Electronics Industry: A Review of the Current State of Blockchain Technology and Its Potential Applications in Electronics Manufacturing—was Mike Carano, RBP Chemical Technology Inc. Receiving Special Recognition Awards were Radu Diaconescu, Swissmic; Michael Ford, Aegis Software; Curtis Grosskopf, IBM Corporation; Craig Lax, Septillion Technologies; and Cameron Shearon, Raytheon Company.

For their leadership of IPC D-32 Thermal Stress Test Methodology Subcommittee that developed IPC-TM-650 Method 2.6.7.2C—Thermal Shock, Thermal Cycle, Continuity, and Microsection—Jim Monarchio, TTM Technologies; Joey Rios, Raytheon Missile Systems; and Jerry Magera, Motorola Solutions received Committee Leadership Awards.

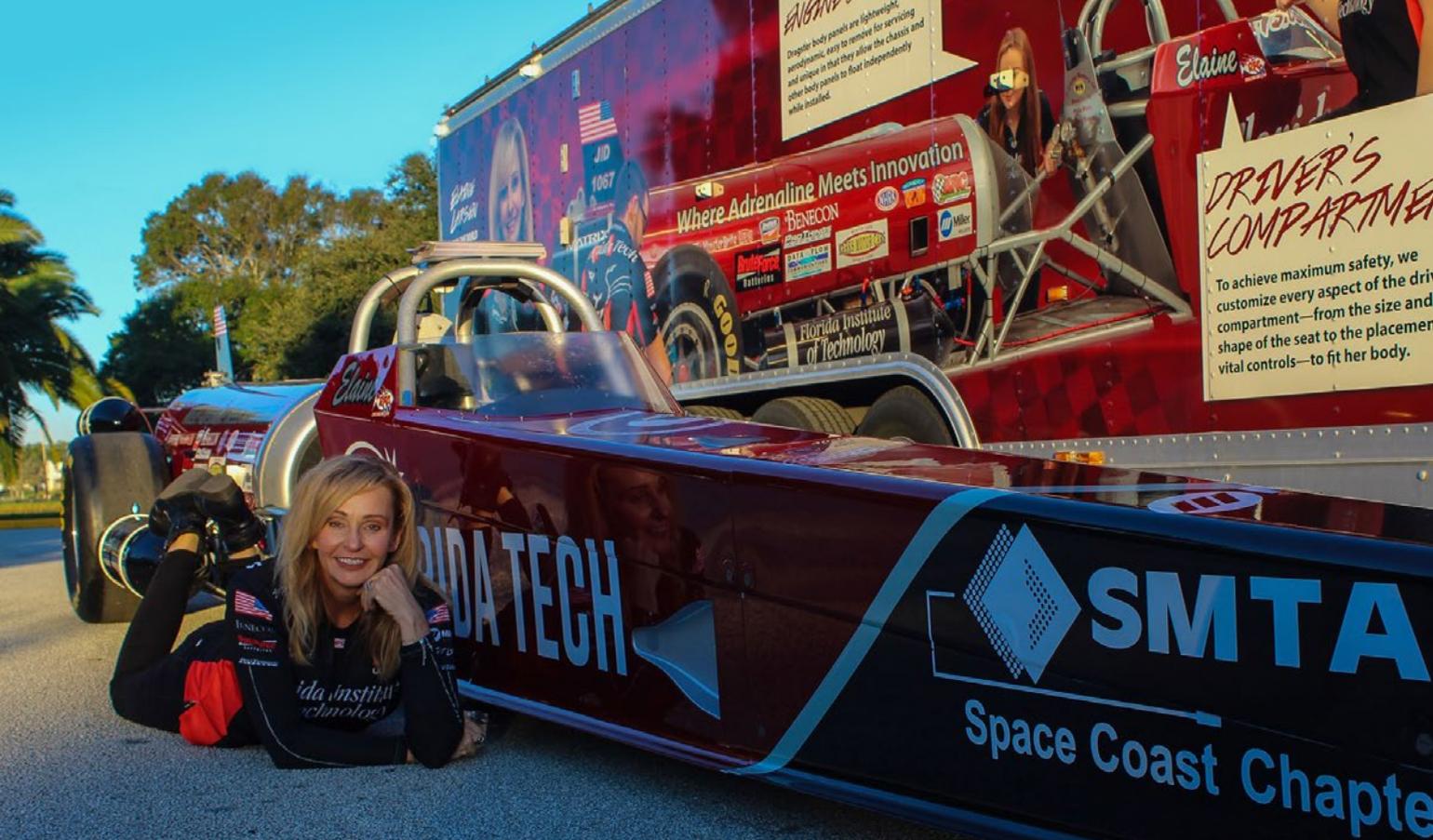
For their outstanding contributions to IPC-TM-650 Method 2.6.7.2C, Lance Auer, Conductor Analysis Technologies Inc.; Scott Bowles, Lockheed Martin Space Systems Company; Don Dupriest, Lockheed Martin Missiles and Fire Control; Tim Estes, Conductor Analysis Technologies Inc.; Stefan Gerhold, Atotech Deutschland GmbH; Chris Mahanna, Robisan Laboratory Inc.; and Nick Meeker, Conductor

Analysis Technologies Inc., received Distinguished Committee Service Awards.

For their leadership of Hermes Standard Initiative that developed IPC-HERMES-9852—the Global Standard for Machine-to-Machine Communication in SMT Assembly—Florian Ritter, ASYS Group, and Thomas Bliem, ASM (Assembly Systems) GmbH and Co. KG, received a Committee Leadership Award.

For their leadership of 7-31f IPC WHMA-A-620 Task Group that developed IPC/WHMA-A-620D, Requirements and Acceptance for Cable and Wire Harness Assemblies, Bud Bowen, Winchester Interconnect; Catherine Hanlin, Precision Manufacturing Company Inc.; George Millman, Raytheon Missile Systems; and Richard Rumas, Honeywell Canada, received Committee Leadership Awards.

Receiving Special Recognition Awards were Bob Cooke, NASA Johnson Space Center; Scott Meyer, Collins Aerospace; Garry McGuire, NASA Marshall Space Flight Center; and Debbie Wade, Advanced Rework Technology-A.R.T. Receiving Distinguished Committee Service Awards were Gerald Bogert, Bechtel Plant Machinery Inc.; Zhiman Chen, Zhuzhou CRCC Times Electric Co. Ltd.; Symon Franklin, Custom Interconnect Ltd; Ben Gumpert, Lockheed Martin Missile and Fire Control; Tim Hoover, Raytheon Company; Joseph Kane, BAE Systems; and Jonathan Vermillion, Ball Aerospace and Technologies Corporation. **S&T**



Elaine Larsen's Keynote: Motorsports and Mentoring

Nolan Johnson spoke with keynote speaker Elaine Larsen, who led the Women in Electronics Reception at IPC APEX EXPO 2020 in her presentation “A Chance Behind the Wheel in a Male-Dominated Industry.” As a jet dragster world champion, Elaine also comes from a male-dominated field and looks to empower women of the electronics industry.

In her keynote, Elaine shared her background growing up Mennonite, and how that set the foundation for her work ethic and no-nonsense approach to her sport. A key to her story was her chance parking lot meeting with a man driving a pretty little deuce coupe as a young adult. That man became her boyfriend, and later, her husband. As a married couple, Elaine helped her husband get established in his trade, and then they turned their atten-

tion as a team to Elaine's purpose in life. In that process, Elaine realized she wanted to try driving dragsters. In her first experiences, she learned she had a knack for—but most of all, a love for—the sport, and their husband-wife collaboration was born. While it is strongly implied that Elaine runs her team as a meritocracy, Elaine's crew is mostly female. Elaine's husband continues to oversee the building of the cars she races.

Elaine's message to her audience was one of inspiration: Follow your dreams and passions, do not let gender be a barrier, and keep yourself wrapped in a support network that will lift you up and keep you going.

Nolan Johnson: You just finished your keynote address at the Women in Electronics Forum,

and it was fantastic! You tell such a life-affirming story.

Elaine Larsen: It's fun. I'm 52 years old, and when I think back to where I was even 10 years ago, the confidence that has grown inside me electrifies the room. All of the strong women in that room supported me when I went on stage and told my story and my truth. It's awesome to get that positive feedback.

Johnson: Your message really was about "going out and doing it." You talked about not being afraid and finding support wherever you can.

Larsen: Absolutely.

Johnson: Is your crew all female?

Larsen: We have a lot of women on my team, but we don't just let women apply. It's an open environment. When they walk in, they know that I'm not going to judge them. I'm going to give them a chance to have a seat, but

they have to earn it; they can't just think it's expected. This is the real deal because my life, and the lives of others, are attached to these jobs, so they have to be willing to put in the work.

Johnson: Even in the electronics industry, there's still not true gender equality, but we're working on it.

Larsen: By now, gender shouldn't matter. I hope we'll reach gender equality someday. Until then, it's important for people, especially women, to talk about the issues at hand and bounce ideas back off from each other, and network. Who better to champion equality?

Johnson: I find a lot of parallels between what is happening in our industry and what happens in your profession, being in the male-dominated field of motorsports.

Larsen: Absolutely. Your brand, including who you are and what you do, is so important.





Johnson: Could you recount some of your key-note where you spoke about being in the hospital after crashing your dragster into a wall at 280 mph with severe injuries.

Larsen: It was scary. My husband knew that he had built the car that ended up hurting me. But as I saw it, he built the car that saved my life. Had he not built such a strong car, I wouldn't be here talking to you today. He did the right things, but he felt extreme guilt. When I opened my eyes, he knew that I was okay and that we were going to keep going because he knew how much I loved getting behind the wheel of this race car.

Everyone was saying, "You're done. That's it for you." Instead, my husband said, "This is not your last race. This is not how people and young girls are going to remember you—getting taken out in an ambulance." He was there when I couldn't stand up on my own, and he was there to help hold me up. He was so supportive and helped me regain my confidence.

Johnson: That's fantastic.

Larsen: Having a support system is so important. You have to surround yourself with peo-

When I race, I wear my sponsor brands, so I not only represent myself, but I represent every single sponsor. And when I walked to the stage at IPC APEX EXPO 2020, I had already thought about what I wanted everyone to take away from it. I wanted to put out the vision that I have when I see myself in the mirror. I wanted to be a strong, confident woman who's not afraid to take chances; if you feel that from the inside out, then usually people receive that.



ple who don't want to necessarily put you up on a pedestal but are there to lift you back up because some days I'm not the best. Some days, I'm only good, and I need other people to pick up the slack and help me become great; at other times, those same people are at their best, so it's more up to you.

Growing up in a loving community with people always looking out for each other is what has brought me to where I am today. I'm not out here to be better than anyone else; I'm just out here to be my personal best. There's always going to be someone who's going to be better than me, calling me out for a race and trying to beat me, and that's okay. As long as I'm out there doing what I love to do and helping empower young people to be able to do what they want to do, then I win.

Johnson: Terrific. Thank you, Elaine.

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

Elaine Larsen is the 2014 and 2015 IHRA Jet Dragster World Champion and driver of the Florida Institute of Technology Florida's Space Coast Jet Dragster. With more than 20 years of drag racing experience, she has never let being a female in the male-dominated racing industry affect her. In addition to racing, Elaine also focuses on mentoring the next generation of high-performance vehicle specialists.

In 2014, Larsen Motor Sports (LMS) launched its STEM initiative. Elaine and her team work with students who have their eyes on the finish line. LMS has full fabrication capabilities, from composites, engines, and fabrication to the day-to-day operation of a multi-car, turbine-powered race team; this is where students get the opportunity to jump right in and learn what it takes to put the dragsters down the racetrack. The company's affiliation with the Florida Institute of Technology has opened the door for internships, which led the LMS team to research many different avenues from biofuels to human-centered design.

IPC APEX EXPO 2020 Show Week Time-Lapse Video



We'd like to thank our good friends at MacDermid Alpha for letting us set up our camera in their booth. **CLICK IMAGE TO VIEW.**

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January 23 – 28

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2021 Call for Participation

Join us at **IPC APEX EXPO 2021** as a presenter or instructor and share your latest work with the electronics industry. The time to plan your participation is now!

IPC APEX EXPO is the electronics industry's premier technical conferences and exhibition, drawing an international audience to experience the latest advancements in design, materials, assembly, processes, inspection, and equipment. Areas of interest are diverse and ever-changing to keep up with the pace of innovation.

Presenting at **IPC APEX EXPO** provides visibility for you and your organization. The technical conference proceedings reach an audience of thousands and are regarded as the best place to follow current technologies and best practices. Your material will be seen by key managers and executives from all segments of the worldwide electronics industry.

To recognize exceptional achievement, an award will be presented for "Best Paper." **2019 Best Paper Winners** were Chen Xu of Nokia, and Jason Stafford of Dept. of Chemical Engineering, Imperial College London with their paper titled: Reducing Dust Deposition on Electronic Equipment By Optimizing Cooling Air Flow Pattern.

Professional development courses are a great way to delve deeper into the challenges facing the electronics industry. Instructors of these courses reach a wide swath of attendees focused on learning. This is also a great way to pass on knowledge based on years of experience and leave a legacy.

Technical Conference

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. Speakers receive a complimentary technical conference pass for the day they present and special pricing for additional conference options.

Conference Paper Timeline

Abstracts due **June 20, 2020**

Professional Development Courses

Course proposals are solicited from individuals interested in teaching half-day (three-hour) professional development courses on design, manufacturing processes, materials, supply chain and reliability.

Honorariums are offered to professional development instructors to cover travel expenses.

Professional Development Timeline

Proposals due **June 8, 2020**

For more information on TOPICS, SPEAKER BENEFITS and SPEAKER RECOGNITION AWARDS, please visit www.ipcapexexpo.org/cfp.

Any questions or special requests, contact **BrookSandy@ipc.org**.

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ADVERTISER INDEX

Blackfox Training Institute.....	51, 97
Bowman XRF.....	59
Burkle North America.....	39, 133
I-007e Micro Webinars.....	89
I-Connect007.....	131, 139
I-Connect007 eBooks.....	61, 129
IPC.....	79, 152
LiloTree.....	115
Mirtec.....	71
Rogers Corporation.....	55
Super Dry.....	35, 111
Taiyo America.....	66, 67
Technica USA.....	25, 101
Uyemura.....	83
Ventec International Group.....	15, 107
Zentech.....	43



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Thank you to all who have contributed
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