



The European Institute for the PCB Community

## EIPC SPEeDNEWS

*The Weekly On-Line Newsletter from the European Institute of Printed Circuits.  
Issue 25 – December 2019*

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### NEWS FROM CHINA

**Ventec invests in key equipment to support expansion of PTFE laminates manufacturing capabilities**



**December 16<sup>th</sup>, 2019 – Ventec International Group Co., Ltd. (6672 TT) has significantly increased its PTFE laminate manufacturing capabilities following a strategic investment in a new state-of-the-art high-temperature**

**press and lay-up/break-down line at its Suzhou (China) manufacturing plant.**

With 5G and evermore sophisticated radar applications, the demand and requirements for low loss/high frequency material is accelerating. Critical RF/Microwave-, antenna-, power amplifier- and sub-assembly-applications require superior electrical performance that can be delivered through PTFE laminates. To serve the increasing demand of these PTFE type products, Ventec has strengthened its investment in its Suzhou manufacturing plant to be even better positioned for the increase in demand and meet customers accelerated radar and 5G deployment requirements.

The most recent important equipment investment in a new state-of-the-art high-temperature press and lay-up/break-down line at Ventec's Suzhou (China) manufacturing plant delivers a significant increase in manufacturing capacity to meet the growing demand for PTFE laminates. This includes the launch and roll-out of tec-speed 30.0 - Ventec's latest ceramic filled high-speed/high-frequency PTFE material range that offers the highest signal-

integrity characteristics for the most advanced high-frequency systems such as 77~79 GHz automotive radar systems.

tec-speed 30.0 (VT-3703) offers:

- Dk 3.0 with extremely low Df (0.0009)
- DK-stability versus temperature
- Lower in-plane thermal expansion

The current Dk 3.0 tec-speed 30.0 version will be supplemented by Dk 6.15 and Dk 10.2 versions in the first half of 2020, offering an even wider range of options for applications such as automotive radar, cellular base stations, power amplifiers & antennas, global positioning satellite antennas, patch antennas for wireless communication or power backplanes.

Jason Chung, CEO said: "The investment and installation of the PTFE manufacturing line is yet another important piece of the puzzle in our global growth program. The addition of the line to our range of capabilities demonstrates to our customers our commitment to maintaining the most up-to-date manufacturing technologies that support our clients' PCB design, development and manufacturing needs."

For more information about Ventec's solutions and the company's wide variety of products, please visit [www.venteclaminates.com](http://www.venteclaminates.com).



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## NEWS FROM GERMANY

# FED

Fachverband für Design,  
Leiterplatten- & Elektronikfertigung

### **FED 2020: dates and events in the New Year**

The new year will soon start: In 2020, the FED would like to continue to support you in expanding your knowledge and network. Choose from more than 160 seminar dates or visit one of our 12 regional group events with practical lectures on current electronics topics. In terms of content, the highlight will be the 28th FED conference, which will take place from 17.09. will take place in Augsburg until 18.09.2020. Make a note of the dates now and come by!

### **4.12.2019 - Berlin - FED**

Innovation network 3D electronics is still looking for two SMEs for development projects

The innovation network 3D electronics offers small and medium-sized companies (SMEs) the opportunity this year to become partners in the network and to implement research projects on three-dimensional electronics. Two other SMEs with less than 500 employees can participate, who want to work together on new, three-dimensional solutions for electronic assemblies and devices. The participating companies receive support and expertise from industrial companies and research institutions in the network in order to promote their own innovation projects quickly and easily. SMEs can receive grants of up to € 170,000 through the ZIM program from the Federal Ministry of Economics. The network initiated by the Electronics Design Association (FED) has so far been made up of eight SMEs, 5 Fraunhofer Institutes, 2 universities and the network management facility Jöckel Innovation Consulting. The goal of the network is to provide innovative products and processes for individual and technically demanding

To develop electronic elements. Further information on the network, the contact persons and the current partner structure can be found on the homepage: [www.3d-elektronik.net](http://www.3d-elektronik.net).

### **2/02/2019 - Berlin - FED**

**FED congratulates new ZED graduates**

At the end of the year, the FED can congratulate other ZED graduates who completed the training program "Certified Electronics Designer" in November 2019.

Congratulations to the following graduates who have successfully passed the required ZED levels and are therefore entitled to the title of Certified Electronics Designer ZED:

- Frank Greve, Dräger Safety AG & Co. KGaA
- Fabio Vilella, Kontron Electronics AG

All graduates from ZED Level I to IV can be found at [www.fed.de/zed](http://www.fed.de/zed)

### **12/02/2019 - Berlin - FED**

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### **Jan 28, 2020 - Berlin - FED**

#### **Save the Date: regional group event Berlin**

The next regional group event in Berlin will take place on January 28, 2020 from 1:00 p.m. to 5:00 p.m.

Look forward to two interesting lectures: Stefan Kappes and Felix Büchner from ZESTRON report on the subject of "surface requirements before coating". Afterwards Paul Ranft, Optimel Fusion Casting Technology, will speak about "Low Pressure Molding". At the end of the

During the event, guests can visit the laboratory on a guided tour. Make a note of the appointment now. There are still places available.

**FED e.V.**

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**info@fed.de**



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### NEWS FROM THE EIPC

#### ***The Needs for the Next-Generation Electronic Devices and changes in fabrication solutions for PCBs, PCBAs, Materials and Technologies.***

Attending an EIPC Conference in the middle of winter is becoming a tradition. It joins many other traditions, nay even ancient customs, such as Beating the Bounds. This is still observed in some English and Welsh parishes. Under the name of the Gangdays, the custom of going a-ganging was kept before the Norman Conquest. A group of old and young members of the community would walk the boundaries of the parish, to ensure that no farming was encroaching upon the 'common' land upon which livestock could be grazed. They were usually led by the parish priest and church officials, to share the knowledge of where they lay.

It's the words 'gang' and 'old and young' which resonated, along with the sharing of knowledge. For 'parish priest' you might think of Alun Morgan, our Chairman, and for 'officials' you could really only think of Kirsten, who is the only official we have. True, we have Directors, but they are invariably busy tending their own flocks.

So it would be really good if you could cut along to Rotterdam and join members of the PCB community and walk the boundaries of knowledge for a couple of days!

During the EIPC Winter Conference 2020, participants will learn how to meet and adapt to the changing needs of Europe and the global electronics market. Industry experts will explain the changes in the world-wide PCB supply chain for technology, materials and surface coating of printed circuit boards.

#### **Bonus Programme:**

Visit to the Hutchison Ports ECT Rotterdam and Network dinner The Castle, Sparta Stadium  
**First come, first serve!**

We look forward to welcoming you in Rotterdam February 13 &14!

[Registration form EIPC Winter Conference Rotterdam](#)

#### **Conference hotel:**

Van der Valk Hotel Rotterdam-Blijdorp  
Energieweg 2  
3041 JC Rotterdam  
[www.hotel-rotterdam-blijdorp.nl](http://www.hotel-rotterdam-blijdorp.nl)  
[info@rotterdam-blijdorp.valk.nl](mailto:info@rotterdam-blijdorp.valk.nl)

For your hotel room reservation for the period: 12.02.2020-14.02.2020 please note the following conditions:

Booking code: BLI-GF17014 EIPC

Double room for single use including breakfast for 110.00 EUR/per night excl Tourist Tax

Double room including breakfast for 129.50/per night excl Tourist Tax

Please contact the hotel to make your hotel reservation via

[info@rotterdam-bljldorp.valk.nl](mailto:info@rotterdam-bljldorp.valk.nl) or call +31-102988777

<b>Conference Programme Day 1, Thursday February 13</b>		
The Needs for the Next-Generation Electronic Devices and changes in fabrication solutions for PCBs, PCBAs, Materials and Technologies		
08:00-08:30	Conference Registration and Table Top & Poster Exhibition build up	Table Top & Poster Display Area
08:30-09:00	Welcome by the EIPC President	Alun Morgan, EIPC, UK
<b>Keynote Session 1: New Business &amp; Market Outlook</b>		<b>Moderator: Alun Morgan, EIPC, UK</b>
09:00-09:30	Business Outlook: Global Electronics Industry	Walt Custer, Custer Consulting, USA
09:30-10:00	TBC	Dr. Hayo Nakahara, NT Information Ltd.
10:00-10:30	5G - mmWave Technology Challenges for PCB Manufacturing	Johal Kuldip, Atotech Deutschland, DE
10:30-10:40	Panel discussion	
<b>Session 2: Inkjet Technologies/Coating Technologies</b>		<b>Moderator: Emma Hudson, Gen3 Systems, UK</b>
10:40-11:00	Printed Electronics - Pushing the Limits	Dr. Andreas Albrecht, Cicor Group, CH
11:00-11:20	Development and processing of an ink jettable solder mask and the benefits of its use in PCB manufacture	Chris Wall, Electra Polymers, UK
11:20-11:50	<b>30 minutes Coffee break</b>	
11:50-12:10	Update on Inkjet Soldermask	Don Monn, Taiyo America, USA
12:10-12:30	New manufacturing technologies	Uwe Altmann, Orbotech, BE
12:30-12:40	Panel discussion	
12:40-13:40	<b>Network Lunch</b>	<b>Hotel restaurant</b>
<b>Round table: Roadmapping and Standardization</b>		<b>Moderator: Tarja Rapala-Virtanen, EIPC, FI</b>
13:40-14:40	Industry Roadmap	iNEMI, Grace O'Malley, UK
	Reliability and Standardization	Elmatica, Jan Pedersen, NO
	Standardization updates	Emma Hudson, Gen3 Systems, UK
<b>Session 3: Material technology - Reliability - Environmental Technology</b>		<b>Moderator: John Fix, Taiyo America, USA</b>
14:40-15:00	High Frequency Dk & Df Test Methods Comparison	Martin Cotton, HDP User Group, UK
15:00-15:20	TBC	Alun Morgan, Ventec Group, UK
15:20-15:40	Reliable, high temperature stable materials are becoming increasingly more important	Volker Klafki, Technolam, DE
15:40-16:00	Quo vaditis Flame Retardants? How can we meet ever more stringent performance and sustainability demands?	Adrian Beard, Clariant Germany, DE
16:00-16:20	Analytical determinations of unreacted TBBPA flame retardant in printed wiring boards	Dr. Sergei Levchick, ICL-IP, USA
16:30-19:00	<b>Departure &amp; Visit Factory Hutchison Ports Rotterdam</b>	
19:30	<b>Network Dinner Sparta Stadium "The Castle"</b>	
22:30	<b>Return Valk Hotel Blijgaarde</b>	

## Conference Programme Day 2, Friday February 14

The Needs for the Next-Generation Electronic Devices and changes in fabrication solutions for PCBs, PCBAs, Materials and Technologies		
<b>Session 4: New technologies / Design</b>		<b>Moderator: Martyn Gaudion, Polar Instruments, UK</b>
09:00-09:20	Recent development on Design & Manufacturing of Lab on PCB Devices	Dr. Despina Mochou, University of Bath, UK
09:20-09:40	Direct Imaging	J-P Birraux, First EIE, CH
09:40-10:00	New innovation for PCB registration improvement	Hans Fritz Inpeko/ SAT Electronic GmbH
10:00-10:10	Panel discussion	
10:10-10:40	<b>30 minutes Coffee break</b>	<b>Table Top &amp; Poster Display Area</b>
<b>Session 5: Manufacturing Technologies and New Processes</b>		<b>Moderator: Oldrich Simek, Pragoboard, CZ</b>
10:40-11:00	Vecs; How to increase efficiency	Joan Tourné, Nextgin Technology, NL
11:00-11:20	InPulse 3 - A New Horizontal Cu Plating System for mSAP/amSAP Technology	Mustafa Özkök, Atotech, DE
11:20-11:40	Thermal Management Solutions using PCBs	Mike Tucker, Shenzhen Kinwong Electronic, CN
11:40-12:00	TBC	Laurent Nicolet, SCHMID Group, CN
12:00-12:15	Panel discussion	
<b>12:15-12:25</b>	<b>President closing remarks - End of Conference Day 2</b>	
<b>12:25-13:30</b>	<b>Network Lunch</b>	<b>Hotel restaurant</b>

The EIPC is not responsible for the content and the presentation of the technical papers, which rests with the presenters. Changes in the programme may occur, due to circumstances, for which the EIPC may not be held responsible.



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### ELECTRONIC INDUSTRY NEWS

#### **Samsung is leading the 5G smartphone market with a 74% share**

*The 5G industry is growing*

By [Rob Thubron](#) TechSpot on December 11, 2019, 8:41 AM

In a nutshell: Samsung has long been at the top when it comes to worldwide smartphone shipments, and it's leading the 5G handset segment, too. The Korean giant took 74 percent of this emerging market in the most recent quarter, according to new research.

IHS Markit [reports](#) that Samsung shipped 3.2 million of the 4.3 million 5G smartphones in Q3 2019. And while its share of devices fell from 83 percent to 74 percent, its shipments increased over 100 percent from the previous quarter's 1.5 million.

Sitting behind Samsung in second place is LG, which took 10 percent of the market with 400,000 shipments. Both companies were quick to get their 5G devices onto the market and take advantage of the early 5G networks in South Korea.

With a total of five 5G devices, Samsung has the largest portfolio of these phones. Its Galaxy Note 10 Plus 5G was the best-selling 5G handset last quarter, moving 1.6 million units. "Samsung is integrating 5G connectivity in a broad range of devices, from the Galaxy A90 to the Galaxy Fold 5G," said Jusy Hong, smartphone research and analysis director at IHS Markit. "The Galaxy Fold's combination of new display technology and 5G connectivity shines a light on the potential of multiple technologies to transform the mobile user experience."

The rest of the top 5G companies is made up of Chinese firms: Vivo, Huawei, Oppo, and Xiaomi. While they may take a large share of the non-5G smartphone market, their combined share here is just 17 percent.

The average price of a 5G smartphone is dropping, down from \$1,153 in Q2 to \$994 in Q3, though they're still three times higher than the average smartphone price of \$309. But with costs declining, the likelihood of 5G iPhones, and more 5G networks coming online, including those in China, demand for the handsets is expected to jump from 13.5 million in 2019 to 253 million next year.

Samsung is also leading the way when it comes to non-5G Android phones. Recent data showed the Galaxy Note 9 was the most popular of these handset in most US states.

## A Self-Driving Freight Truck Just Drove Across the Country to Deliver Butter

It made the daunting 41-hour trip from Tulare, California to Quakertown, Pennsylvania.

*By [Courtney Linder](#), [Popular Mechanics](#).*

**Plus.ai**, an artificial intelligence start-up in Cupertino, California, has engineered an autonomous driving system for commercial freight trucks. This week, it made the world's first cross-country trip of its kind to deliver butter to a small town in Pennsylvania.

- While this isn't the first time an autonomous truck has made a cross-country trip, it's likely the first time a commercial freight truck has made a real delivery like this.
- Autonomous trucks are likely going to become mainstream before any self-driving consumer vehicles. That's because the long stretches of highway are pretty boring and predictable compared to the dynamic buzz of last-mile city streets.

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If you happen to live in Quakertown, Pennsylvania, some 50 miles outside of Philadelphia, your next stick of creamy butter just may have been delivered via self-driving freight truck. It's believed to be the first time an autonomous freight vehicle has made a cross-country trip, let alone a commercial delivery.

Plus.ai, the company behind the self-driving technology, announced the news on Tuesday. The company has only been around since 2016, so this is a particularly interesting feat.

The founders, a group of Stanford Ph.D. students, knew that trucking—which has been experiencing a labour shortage since 2003, according to the Bureau of Labor Statistics (BLS)—is the primary method for shipping goods across the U.S. So they decided to apply their artificial intelligence know-how to long-haul trucking, building out the full-stack self-driving technology needed to make a cross country freight trip possible.

Hidden Swimming Pools

Play Video



SCREENSHOT/GOOGLE MAPS

### ***The 2,800-Mile Journey***

The trip took about 41 hours to complete, according to data from Google Maps, and spans over 2,800 miles. It took the Plus.ai truck three days to complete the journey, during which it made a few stops, but never because it couldn't handle the driving. In fact, there was a safety driver aboard the vehicle, but they never had to take over and intervene for the truck other than during fuel stops and federally mandated breaks. The company said there were zero "disengagements," where the truck lost control.

Back in March 2017, Plus.ai became one of the first autonomous trucking companies to land a California Autonomous Vehicle Testing License, which is exactly what it sounds like. According to the California Department of Motor Vehicles, there are now 65 companies that hold one of these permits.

To complete the long trip and deliver the butter before it perished, the truck relied on Plus.ai's SLAM technology, which is an acronym for its instant positioning and map building solution. That includes a suite of sensors like cameras, lidar and radar, very similar to what you'd see in an Uber self-driving Volvo or an Argo AI Ford Fusion. What stands out is the company's data fusion system, which combines this information to create a field of front detection that's over 1,600 meters deep, allowing the truck to see far ahead. At the same time, Plus.ai achieves a wide field of view to help the truck adapt to new road shapes and slopes.

Let's not forget that the damn thing was pulling around a refrigerated cooler with 40,000—we repeat, 40,000—pounds of butter onboard. The other primary obstacle, beside the perishable goods, is weather. This trip, which took place during the week of Thanksgiving, encompassed 12 states and some pretty inclement conditions, including snow.

### ***Trucking Companies That Deliver***

Despite this success, Plus.ai is not operating in a vacuum, and competitors are working hard to accomplish much the same.

Over the summer, San Francisco-based Starsky Robotics partnered with Loadsmart, a New York City logistics company, to automatically dispatch a freight truck. Through Loadsmart, the goods were priced, tendered and booked. Starsky, which has remotely driven a freight truck over nine miles on an Orlando, Florida highway, can handle the actual driving. That trip was the first unmanned test of a self-driving truck on a public highway. All this is to say that the partnership is working toward a human hands-free operation.

However, Trucking People LLC—a Houston, Texas-based talent acquisition firm specializing in the transportation industry—told *Popular Mechanics* that Starsky Robotics "laid all their drivers off before Thanksgiving, and have left vendors stuck with invoices," including Trucking People, itself.

It illustrates just how nascent this technology truly is and the fact that players in the space can experience success and then fall; it's an unpredictable market.

#### MORE TRUCKS



**Hyundai's Hydrogen Semi Is Built to Take on Tesla**



**The World's Largest EV Is a Dump Truck**



**This Is Tesla's New Electric Pick-Up Truck**

Meanwhile, there's plenty of other competition.

Xos Trucks in Los Angeles is working with UPS to test fully electric delivery trucks. Pronto.ai, founded by former embattled Uber engineer Anthony Levandowski, has engineered a highway safety system that offers full adaptive cruise control, automatic emergency braking and proactive lane centering. TuSimple, based in San Diego, has partnered with the U.S. Postal Service to haul trailers between Phoenix and Dallas. Aurora Innovation, Ike, Einride, Kodiak Robotics, and Embark also want a slice of the pie.

### ***A New Shipping Standard***

When long-haul autonomous trucking becomes an industry standard, railroads and other shipping options will feel the pinch, according to Omar Allam, a Twitter user who works in the trucking industry. He put together a topical thread to put Plus.ai's feat into context. He says that Pepsico's primary mode of shipping is through trucks, because it's typically the fastest option, but the company will use railroad shipping in some cases to cut down costs.

"For Propel and Gatorade, the current routine shipment from Penn to San Fran area is about 9 days total. 7-8 days by rail from PA to Phx, then an additional 1-2 day transit by truck from Phx to San Fran. In urgent rushed cases, a direct truck between the two takes around 5 days," Allam wrote. "Considering the estimated cost savings anticipated from autonomous vehicles, if the cost of a shipment in 5-15 years from Penn to Cali via self-driving truck comes even close to the cost of a rail shipment, neither rail, nor human-driven trucks, will stand a chance."

Allam estimated truck transit times could be shaved down 30 to 50 percent and rail transit times could be shortened by 200 percent. For perishable goods, this is a huge deal. Tropicana drinks, he said, have a shelf life of about 30 days. Any extra time-on-shelf could lead to higher profit margins. Plus, a 3-day transit route rather than a 9-day trip means companies can become more discerning with products. That is, they can adapt to consumer demand much more adeptly with these shorter shipping times.

In turn, truck drivers—who earn a very livable middle class wage of around \$43,680 per year, according to BLS data—will be hit, Allam said.

"Surely we won't replace all 3.5 million truck drivers in 15 years, but even 1/5 of that number would be 750,000 drivers," he wrote. "96% of whom are men, average age 49, average salary around 45k/year, all off of a high school education. That's 750,000 families left with nothing."

**Be careful what you wish for.**



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### NEWS FROM THE UK

## Mark Your Calendar Now

### **IFS2020 - Future Horizons' Annual SC Industry Outlook & Forecast.**

Our industry forecasts, methodology and analyses have consistently proved both accurate and insightful, second to no-one. For example, we were the ONLY industry analyst to correctly forecast the 2018 double-digit super-cycle growth, at a time when ALL other analysts were incorrectly predicting low, single-digit industry growth. Our analyses explained why we believed we were right; the ensuing events subsequently proved our analysis correct. This was not good luck; low growth was never an option and we were not afraid to stick our necks out and go against the tide.

Entering 2020, the industry remains on edge, hardly surprising given the raft of global economic uncertainties engulfing the world ... from China tariffs to Brexit; trade wars to equity corrections. Muddying the waters further is the fact some firms are performing badly (e.g. TI and Infineon) whilst others are showing strong growth. These uncertainties are casting an emotional fog on the outlook. Now, more than ever, is the time for cool heads, sound information and a focus on the fundamentals.

Find out the facts with the proven industry analysts' view at Future Horizons annual industry outlook and forecast, Wednesday 15 January 2020 at the Holiday Inn Kensington Forum, London SW7 4DN, UK, 10:30am-4:00pm (Registration from 10:00am). For full details, visit: <http://www.futurehorizons.com/page/13/Semiconductor-Market-Forecast-Seminar>.

Now in its 32nd year, Future Horizons' twice-yearly forecast events are a vital link to provide industry with high quality, cost effective, market research together with the analyses and reasons why. Whether a seasoned veteran or industry newcomer this event is invaluable to executives from the semiconductor, electronics and related industries. Delegates will receive copies of all the material presented in both binder and electronic format.

## **Can't**

No need to miss out, buy the proceedings instead

The seminar can also be held in-house for your convenience

Please pass to a colleague if already attending or not suitable for you

## **Register Now**

To reserve your place [call](tel:+441732740440) (+44 1732 740440), e-mail ([mail@futurehorizons.com](mailto:mail@futurehorizons.com)), fax (+44 1732 608045), on-line ([www.futurehorizons.com](http://www.futurehorizons.com)) or by post (Blakes Green Cottage, Sevenoaks, Kent TN15 0LQ, England)

Malcolm Penn  
Chairman & CEO

## **Attend?**



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## INTERNATIONAL DIARY

**News from China**  
**Read more**

2020

**EIPC Winter Conference Rotterdam, NL**

**Visit Terminals ECT Port Rotterdam**

13 & 14 February

Rotterdam, NL

**SMT Hybrid Packaging**

5-7 May 2020

Nurnberg, DE

**EIPC Summer Conference Örebro, SE**

**Visit Ericsson 5G Test Centre**

16 & 17 June

Örebro, SE

**ECWC15, WECC World Electronics Circuits Council**

30 November-2 December

Shenzhen, CN



Issue 25 – December 2019

## NEWS FROM THE IPC

### **IPC Welcomes U.S. – China Phase One Deal**

The following statement can be attributed to John Mitchell, IPC president and CEO:

“The electronics manufacturing industry welcomes the announcement that the U.S. and China have agreed to a "phase one" trade deal bolstering enforcement of China's intellectual property laws and rolling back or postponing retaliatory tariffs on thousands of goods traded between them.

“As documented in a recent IPC study, many IPC members are feeling the pain of higher costs, supply chain disruptions, administrative hassles, and reduced access to valuable markets as a result of the U.S.-China trade war.

“We call on the governments of the United States and China to de-escalate the tariffs on both sides; focus on results at the negotiating table and conclude agreements that address long-standing issues of concern to both sides. We also call on all members of the World Trade Organization to restore that body's ability to play its role as arbiter of international trade disputes, so that nations won't feel a need to resort to tariffs to resolve disputes.”

### **Electronics Manufacturers Report Slowing Growth and a**

### **Cautiously Optimistic Outlook**

Growth is slowing worldwide and the industry's outlook is less optimistic than in previous quarters, although it is still generally positive, according to the results of IPC's fourth-quarter 2019 Pulse of the Electronics Industry survey. Based on

responses from 82 companies that make up a representative sample of the industry, global third-quarter 2019 sales growth, averaging 3.0 percent, was at its lowest level since the quarterly survey began in mid-2017. The sales growth the respondents predicted for the current quarter is down further, averaging 2.6 percent.

This quarter's composite score for the current direction of the business environment also fell to its lowest level since mid-2017. It remains in positive territory, but just barely. Current-state scores for Europe and the Americas turned negative this quarter. Sales, orders and profit margins are moving in a positive direction on balance this quarter, while labor and material costs, ease of recruiting, inventories and order backlogs are having a negative impact on the current state.

The industry's expected direction in the next six months remained generally optimistic, with all business indicators looking positive. Among the industry segments, PCB fabricators are the most optimistic about the next six months. Overall, however, the six-month-outlook score continued to weaken compared to the first three quarters of this year. This indicates that the industry expects its health to remain generally good through the first quarter of 2020 despite some slowing.

The respondents' outlook for the next 12 months remains positive but is down substantially from previous quarters. While a majority of respondents in all segments described the 12-month business outlook as very or somewhat positive, only PCB fabricators were unanimous in reporting a positive outlook. The composite scores on the business outlook for the next 12 months are positive in all regions except Asia, where the score declined to neutral (0 on the index). The uncertainty of trade relations between the U.S. and China is a contributing factor to the lacklustre 12-month outlook for respondents in Asia.

A ranking of opportunities that will drive the industry's future business growth showed that the Internet of Things (IoT) and smart systems is seen as the number one driver, followed closely by growing markets and 5G/high-speed

communications. Defense and aerospace topped the list of growing vertical markets cited by the respondents. Medical device and LED lighting markets were also cited.

Respondents also ranked a list of major concerns about conditions in the business environment in terms of their impact on future business growth. Economic uncertainty is the leading concern. Asked about conditions or trends that are significantly increasing their costs, respondents predominantly cited the tight labor market and trade conflicts.

Pulse of the Electronics Industry is a global survey-based data service from IPC that provides a quarterly report on the health of the industry and its outlook for the coming year. The quarterly report shows what factors are driving or limiting growth, and how the outlook differs in various regions and segments of the industry. The confidential surveys are open to all in management positions in the electronics industry. Survey participants receive the report on the quarter's results.