

December 2016

the pcb magazine

- 12 Much Ado about Sales and Marketing
 - 30 Selling Technology— a PCB Engineer Transitions to Sales
 - 38 Strengthening Your Value Proposition to Boost Organizational Success
- Much More!



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Featured Content

Sales & Marketing

Our feature contributors have plenty to say this month, including thought-provoking ideas and unique perspectives they've accumulated in the quest for successful sales and marketing strategies. We open this issue with results of our monthly survey on the topic at hand, and a breakdown of the responses.



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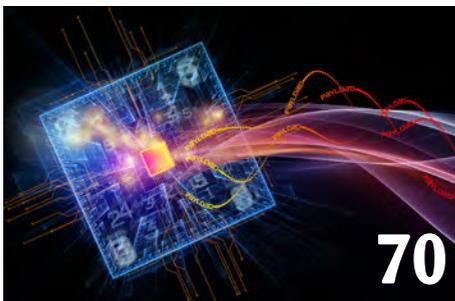
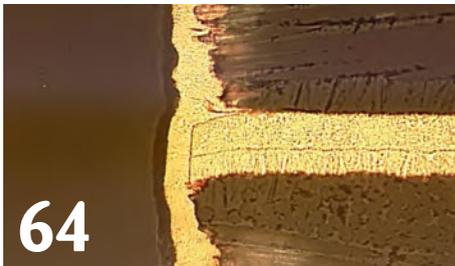
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We're All in Sales

by Patty Goldman
I-CONNECT007

When I was in technical marketing and visited customers with sales guys, I studied the various techniques they used. Some were very good at selling their process, regardless of which of the chemicals companies they worked for. One sales fellow in particular was very much in his customer's corner, to the extent that they provided a desk for him at their plant. Another was so in tune that he went to his biggest customer every day to do the morning electroless copper analysis (I presume to make sure that it was correct). Maybe that was excessive, but it probably headed off a lot of potential problems, too. For the most part, all were enthusiastic about the products they were selling and convinced they had the best stuff on the market.

In the meantime, I thought, sales is not for me. I much preferred coming in and making presentations without the day-to-day responsibility for making numbers. I thought of cold calling and in fact almost any type of calling on customers as a bit frightening. It took a long time before I realized that I was selling and in fact we all are selling our companies' products in one way or another. For me it was making presentations, writing articles and helping the sales guys in whatever way possible. Still selling for the company, right? Writing a cover letter for a quotation, answering questions, expediting this or that, attending a meeting to represent our interests—all forms of selling. Even the newsletter I instituted to keep the sales guys up to speed and on target for a fast-moving product counted as sales. When working in a PCB shop, even without any actual customer contact, if you "touch" your customer's product in any way, you are selling—by the quality job you do, by the speed with which you do it, and half a dozen other things that you will learn by reading *The PCB Magazine* this month.

As you have probably noticed, we have quite

a few regular columnists and authors these days—and this was yet another issue that just about everyone wanted to chime in on. So let's get on with it and tell you what we have inside here.

We open this issue with results of our monthly survey on the topic at hand, as presented by the I-Connect007 Research Team. We received some interesting results, plus a few thought-provoking ideas that we definitely want to share with you.

Next, we have All Flex's Dave Becker with a great column on...duh...sales. Dave describes the "customer acquisition of finding and selecting new customers," followed by "execution," meaning the successful building and delivering of the product. He echoes my sentiment that "everyone is a salesman."

We asked our resident sales and marketing guru, Dan Beaulieu, to write a column for this issue. He chose to present his five favorite books on sales. Read the reviews of his five books and I guarantee you will be looking them up a moment later. As Dan says in his opening paragraph, these five books "can directly influence the way



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we think about sales, marketing, customers and customer service.”

American Standard Circuits' John Tusant writes on transitioning from a PCB engineer into a sales position. John gives some excellent advice on dealing with customers' revised view of the engineer-turned-sales-guy. Worth reading because in our industry, technical sales is where it's at.

And our resident social media guru at PCB007.com, also a regular columnist who sometimes gets overlooked because it seems his subject matter is not necessarily germane to the PCB world, Bruce Johnston presents a great case for making use of LinkedIn as a sales tool in your sales/marketing toolbox. After reading his column, take a few moments to check out Bruce's columnist page for some real how-to instructions on how to get started and make the best use of this powerful tool.

Sales and marketing is all about making your company more successful. Which is why this month, IPC's John Mitchell provides solid advice on how to strengthen your value proposition in order to boost your company's success. Do you know your company's value proposition, and is it strong? Read this article, especially if you aren't quite sure...

Tara Dunn of Omni PCB has done a little survey of her own, asking both PCB manufacturers and PCB users a couple of questions on what makes a good salesperson and what can be improved—from both sides of the aisle, so to speak.

I included a couple of interviews in this issue, both by Dan Beaulieu. I know, that's a lotta Dan, but you will find them interesting. The first is with our industry M&A guy, Tom Kastner of GP Ventures. Tom reviews the M&A activity of 2016 and then looks ahead to 2017. The second interview is with Bruce Johnston, truly a sales veteran. We get to know Bruce a lot better in this interview. He is a real go-getter! And it turns out both of these guys are “real” PCB people—yes, they actually worked in the business.

This month, Barry Cohen (Launch Communications) adds his usual whimsical, yet informative touch as he talks about developing a total marketing program with integrated tactics, as opposed to one-off projects that are not part of the plan, so to speak. His tongue-in-cheek

style aside, you will always do well to follow his advice.

No issue would be complete without some good technical columns. RBP Technology's Mike Carano delivers with his second column on drilling, a continuation of last month's column. True to form, Mike focuses on some common defects and troubleshoots them for us.

Keith Sellers, NTS-Baltimore, writes this month on supplier surveillance plans. While it sounds slightly ominous, Keith explains the importance of ensuring that what you get is exactly what you ordered. As he puts it, “A little bit of testing on the front end...can go a long, long way in providing you and your customer some piece of mind.”

Last, but of course not least, we have the final column in Happy Holden's 25-chapter Essential Skills series. This last chapter is on predictive engineering for new products, of which design for manufacturing and assembly (DFM/A) is a part. Happy explains predictive engineering as an activity involving trade-offs, focusing on product definition, design, PCB fabrication, and assembly, as well as specs, standards and regulations. Watch for an expanded edition of the entire 25 chapters in an upcoming downloadable book published by I-Connect007.

I originally thought this would be a “light” issue but there was just so much to talk about—and so much to be said. Don't forget, techies, we're all in sales, so do study up a bit with this. Next month we're back to the nitty-gritty with an issue devoted to plating and surface finishing. Ah, wet processing! [Subscribe](#) now and be one of the first to read next month. **PCB**



Patricia Goldman is a 30+ year veteran of the PCB industry, with experience in a variety of areas, including R&D of imaging technologies, wet process engineering, and sales and marketing of PWB chemistry. Active with IPC since 1981,

Goldman has chaired numerous committees and served as TAEC chairman, and is also the co-author of numerous technical papers. To contact Goldman, [click here](#).

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Much Ado about Sales and Marketing

by I-Connect007 Research Team

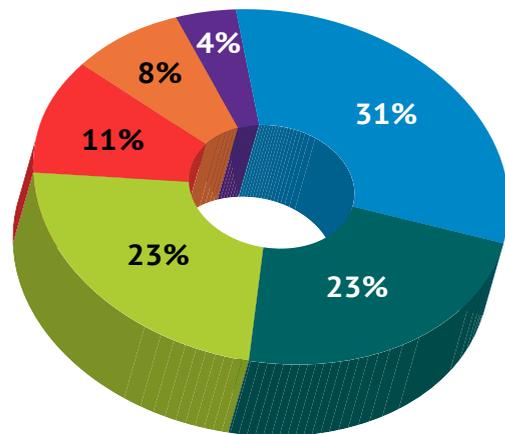
We all know that without a concerted sales effort there are no customers, and without customers there is no business. It is also no secret that most companies in the printed circuit board fabrication and assembly businesses have suffered from lack of sales over the years—possibly because company leaders are traditionally technologists, engineers or operations people. And these people have very little, if any interest, in the art of sales and marketing.

In fact, until recently, most companies did not believe in marketing their companies at all—figuring that if they built great products, customers would show up at their door. But times are changing and companies have been forced to focus more on their sales and marketing effort as they realize that they must find new customers and win their business if they are going to live another day.

Realizing that, we at I-Connect007 recently surveyed our readers to get a better idea of what company leaders thought about sales and marketing. We did this for a couple of reasons. First, we were curious; second, we wanted to learn more about our readers, what they need and want, and how to best help them.

We sent this survey to several sales leaders; the results were informative, at times surprising, and even a bit disappointing, especially when some of the participants reported that they had no sales and marketing plan at all. Figures 1 and 2 illustrate the demographics of those who responded.

Primary Business of Respondents



● Suppliers ● PCB Fabricators ● Consultants ● Ass. ● OEMs ● Designers

Figure 1: Primary business of respondents of the 2016 I-Connect007 sales and marketing survey.



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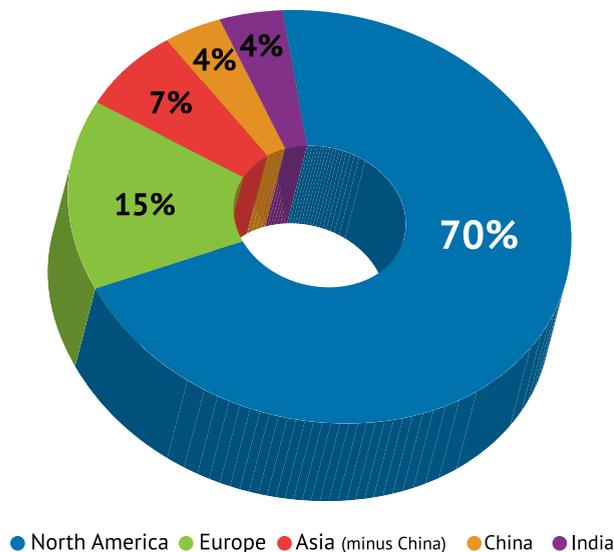


Figure 2: Location of respondents to the sales and marketing survey.

We also asked respondents' titles; more than 60% were in upper management positions ranging from owner/founder to general and business managers. Another 20%+ were in a sales function with the remainder in design, engineering and similar capacities, which indicated that responses were indeed from our intended audience.

The following is a summary of our findings.

1. What's your preference—direct sales people or sales representatives?

Essentially two-thirds of the respondents preferred direct sales, while one-third preferred sales reps. A variety of reasons were named, including:

- You own them and can therefore direct them
- They are better motivated because they sell technology...
- You can control their behavior tied to corporate goals

For the most part, our responders preferred direct salespeople but found them very expensive as opposed to reps.

2. What are the greatest challenges in working with reps?

Results indicated that people felt it was difficult to keep reps focused and working on the product. Also mentioned was making sure reps were properly trained and educated, to ensure complete product knowledge. Other issues mentioned were territory conflicts and distance, forecasting, and loyalty; some of you felt that reps' and company interests were not always fully aligned.

3. What are the greatest challenges in working with direct salespeople?

Some respondents stated no major drawbacks, while many cited the expense of direct salespeople. Motivating direct salespeople to get new business was considered a serious challenge as was lack of technical knowledge. Getting them out of the office was cited as one of the biggest challenges. And there was concern about getting them to sell what you build rather than what you don't build.

4. What is the overall greatest challenge in your sales process?

Representative responses include:

- Getting new accounts
- Price
- Selling against offshore
- Developing a plan and working that plan for results
- Forecasting and budgeting
- The entire lead generation process and making the sales people stick to it

Sadly, albeit truthfully, one person said, "The PCB industry has left the country."

5. How long does it take for you to convert a prospect to a customer?

The conversion-time breakdown can be seen in Figure 3. Generally, the respondents answered around three months to a year to convert a prospect to a customer. Others, meanwhile, said it depends on the scope and complexity of the project, and the qualification process by the customer.

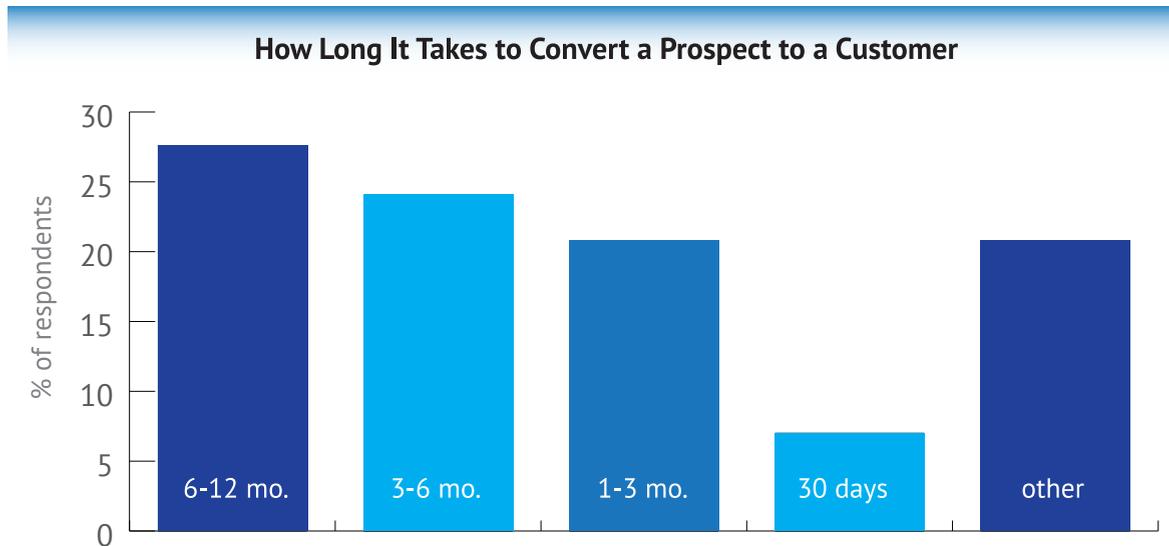


Figure 3: Length of time to convert from prospect to customer.

A few notable comments:

- “Be careful of customers who are too easy to convert.”
- “The larger the longer.”
- “...the day of the first meeting to 2 years.”

6. What advice/strategy would you give a salesperson in this market?

Most of the answers were covered by these comments:

- Treat your job as a career
- Be serious about it
- Know the product
- Shut up and listen
- What your customer says is more important than what you say
- Tell the truth always
- Know your prospects and understand their needs

And one person said, “Find another industry.”

7. Do you have sales training programs for your salespeople?

- Yes: 44%
- No: 56%

A sampling of the comments:

- “A good salesperson does not follow a canned approach.”
- “Some inside training and some outside training depending on the individuals.”
- “No sales department.”
- “We have a PPT training program covering every aspect of the sales from lead generation to...the first sales call... to winning the first quote, etc.”

8. How did you develop your sales plan?

The responses included:

- “We don’t have one.”
- “Our plan is to sell more.”
- “It’s confidential.”
- “President comes up with an idea of what to sell... the rest of the team comes up with what the customer really wants.”
- “Doing a line by line analysis with the right people.”
- “Many years of experience.”

9. How do you target or select your customers?

We got quite a range of answers:

- “Poorly”
- “Develop ideal customer profile and use it as a filter”

- “Industry segments”
- “360-degree assessment”
- “Based on needs”
- “Type of products they need”
- “End-market segment”
- “Targeting specific organizations and applications”
- “Trade shows”
- “Target our competitors’ customers”
- “Face-to-face meetings”

We’re not quite sure if the question wasn’t clear or if perhaps there is not much real targeting going on.

10. What are the top three attributes of a great salesperson?

Responses were a variation of some great attributes:

- Hard working
- Passionate
- Trustworthy
- Honest
- Knowledgeable
- Motivated
- Relationship-oriented
- Aware of the importance of closing
- Personable
- Strategically minded
- Persevering

11. What do you think are the most effective sales strategies to use?

This question had the greatest number of responses, with most distilled into this list:

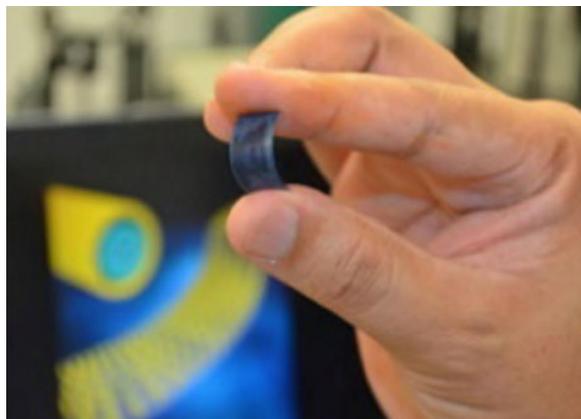
- Demand hard work
- Utilize direct sales calls
- Funnel
- Understand your capabilities
- Mention value, not price
- Offer a solution to the problem
- Pay them well and receive results
- Create a landmine map
- Trust them
- Measure and support the team to obtain goals

Conclusion

Although the results of this survey show that we still have a long way to go to be a sales-driven industry, it also reflects a growing interest in sales and marketing. We received many more serious and thoughtful answers than not and detected common themes among the various stated company philosophies, which we found interesting. Overall, results indicated a great deal more focus on knowing the product and the customers than we have found in past surveys, which means that our industry is taking sales and marketing seriously—and that’s a very good thing. **PCB**

UCF Scientists Bring a Phone that Charges in Seconds Closer to Reality

A team of University of Central Florida’s scientists has developed a process for creating flexible supercapacitors that store more energy and can be recharged more than 30,000 times without degrading. The novel method could eventually revolutionize technology as varied as mobile phones



and electric vehicles.

“If they replaced batteries with these supercapacitors, you could charge your mobile phone in a few seconds,” said Nitin Choudhary, a postdoctoral associate who conducted much of the research published recently in the academic journal *ACS Nano*.



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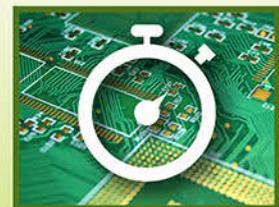
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Customer Acquisition

by Dave Becker

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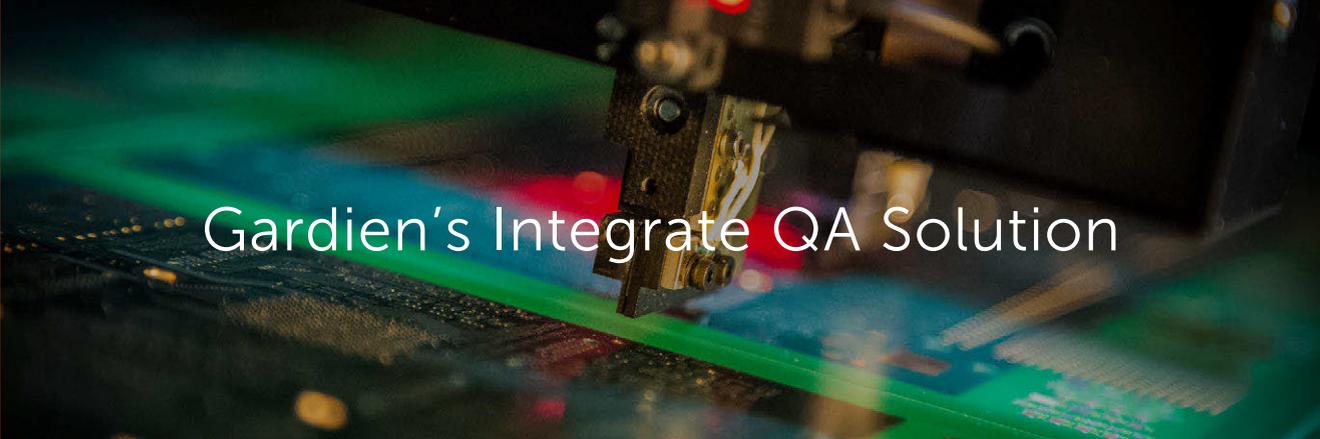
How good is your process for finding and capturing new customers? In the world of electronics, this challenge is often a key ingredient to business success. It is estimated that the average life cycle of an electronic product is between four and five years. How long have you owned your current cellphone? This relentless churn of new products has a profound effect on companies producing the components (like printed circuits, connectors, displays, etc.) required to build the myriad of today's high tech electronic products. With this short product life cycle, simple math suggests manufacturing companies might expect about 20-25% of the part numbers they produce to become members of the e-waste pile in any given year. Which is another way of saying, "Time to find some new customers!"

The "Customer Acquisition" process can be thought of as consisting of three major segments: collection, selection and execution. While these sub-divisions should be considered as intimately interrelated, examining them as separate disciplines can be enlightening.

Collection

This broadly describes the marketing process. How are new customer opportunities discovered? Word of mouth is one way, and as start-up companies become established it is a critical element. A positive customer experience often multiplies goodwill as new generation products are developed and word is spread across an industry. The names and faces of buyers and engineers frequently show up within differing companies in the same industry so a



A close-up photograph of a PCB manufacturing process, showing a green laser line and a metal tool working on a blue and green circuit board.

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positive (or negative!) customer experience is often transferred as employees move from one company to another. But as companies mature and are challenged to grow beyond a regional customer base, an expanded marketplace visibility is necessary. This challenge is compounded as component suppliers are most often building custom products and selling customized engineering. As such, the supply base needs to make customers aware of capabilities, which differs from marketing to an end user. This presents a unique challenge (i.e., how to make potential customers aware of your capabilities rather than the end product you supply).

Getting capability and visibility out to the world of design engineers can be done in a wide variety of ways. Several examples include:

- Advertising in online trade magazines (like *The PCB Design Magazine*) and on the Internet
- Exhibiting at trade shows
- Attending industry events and joining professional organizations
- Paying Google for position rank
- Using SEO strategies to rank highly for organic search
- Utilizing an outside sales function. Most times this is in the form of a manufacturer's rep paid on commission
- Contacting prospective customers with an inside sales function
- Distributing literature (design guides, datasheets, etc.) and mailing out sales samples
- Content marketing (non-commercial technical information that is highly useful to your target market, such as blogs, published articles, white papers, etc.)

These methods are intended to make a company highly visible, hopefully during the design phase of a new project. Since the sale is intended to take advantage of a supplier's capabilities, the earlier the involvement the better value the supplier can provide.

Selection

Once the opportunity has been collected, a determination about engagement occurs. This

section of the customer acquisition process often begins with a request for quotation (RFQ) from a potential customer. Vetting the opportunity requires consideration of several metrics such as size of the project, size of the customer, potential for future business, engineering resource requirement, and estimated profit margin. These are measures of the desirability of the business and are considered as part of the selection process. Creating a checklist with these factors is a common practice for determining pricing. The multiple dimensions represented by this information are considered as a supplier decides if and how to generate a quotation. The offer of a price per various quantities is the final method used to select a customer. Most printed circuit fabricators employ a staff of applications engineers who are tasked with completing the selection function. This is truly the 'point of the arrow' as they try to balance customer needs and supplier capability. The applications engineering group is challenged to have one foot in the factory and one foot representing the customer. Determining the Goldilocks ("just right") price means the supplier realizes a reasonable profit and the customer is pleased with the value received.

Execution

The execution phase describes how the project is managed after the customer's order is received. On time delivery and cycle time are key metrics during the execution phase. Suppliers that can consistently meet expectations will enjoy new part number opportunities. In the world of flexible circuitry, job set-up and CAD get the part ready for production and the operations team schedules and builds the part. Although building the initial prototype parts is often not considered part of the sales organization, success at this phase can certainly have a lot to do with customer acquisition. Making the sale and prematurely assuming program responsibility has been successfully transferred to operations is often a recipe for failure. Ownership of a project is best retained with a sales/applications engineer at least until the initial parts are delivered successfully. In a world of time-based competition, fabricators focused on cycle time reduction are in step with customer's basic requirements.

Collection, selection and execution can be thought of as three legs of a stool. Being good at only one or two will make success a difficult balancing act at best. Describing the customer acquisition process with these three segments helps define roles played by various departments and functions. Metrics describing performance success vary from segment to segment and performance tracking can be insightful. As new part numbers and customers place orders, the customer acquisition segmentation helps people understand their critical role in the organization's success. It also helps measure

what is done well and where improvement is needed. A good way to view this model is to believe the statement, "In our business, everyone is a salesman." **PCB**



Dave Becker is vice president of sales and marketing at All Flex Flexible Circuits LLC. To read past columns or to contact Becker, [click here](#).

Walt Custer's Global Market Outlook

by **Barry Matties**

With 2016 winding down, Walt Custer shared his end-of-the-year market research data with me at the recent electronica trade show in Munich, Germany. In our interview, Walt breaks down his findings and offers insight into the changing trends as we head into 2017.



Barry Matties: *Walt, it's coming up to the end of the year. It's crazy how fast this year has gone by. Let's hear about the show, and then get into the Walt Report.*

Walt Custer: First, the show has been great this year. It's been very busy. Yesterday was jumping and there new halls open this year, so it appears Europe is optimistic. Recent data confirms that Europe is outperforming much of the world right now. Not in volume, because that's all in Asia, but in growth rates of its local end markets.

Matties: *Was that a surprise to you or was this something you predicted?*

Custer: Well, a couple of months ago, the European leading indicators went down, but then they came way up again. Then October PMI leading indicators for the Eurozone showed virtually every European country was up, and thus the compos-

ite Eurozone PMI was also up. Most of the world's manufacturing leading indicators are in expansion territory again. I would say there's a smile on a lot of people's faces. A couple of places aren't doing well. South Korea is still struggling a little bit, but in October China moved to positive growth and Japan and the U.S. were also positive. So right now, leading indicator results for almost every area of the world are looking a lot better.

Matties: *It's been a long time since we've seen that, hasn't it?*

Custer: Yeah. However, they're not booming.

Matties: *No, but at least we are moving in the right direction.*

Custer: Sure, going up rather than down is encouraging. We know electronic equipment production is seasonal and China and Taiwan hit their seasonal peak either in October or November. That's right before the Christmas season. And after that normal late autumn seasonal surge electronic manufacturing in Asia will decline through the late autumn peak first quarter of next year. So we've hit our peak, and the 2016 peak actually wasn't as high as it was the year before.

To read the complete interview, [click here](#).

Five New Books that Will Change Your Perspective on SALES AND MARKETING



by **Dan Beaulieu**

In honor of this month's topic of sales and marketing, I'm providing a review of five books that can directly influence the way we think about sales, marketing, customers and customer service.

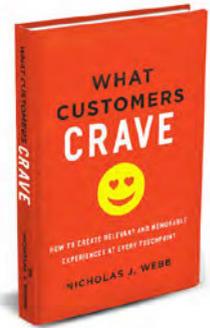
When selecting these books, I considered the following criteria:

- I wanted the books to be relatively new—no older than 24 months
- I wanted them to represent a new way of thinking
- I wanted books with innovative ideas
- I wanted books that could make a sales and marketing person better



What Customers Crave: How to Create Relevant and Memorable Experiences at Every Touchpoint

Author: Nicholas Webb
Amacom, 2017
Price \$25.00



Customer service is out and customer experience is in. It's not enough to deliver great customer service any more—you must instead deliver an entire customer experience and a great experience at that. Customers want to feel good about the very act of working with you. They want to feel that you are on their side and that you have their best interests at heart.

This book goes beyond traditional thoughts about service. In the first part of the book, the author discusses something we have all become aware of and that is creating customer value. He points out that it is much more effective to keep a customer happy than it is to get a new customer. From the book: "...probability of selling to a new prospect is 5 to 20 percent, while the probability of selling to an existing customer is 60 to 70 percent."

Mr. Webb goes on to explain just how we can provide value to our customers. He describes in detail how to create customer confidence in you, your company and your products and services.

This is one of those books that inspires great thoughts and ideas by giving the reader "triggers" that encourages thinking about customers in a way you have not done before. He shows you how to put yourself in their place and grow your understanding of how they view you and your company, and most importantly, what they expect from you.

I especially like the section entitled, "Make an upset customer a lifelong customer in five easy steps." From the book:

- 1. Affirm:** Create a complete understanding of the problem and what it means to the customer.
- 2. Listen:** Yes, shut up and listen and hear exactly what the customer is saying to you.



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3. **Confirm:** Repeat back to the customer what the problem is so that he understands that you understand... that you get it.
4. **Fix:** You know what the problem is, now fix it.
5. **Follow up:** Yes, follow up to make sure that the problem is solved and the customer is completely satisfied.

I would add one of my own and that is to do all of this as quickly as possible so that the situation is alleviated in the blink of an eye. Doing this will in fact make the customer respect you for life.

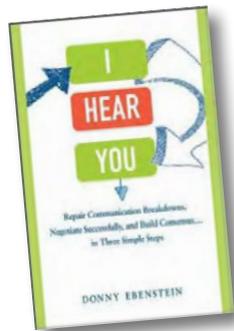
There is much too much in this book to cover it all. There is valuable information, from learning everything you can about your customers to getting referrals and recommendations.

This is a must have for anyone who is serious about customer service and retention...and who isn't?



I Hear You: Repair Communication Breakdowns, Negotiate Successfully, and Build Consensus...In Three Simple Steps

Author: Donny Ebenstein
Amacom, 2013
Price \$24.95



If your life is conflict free you don't need this book, but then again who are you kidding?

This is the kind of book that you just don't expect to see on a business bookshelf. In fact, you probably would not go looking for this book in the first place. After all, who thinks they need a book about resolving conflicts?

It turns out we all do, whether it's communicating with our boss, a co-worker, a customer or a neighbor; we all need the skills that Donny Ebenstein writes about in this book.

My favorite part of this book, besides the tools he teaches of course, was the fact that he

uses real-life examples to set the stage for each step—each simple step, as he says. By using those specific examples (names changed to protect everyone, by the way) he then shows that by using the techniques laid out in the book you can, as he says, “repair communication breakdowns.”

The key to what Ebenstein is writing about is flexibility to get in the other person's head, walk in their shoes, if you will, and see things from their point of view...but without giving up on your own. Not an easy task that. This is why we need techniques laid out here so that we can hold two points of view at the same time, thus allowing us the ability to work with the other party, come together, and develop a consensus that both sides can not only just live with but be able to love with.

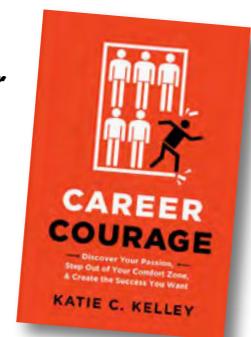
Like every elegant solution, this all sounds very easy, but it is only by following Ebenstein's expert advice that we can even hope to get to the point where we can do this on our own while leaving our emotions at the door.

Whether you are a teacher dealing with an administrator, an attorney trying to mediate a divorce, or a salesperson trying to make that sale with a difficult customer, this one is for you. Don't live another day without it.



Career Courage: Discover Your Passion, Step out of Your Comfort Zone, and Create the Success You Want.

Author: Katie C. Kelley
Amacom, 2016
Price \$16.95



This is a great book for all ages but particularly for those starting a career. If you have a son or daughter carving out a career path, this book is chock full of the right kind of advice for them. Or if you're a person who started down one path, but are finding that it is just not you, this is a great book for you. If you're middle-aged and are looking to re-invent yourself, you'll find this book especially helpful.

Writing with the insight of someone who has been there, Ms. Kelley offers a virtual handbook for finding yourself and what you want to do with your life. Not only will this book show you the way to get started it will also show you the way to accelerate your journey once you are on the right path.

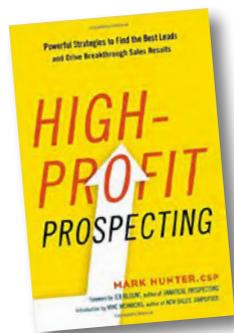
I especially appreciate the examples of real people that the author includes. Each chapter, on topics ranging from motivation and confidence to vision and harmony, expressively defines each step of the way, highlighting it with true life examples.

The book is filled with helpful, delectable little sections designed to allow the reader to participate in activities that drive the point of that chapter home. The book includes sections like: “Coach’s Challenge,” which helps the reader to think things through by applying the challenges to his own situation; and “Game Time,” where the author wraps up each chapter with summaries of what we have learned in that chapter and applying them to our own situations.

This is one of those books that you don’t realize you need until you open it. This book stimulates your mind and makes you think about things you should be thinking about, from your career to your life. People of all ages can benefit greatly from reading Career Courage.

High Profit Prospecting: Powerful Strategies to Find the Best Leads and Drive Breakthrough Sales Results

Author: Mark Hunter
Amacon, 2016
Price \$18.95



Man, this is a great book. This is by far the best book on prospecting and lead generation I have ever read or, I should say, used. As a sales columnist and consultant, I am always on the lookout for books that are not only going to give me ideas to help me help my clients but also books that will give me some thought-

provoking subjects for my columns, and I feel that with this book I have found a virtual gold mine. Truth be known, I have already based three weekly versions of *Its Only Common Sense*, my weekly PCB007.com column, on subjects that I found in this book. The first was based on Hunter’s myths about prospecting; the second one was on working with the right prospects.

I have also recommended that two of my clients buy copies of this book for their sales teams.

From why to prospect, to how to prospect, to choosing the right prospects and making sure they are the right ones, this book has everything a salesperson novice or old timer needs to be successful.

I especially like the way the author deals with the difficult subjects of getting appointments and what to do at those appointments to dealing with voice mail and how to leave an effective voicemail message.

This book does more than give the reader the basic rules of successful prospecting. It also motivates the reader into taking action, getting down to work, and getting it done. High Profit Prospecting is the have-to-have book for your sales library. I urge you to get it today and oh yes, make sure you have a highlighter nearby when you start reading it—you’ll need it!

Fail Fast or Win Big: The Start-up Plan for Starting Now

Author: Bernhard Schroeder
Amacon, 2015
Price \$21.95



Stop aiming and start firing!
Every so often you find a book that ends up being more of a stimulant for ideas than just a book. This is one of those books. I want to call it the “Nike—just do it” book because that’s exactly what the message is. He claims for example that business plans are a thing of the past, that they take too long to do and that they are not as effective as well as just doing it.

The business model, a short business model with the good and the bad and the ugly of just trying something is the way to go.

Schroeder gives numerous examples of entrepreneurs who gave it a go before most people would have thought their new product or service was truly ready for prime time.

So many times, people have a great idea but they wait too long to execute that idea, and instead they spend their time writing long business plans to please those bankers who are never going to give them the funds to start the business anyway. Schroeder tells us to just get going. He says that all we need is a great story, a story that will explain exactly what we are trying to sell and how it will work.

He says that instead of a full-blown business plan, all we need is what he calls “the Lean Model Framework,” consisting of the following slides:

- Company Purpose
- Problem and Solution
- Why now?
- Market Size
- Competition
- Product
- Business Model
- Revenue Model
- Team and Financials

And that is all you need to launch your new business.

He wants us to develop a model as soon as possible with the understanding that it will not

be perfect but that it will be good enough to exemplify what the product or service should look like, enough to get someone interest in the product and thus the company.

From the book:

Lessons learned:

- Believe in your product, not foolishly, but with common sense
- Find ways to get things done
- Follow the trend
- Look at alternate sources of distribution if traditional sources don't work
- Seek out other people or companies who have the same beliefs and look for either leverage or distribution opportunities

Schroeder ends Chapter five with this quote:

You really don't know if you have a company until you have created a product or service prototype and have sold it in the marketplace. That is, you can't improve a product unless you get customer feedback. And you need to move faster than potential competitors. So create a prototype sooner rather than later.

If you are passionate about your career, then you will eat and breathe and drink sales. This also means that you will read every good business book you can get your hands on. You might start with these five that I just recommended. Good reading, and good learning, means good selling. **PCB**

Printed Electronics Market to Reach \$12.10 Billion by 2022

Research and Markets has announced the addition of the "Printed Electronics Market—Global Forecast to 2022" report to their offering.

The printed electronics market was valued at US \$3.13 billion in 2015 and is expected to reach \$12.10 billion by 2022, at a CAGR of 22.38% between 2016 and 2022.



Printed electronics (PE) is gaining a wide momentum owing to the many benefits it offers over conventional printing such as low fabrication cost, scalability, and simple

fabrication. Their low cost provides added benefits of thin form factor, flexibility, stretchability, portability, and rollability.



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Supply Lines Highlights



[HKPCA & IPC Show to Spotlight Automotive Electronics](#)

The upcoming 2016 International Printed Circuit & APEX South China Fair will highlight the fast-growing automotive PCB segment of electronics manufacturing. This show will take place December 7-9, 2016, in Shenzhen, China. The automotive electronics market is undergoing rapid growth with the trend of lightweight, miniaturized, intelligent and electrified automobiles.

[Insulectro Displays Komodo Medical Sleeve at IDTechEx Show](#)

Insulectro, the largest distributor of PCB and printed electronics materials, will showcase Komodo Technologies remarkable AIO Compression Sleeve before it enters the marketplace at IDTechEx's Printed Electronics World 2016 conference, November 16-17, in Santa Clara, California.

[Rogers Highlights Thermally Enhanced 92ML Materials at electronica](#)

I met with Rogers Corporation Business Development Manager John Ranieri at Electronica recently. Ranieri's professional focus is on the 92ML series of laminate, prepregs, and IMS, which was highlighted at the Munich show. The 92ML products are geared for the power electronics marketplace where thermal management is a major concern.

[Ucamco's Gerber Netlist Goes Live with KiCad](#)

Earlier this year, a draft specification for netlist and component attributes in Gerber X2 was published on the Ucamco website by its Managing Director Karel Tavernier, and made available to the Gerber community for review and comment.

[What's New with IPC's Validation Services](#)

During this year's IPC Fall Committee Meetings, held in conjunction with SMTAI in Chicago, I met with my friend Randy Cherry, director of IPC Validation Services. Since the inception of Validation Services three years ago, I've conducted

video interviews with Randy at IPC APEX EXPO, and I've been tracking the growth and progress of this program.

[New Developments at MacDermid Enthone](#)

One of the best parts of industry conferences and shows is the opportunity to meet new people and renew acquaintances. Another highly enjoyable part is learning what is going on within companies—especially those with which one has had a close association in the past.

[All Flex Adds Flying Probe Electrical Test Capability](#)

All Flex invests in advanced flying probe electrical test equipment for fast-turn bare-board testing of its flexible circuitry.

[Insulectro Leverages One Source Distribution for Printed Electronic Materials at IDTechEx](#)

Insulectro will exhibit in booth i22 at IDTechEx's Printed Electronics World 2016 conference held November 16-17, in Santa Clara, California.

[PCB Makers Hike Prices Due to Increased CCL Cost](#)

Taiwan-based PCB makers, in response to price hikes by copper-clad laminate (CCL) suppliers, have raised quotes to reflect increased costs.

[Ventec International Group Celebrates the 10-year Anniversary of Ventec Europe](#)

Ventec International Group celebrates the 10-year anniversary of Ventec Europe at electronica 2016, in Munich, Germany!



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Selling Technology—A PCB Engineer Transitions to Sales

by John Tusant

AMERICAN STANDARD CIRCUITS

Selling technology today takes a great deal of time, patience and most of all knowledge of the product. There was a time when a salesperson was just that, a salesperson. Now, with the onset of all the new technologies, from RF and metal backed boards to flex and rigid-flex boards, to HDI and microvia boards and heavy copper boards, a salesperson must know what he's talking about.

To be successful today, a PCB salesperson should be educated in these technologies and have at least a working knowledge of how they work. He or she must know how these boards are fabricated as well as what they are used in.

I work for a company that produces a wide range of PCB technologies including all of those I mentioned above and more. When I joined American Standard a few years ago, I quickly came to realize that I was going to have to assume the role of applications engineer as well as salesperson. I had to go into the shop and learn

as much as I could about what we did, what it was for and who would want it.

I also had to learn when to answer a customer's technology question myself and when to defer to one of our experts. One lesson that was difficult to learn was that being a salesperson trying to talk technology made my customer wary if not downright suspicious. They often thought that the advice I was giving them was suspect because I was driven to make the sale rather than consult with them impartially and giving them the best solution regardless of winning the order or not.

Even though I have worked in PCB houses as an engineer, customers now looked at me differently—even the ones who had known me as an engineer in my previous life. Now, although they did listen to me, they often wanted a second opinion from one of our company experts. That took some getting used to at first, but now it is something I've gotten used to.



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This is what I would advise salespeople who are in my position, selling for a PCB fabricator that sells a wide range of technologies as my company does:

1. Always be helpful and courteous, even when you know more than the customer.
2. Do not be offended if customers who once turned to you for technical advice now defer to one of your company's experts because you have the word "sales" on your card. Handle it.
3. But don't be afraid to show your experience and knowledge when the customer asks for your advice. Be ready to step up and help them out. Always remember that a technical sale is a consultative sale. Your job is to make it as easy as possible for customers to buy from you.
4. Make sure you help your company experts. Let them know what your customers are up to. Inform your management of any upcoming changes in your customer's technology. You are literally the scout for your company. You are out there on the front lines seeing, hearing and talking to your customers about what they are doing today and where they will be going in the future. It is your responsibility to help your

company be prepared to handle your customers' future technology needs.

5. And finally, just because you are now in sales is no reason to stop being an engineer. The more you know about technology the better salesperson you will be. The more you can learn and relay your customers' technology needs, the more value you will bring to your customers and your company.

I believe that the future is bright for people with my background. Because of the rise in technology levels, more companies are looking to bring PCB engineers onto their sales team. And with our customers needing our technical help this will be a good thing. **PCB**



John Tusan is West Coast sales manager with American Standard Circuits. To read past Standard of Excellence columns or to contact the ASC team of authors, [click here](#).

Manchester Graduates Hoping to Inspire With Their DIY Walking Robot

Two engineering graduates from The University of Manchester have launched a DIY walking robot which anyone can build with 3D printing technology.

Jack Scott-Reeve and Josh Elijah, who graduated with master's degrees in engineering from the University's School of Electrical and Electronic Engineering, have developed QuadBot, a 3D printable walking robotics platform. Their aim is to help as many people as possible to learn about robotics.

The pioneering learning tool helps users with little or no prior experience to understand electronics, coding, 3D design and printing, and maths for robotics.

"There is so much potential for users. QuadBot can walk, dance, light up—and, with sensors, he can follow you around while avoiding any obstacles. He can even play songs."



The animal-inspired QuadBot comes as a kit which features a 'Quadboard,' motors and other non-printable components while the rest of the bespoke machine can be made using domestic 3D printing technology.

"With the support of the University, our [Robotics] society was very successful and we continued the initiative until we graduated. After graduation we then ran many workshops teaching engineering and robotics to the maker communities using Fab Labs around London," added Josh.

"We decided to focus our career solely on engineering education, so we founded EngiMake with one goal—opening up robotics to every 'maker.' We have set out to break down the barriers to learning robotics by engaging with people, communicating knowledge effectively, leveraging the strength of open-source, and tearing down costs."

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4 Reasons Why Every Sales Rep's Toolkit Should Include LinkedIn

by Bruce Johnston

PRACTICAL SOCIAL MEDIA MATTERS

If you can answer “true” to the following statements, you are in good shape. Otherwise, you should be using LinkedIn—effectively.

1. I know who all my prospects are—and I mean all of them.
2. I know all the key people at those prospect accounts.
3. I am absolutely on top of all the personnel changes that can affect our business at those prospect companies.
4. I get through on at least 15% of my cold calls and e-mails the first time.

If you answered “false” to any of these (and let's be honest: everyone should be answering no to question four), keep reading.

1. I know who all my prospects are—and I mean all of them.

Anyone who says they don't have any prospects apparently hasn't used LinkedIn. I was talking to an executive from a PCB manufacturer based where in Toronto, where I live. I asked him how many companies in Toronto purchased PCBs. He thought about it for a minute and said 80, maybe 100. I said, how about 170? How do you know that, he asked? Easy. I put together a search on LinkedIn. It took five minutes. When I first started doing this LinkedIn thing about six years ago, there were 30,000 people in North America with the term PCB in their LinkedIn profile. Now there are more than 130,000. I built a database of more than 5,000 North American companies that purchase PCBs and I once esti-



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**– Michael Doherty
VP, Nova Drilling Service***

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mated the number in North America was 17,000. Don't tell me you have no prospects. LinkedIn's database is better than yours.

2. I know all the key people at those prospect accounts.

These days more people are involved in the vendor selection process. Manufacturing people. Operations people. Product design people. Quality people, and of course Purchasing people. And using LinkedIn, you can find them. Who wants to risk being shut out because they have only one point of contact at a prospect company?

3. I am absolutely on top of all the personnel changes that can affect our business at those prospect companies.

Gee, that must take a lot of work. Now in my case, I set up a LinkedIn search, save it, and LinkedIn tells me whenever someone leaves or arrives at my prospect companies. I don't have all that time you do to be checking in at those companies all the time to stay on top of those so I just set and forget.

4. I am extremely effective at cold e-mail and cold calls.

Congratulations. I know that good e-mail and cold call campaigns get response rates in the low single digits. So if you contact 100 strangers, you get two appointments. I use LinkedIn InMail plus some tricks I know to contact strangers using LinkedIn. I run several different prospecting methodologies using LinkedIn. My worst one yields a 17% response rate, or five or six times yours. My thinking is, if there is someone I want to talk to, I want to have a variety of methods at my disposal that give me a 40 or 50% chance of reaching them. Cold e-mail and cold calling with a 3% response rate doesn't appeal to me at all.

To be fair, my methods tend to be more time consuming, but they are much more effective. I have one strategy that I use for unsolicited messages on LinkedIn that I have been using for two years. My response rate wanders back and forth between 60% and 70%. Yes, you read that correctly, between 60% and 70%. Why? Three reasons, and this sums up how I use LinkedIn effectively and how I coach my clients:

1. Psychology: I understand the psychology behind sending messages to people on LinkedIn and what works and what doesn't.

2. Personalize: Everyone wants to automate their messaging. "Send a thousand e-mails. We may get 15 responses." I personalize and tailor every single outreach message. They send 1,000 to get 15, I send 20 or 25 messages to get 15 responses.

3. Practice: In this strategy, I send a couple of these messages every day—for the past two years. So I have sent around 1,000 of these messages. And when you do something 1,000 times, you get really good at it. Several times a month I will get people telling me that my message was the best one they have ever seen on LinkedIn.

LinkedIn is a tool. It's an awesome tool, but still just a tool. And like any tool, to get the most out of it, you need to understand how to use it. That's where most people fail. They know how to do a basic search for prospects, but not a really effective one. They know that they can send messages using LinkedIn, but they just send awful naked sales pitches that get ignored. If you don't know how to use the tool properly you will just wind up with a mess.

When I was based in Chicago in the late '80s, trying to open the Midwest territory for my employer, I used to dream of a database that had all of my prospects in it—one that would give me a total view into my territory's prospects. Well, LinkedIn gave it to me. LinkedIn is a prospect database that doesn't go bad. It's a prospect database that updates itself. **PCB**



Bruce Johnston is an authority on using LinkedIn to increase B2B sales. He has more than 30 years' experience in high-tech sales and management and more than 10 years working in the PCB industry. To read past columns or to contact him, [click here](#).



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Learn more about the roadmap used to build great companies with a high level of profitability in this article from the March 2016 issue of **The PCB Magazine**.

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—David Dibble



Strengthening Your Value Proposition to Boost Organization Success

by John Mitchell

IPC—ASSOCIATION CONNECTING ELECTRONICS INDUSTRIES

As president and CEO, I know that what we do and say impacts the industry from the shop floor to the board room. I take this to heart and make it my mission to ensure that we understand the needs of the industry and communicate solutions. In my experience, having a strong value proposition creates greater engagement with your customers. This process isn't as formulaic as engineering or building a circuit board, but there does need to be a core message. At IPC, we strive to clearly define and communicate our mission statement and organizational goals.

It starts by having a clear brand promise to your prospects and customers.

What's in a promise?

Clearly define company and/or product benefits for your customers. In what specific ways do you help your customer reach their business goals? Rank your top three to five benefits, focusing on those with the highest impact. If your messaging is weak or unclear, prospects

will pass by without stopping to dig further into what you are offering. And, the lesser known your brand or organization, the more important it is to have a strong value story. Getting this right will boost your sales and marketing efforts.

Next, your benefit statements need to be relevant to your audience and deliver quantifiable results. Measurable benefits can be increased throughput, reduced errors, improved quality, or new capabilities. For example, improving a customer's process can boost their bottom line.

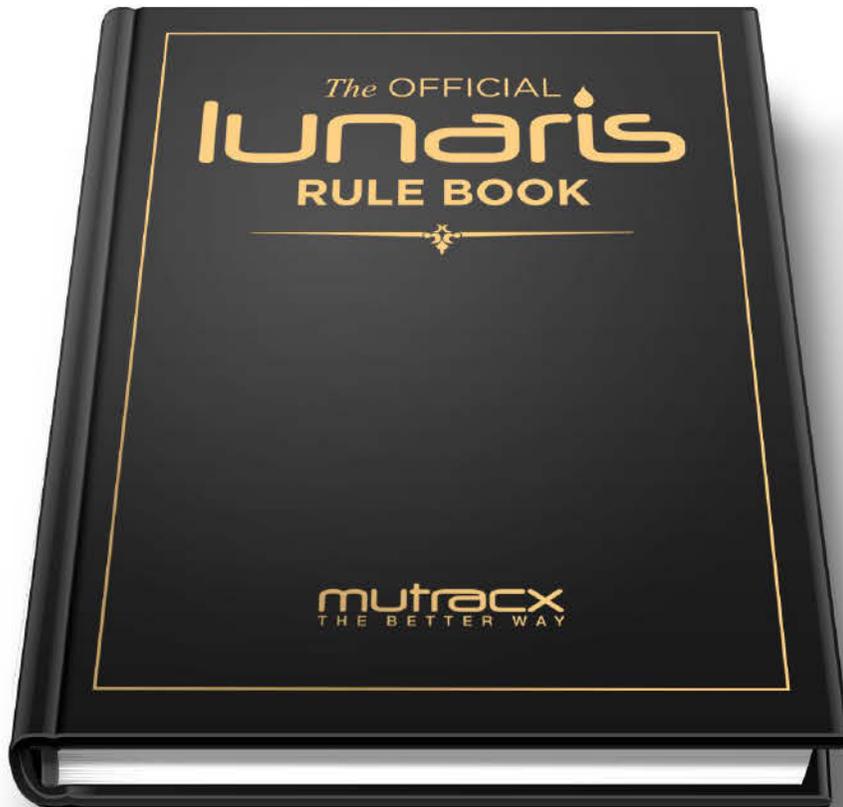
Finally, identify your unique selling points. How is your product or service different than your competition? This is another way to clearly communicate your value vs. the rest of the industry.

It's not an advertising slogan.

Value propositions are meant to be read and understood by the purchasers and influencers you are seeking to engage. It's not an advertising slogan or positioning statement (e.g., "We're #1



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in the industry.”). Write it in the language of the customer. The language you use to describe your products and services is not necessarily the way a customer expresses their needs. Include a headline and three to five key points that deliver the message. Test it on your trusted customers to see if it rings true to them. If not, you may need to improve or adjust some aspects of your product or service. If they love it, ask if they would be willing to give a testimonial.

Consider using visuals to convey your value prop. For example, infographics can be designed to incorporate the benefits as well as the unique elements of your products and services. In today’s web-based media culture this can also prove to be a fast and effective way to reach your audience. Clarity is key and audience attention span is at all-time lows; get right to the point!

A weak value proposition may expose the need to boost your value delivered. Brainstorm ways to increase the benefits delivered to your customer. Consider areas such as performance guarantees (lower risk), customer testimonials

(validation) or bundled services at a discount (lower cost) to pump up the value and differentiate yourself from the competition.

It’s a journey, not a destination.

If you struggle to do this exercise, it may be an indication you have lost sight of the value you are delivering to your customers. Or you may need to consider packaging it in a new and fresh way that speaks to your audience. Either way it’s time well-spent for your entire organization (and customers) to know your value proposition and be the brand ambassadors you want them to be. **PCB**



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

Researchers Create Synthetic Skin

Wearable technologies could be transformed with a new type of artificial material that can mimic the properties of skin from sensing touch to even being self-healing. It is thought that the device could be used in prosthetics, which would improve on current designs that are heavy, easily damaged and cause difficulty in sensing touch in the wearer.



The international team of researchers created a patch using semi-conducting polymers, which are similar to manmade plastic in that they are flexible and can be stretched. The research was carried out over two years at Stanford University in California and published in the journal *Nature*.

Co-author Dr. Bob C. Schroeder, now based at Queen Mary University of London, assisted with the design and synthesis of the new semi-conducting polymer.

“Our research shows for the first time that it is possible to combine the electric properties of organic semiconductors with the stretchability and healing capabilities of skin.”

The prototype skin showed the ability to heal itself after being mechanically damaged. However, the healing occurs only once the material has been exposed to heat or solvent vapour of chloroform. The researchers are working on improving the design and are investigating whether alternative, less toxic solvents could spark the healing process.

The work could also have implications for flexible displays like touch screens in smartphones and TVs. Continuing his research at QMUL’s Materials Research Institute, Dr. Schroeder is developing new materials to power diagnostic sensors using body heat for healthcare monitoring.



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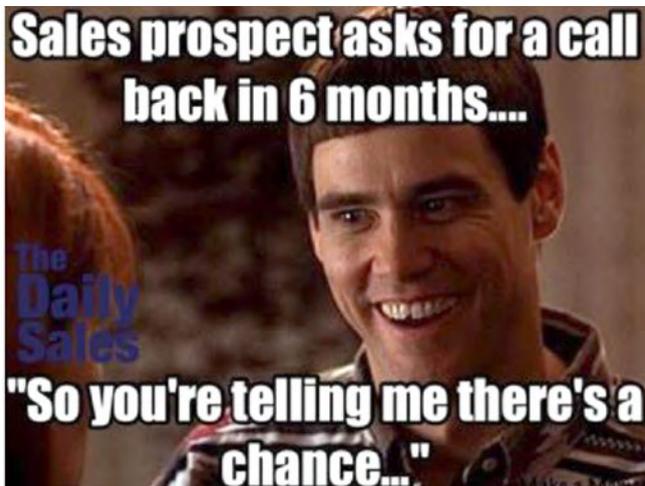
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A Glimpse into PCB Sales

by Tara Dunn
OMNI CIRCUITS

Here is a little sneak peek into the daily life of a PCB salesperson.

Prospecting:



Somebody who is not in PCB sales might get a little laugh, but those of us in the trenches see this and think, haha, is that me? Yes, it is! It is incredibly hard to get in touch with PCB buyers or designers and when someone answers the phone, we do a little happy dance. Then if they don't say "no thanks," we are sure they will one day be a customer. We just have to be patient.

When a customer calls:



I know...someone is reading this and thinking, "Really? The PCB salespeople I know like to take long lunches and spend their afternoons golfing. They don't want to help me." Old stereotypes are hard to overcome. But I have been in PCB industry a very long time and have had the privilege of getting to know many PCB salespeople that are very good at what they do. In my opinion that is often because they truly enjoy getting to know their customers and helping to solve problems.

As I was thinking about what I wanted to say about PCB sales in this column, I thought it would be both interesting and educational to ask both customers and manufacturers their thoughts on PCB sales. I was pleasantly surprised at the enthusiastic response I received.

Question #1:

In your opinion, what traits do good PCB salespeople have in common?

From PCB Users:

- A better than average knowledge of PCB construction
- The ability to offer suggestions and solutions when we struggle with a new design and technology need
- Respond quickly when there is a request or issue
- Provide follow-up to the details so I don't have to worry about what is being completed
- Know the line between persistence and annoyance. PCBs aren't the only thing on my plate
- Excellent communication skills
- Understands when I call with an issue and helps work with manufacturing or engineering to resolve the issue so I can focus on other things

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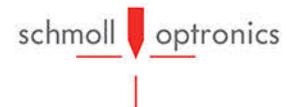
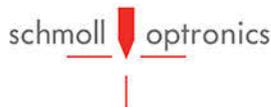
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- Takes the time to learn how we prefer to work and customizes responses to fit as best as possible
- In-depth knowledge of the PCB market, new materials, supply issues, etc., and provides information on what might be important to us

To recap: Knowledgeable about PCBs and the industry, organized, strong communication skills and customer focused.

From PCB Manufacturers:

- Persistence and tenacity to follow through and listen more than they talk
- In-depth understanding of the customer, how they like to work and what additional business is available
- Respond quickly and thoroughly
- Consistently find new opportunities and new business
- Great follow-up, know their customers, aggressive when they need to be and very personable. Did I mention organized?

To recap: Knowledgeable about customers' needs, organized, strong communication skills and brings in new business. These two lists are actually pretty similar.

Question #2:

What do you wish PCB salespeople did that they currently don't do, or don't do well?

From PCB Users:

- Advocate for annual cost savings on behalf of the customer. This would foster trust and repeat business.
- Understand our systems and market pressures outside of ordering the PCB. There are a lot of different considerations and decisions made that may not be apparent to the PCB manufacturer but are critical to us.
- Proactivity. Offer suggestions for cost or lead-time reductions. We are not the experts in PCB design and would be interested in how we can improve.
- Provide the very best price the first time, especially with larger programs. Don't come back with reduced pricing after I give you feedback. That wastes time and resources for both of us.

To recap: Detailed knowledge of customer's business and proactively advocate for your customer's best interest.

From PCB Manufacturers:

- Ask for the PO and know how to sell value, not just on price!



- Stop relying on price to differentiate and win the order
- Close more business in a timely manner
- Identify customers that find value in the quality, customer services, and fast response that we offer rather than sell on price.

To recap: Differentiate the manufacturer's offering so the comparable factor between offers is not price alone. Interestingly, this is like the message above also: Advocate for value of the manufacturer's strengths with your customers.

Summarizing the feedback from both customers and manufacturers, the most successful PCB salespeople are organized, take a genuine interest in their customers' needs and business challenges, have a better than average understanding of the PCB industry, fully understand the manufacturer's strengths and capabilities and advocate for both to find the best solution. There is room for improvement by being more proactive in solving your customers' challenges and in understanding the differentiating value of the manufacturer to sell on total value rather than price.

You will get all you want in life if you help enough other people get what they want. —Zig Ziglar

My closing thought is that it truly is difficult to reach a comprehensive level of understanding of both the customer's needs and the needs of PCB manufacturing. The information that is easily obtained is often just skimming the surface of the full picture. Salespeople continuously search out opportunities to interact with their customers outside of the conference room. Those relaxed conversations often offer the best glimpses into what people really need from their salesperson. There is no roadmap to use; every customer has different needs. If you attend an IPC show, SMTA expo, IPC Designers Council meeting or even Geek-A-Palooza, there is no shortage of salespeople trying to increase their technical knowledge while getting to know others. I strongly encourage PCB users and PCB manufacturers to do the same. The more we all know about each other's needs, the stronger the relationships will be for everyone. **PCB**



Tara Dunn is the president of Omni PCB. To contact Dunn, or read past columns, [click here](#).

Closing Tech Gaps Can Fortify Advanced Manufacturing and Save \$100 Billion Annually

To spur significant innovation and growth in advanced manufacturing, as well as save over \$100 billion annually, U.S. industry must rectify currently unmet needs for measurement science and "proof-of-concept" demonstrations of emerging technologies. This is the overall conclusion reached by economic studies funded by the National Institute of Standards and Technology (NIST) of four advanced manufacturing areas used to create everything from automobile composites to zero-noise headsets.

For each of the four advanced manufacturing technologies studied, the estimated annual cost



savings and percentage reduction in production costs are:

- Additive manufacturing: \$4.1 billion, 18.3%
- Advanced robotics and automation: \$40.1 billion, 5.3%
- Roll-to-roll manufacturing: \$400 million, 14.7%
- Smart manufacturing: \$57.4 billion, 3.2%

The researchers stated that their studies only looked at benefits directly attributable to closing the identified technical gaps in each sector; therefore, the impact estimates are conservative.

[All About Flex: Flex Circuit Specifications for Commercial and Military Applications](#)

Applications across the various markets for printed circuit boards can have significantly different specifications and performance requirements. Circuits for toys and games logically have lower performance requirements than those used in medical devices. IPC-6013 is an industry-driven specification that defines the performance requirements and acceptance features for flexible printed circuit boards.

[The Sum of All Parts: Three Keys to Successful Leadership](#)

It is often easy to lose sight of, particularly in the manufacturing sector, your most valuable resource: people. You can't take purchase orders, operate equipment and develop new strategies all on your own. With so much focus being driven toward quality, margins and customer satisfaction, upper management develops a tendency to forget what keeps all those things in the positive.

[The Sun to Power the Starliner](#)

Boeing will use solar energy to power the company's CST-100 Starliner for crew missions to and from the International Space Station as part of NASA's Commercial Crew Program. The sun's energy offers a reliable and efficient power source for the Starliner just as it does for the space station and satellites.

[Kitron Receives Contract from Northrop Grumman](#)

Kitron has been selected by Northrop Grumman Corp. as an international source for manufacturing of a sub-assembly for the F-35 Joint Strike Fighter.

[It's Only Common Sense: ITAR—The Good, the Bad, the Ugly, and the Very Ugly](#)

Has there ever been a more nebulous qualification than ITAR? It's one of those topics that everyone has an opinion about, but no one really understands. To some of us it's a game with ever-changing rules, and to others it's simply a hurdle to overcome. And for others, it is something to ignore altogether.

[NASA Small Satellites Set to Take a Fresh Look at Earth](#)

Beginning this month, NASA is launching a suite of six next-generation, Earth-observing small satellite missions to demonstrate innovative new approaches for studying our changing planet.

[U.S. Circuit Goes Green with Solar and LED Installation](#)

U.S. Circuit has just completed a \$1 million installation of a 251 kWh solar system covering their entire parking lot. This system makes U.S. Circuit one of a kind within the U.S. PCB fabrication industry.

[NASA Aircraft Arrival Technology Gets Big Test in 2017](#)

Commercial airline pilots who as children played "Follow the Leader" will have no problem with a new air traffic control innovation NASA and its partners are working on that also will make passengers happier.

[IPC's President on IPC EDGE: Cutting Edge and Education](#)

Chatting with IPC President John Mitchell is always a good time—he never fails to be upbeat and full of ideas, and his eagerness to fill us in on what's happening with IPC was evident during our recent interview at the IPC Fall Committee Meetings, collocated with SMTAI in late September.

[Millennials in Manufacturing: A Long-term Career Prospect](#)

The next millennial in this series is Alex Johnson, an associate engineer at Saline Lectronics, who has been with the company for over two years. Even though Alex received a lot of negative information about manufacturing throughout his lifetime, his work experience in engineering has directly challenged those preconceived notions.



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Catching up with M&A Expert Tom Kastner



by **Dan Beaulieu**

If you want to know what is going on in our industry when it comes to mergers and acquisitions, there is no better person to turn to than Tom Kastner. Whenever I want to verify a rumor of a company being bought or sold, Tom is the first person I call, and unless he is under an NDA, he will fill me in. In this, our latest discussion, we talked about the PCB industry's M&A activity in 2016 and what Tom expects to see in 2017.

Dan Beaulieu: *It seems that there is a lot of activity going on right now when it comes to companies buying other companies. Is that real or just my perception?*

Tom Kastner: There is a lot of activity in the past 12 months. I count 10 deals in the PCB sector in the last 12 months, and there are at least five deals going on at present that I am aware of or working on. I am also working on several projects in the EMS/PCBA sector for buyers.

Beaulieu: *What types of sales are happening?*

Kastner: A few of the sales have been larger companies buying smaller ones, and there have been a few mergers such as KCA/Marcel (now called Summit Interconnect) and Dragon/Electro-Plate. Many of the buyers are larger compa-

nies that are private equity-backed or publicly traded, such as Advanced Circuits, FTG, APCT, OSI, etc. More than half of the recent deals have been consolidations (seller's shop was merged into the buyer's).

Beaulieu: *What are the reasons people are selling now?*

Kastner: Most are selling to retire or to focus on other business. Several of the deals are due to underperformance. Of the owners I speak with, most are interested in retiring, but some would like to find a buyer/investor who can take the company to the next level.

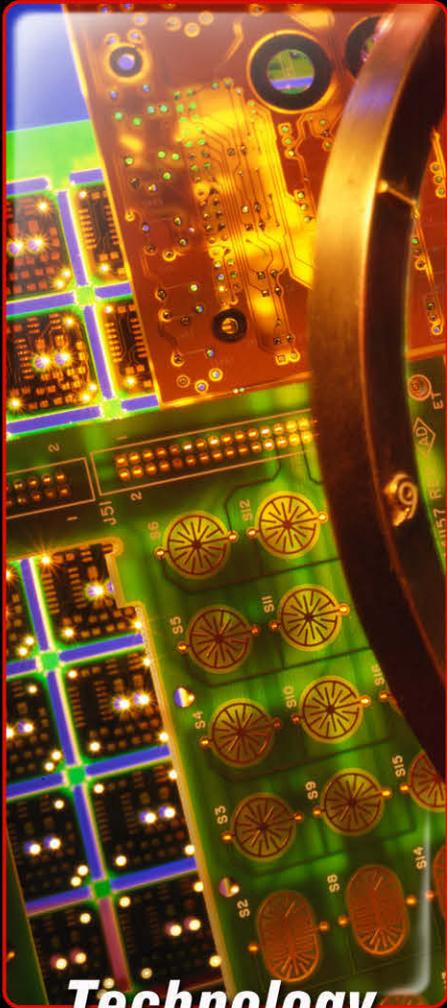
Beaulieu: *I've noticed that there have been several "roll-ups" since last we talked. Please explain to our readers what a roll-up is, who gets involved in them and why.*

Kastner: Because many shops are running below capacity, the idea is that by combining two or more shops, the business will run more efficiently and profitably. Also, a larger shop may be more able to invest in new equipment and technologies. These deals can be tricky, and it requires at least one of the shops to close, and transferring customers may be difficult.

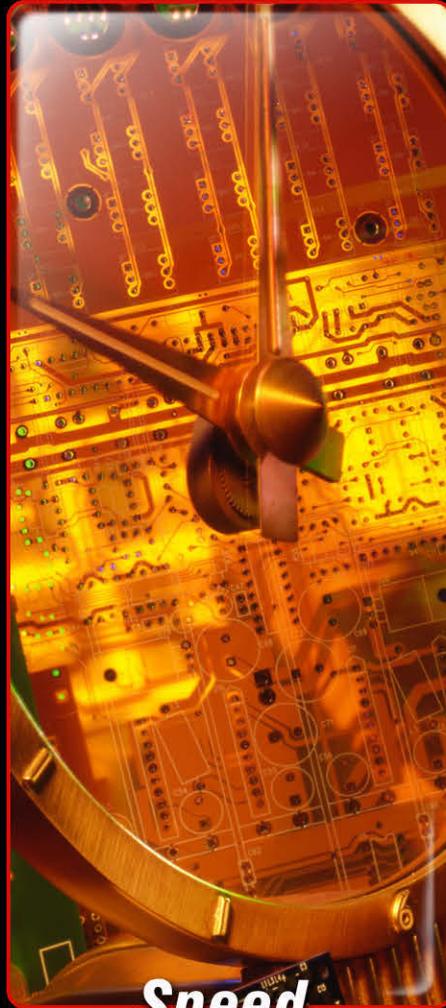
Beaulieu: *Who would you recommend a roll up deal to, a seller or a buyer?*

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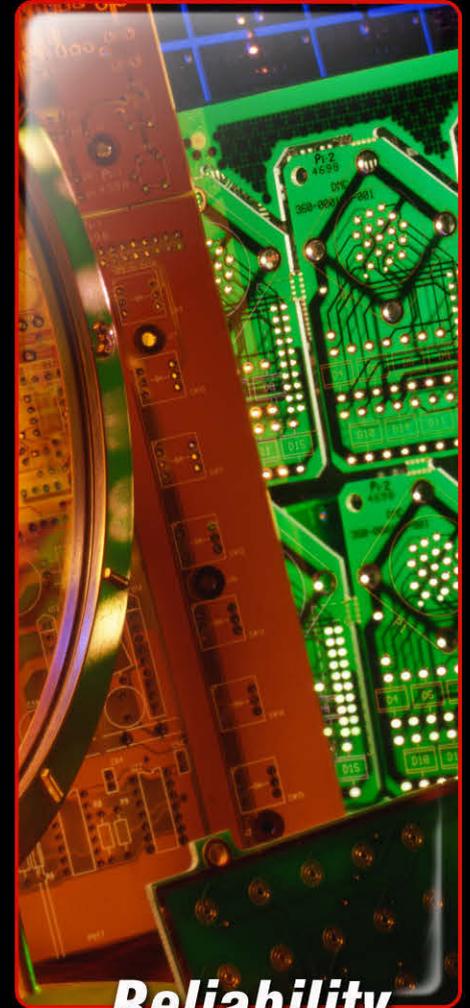
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Kastner: It can be beneficial to both sellers and buyers. For the seller, the owner can retire, or perhaps focus on a role with the merged company that they enjoy the most, such as sales or operations. For the buyer, it can help fill a shop with more work, and it can bring new customers, products, people, reps, equipment, and technologies.

Beaulieu: *Are there any major trends that you are seeing out there?*

Kastner: Two major trends: Customers are insisting that shops invest in technology, such as direct imaging and laser drills. Also, foreign buyers would like a physical presence in the U.S.

Beaulieu: *And what do you think this means?*

Kastner: It will be increasingly difficult for smaller shops to keep up with larger shops that are investing in the newest technology. If they have survived this long, they probably have their costs down and have an interesting niche in the market. Regarding foreign buyers, we'll probably see more foreign-owned shops in the U.S. down the road. This may be part of their global strategy, and it allows them to make prototypes and quick turns in the U.S. and volume production overseas.

Beaulieu: *What kind of deals have you been involved in since we last spoke?*

Kastner: Since we last talked I closed the sale of Tech Circuits to APCT.

Beaulieu: *Without breaking any confidentiality, what do you have on your plate now?*

Kastner: I am representing a \$4.5 million PCB shop that is focused on mil-aero prototypes and quick turns, and I am representing a few buyers in the EMS space (one in PCBA, one in wire-harness/assemblies).

Beaulieu: *I know that you have made some additions to your own firm since we last talked. Can you tell us about those?*

Kastner: We added three people: two professionals and one assistant/researcher in the U.S. That brings us up to five total, with four in the Chicago area and one in Tokyo. We are still focused on the electronics and tech fields, both sell-side and buy-side advisory services. We also offer grooming services, in which we help sellers get ready to go to market.

Beaulieu: *Sounds like you are prepping for the future. What do you think that is going to look like?*

Kastner: We are busy already, but we think that baby boomer owners will be retiring in droves over the next few years. Also, there is a tremendous amount of strategic capital and private equity capital in the world that is seeking companies to buy, in a wide variety of sectors. I believe that the number of PCB and EMS shops will continue to drop, but the shops that remain and invest in equipment and technology will be stronger than ever.

Beaulieu: *Any final comments?*

Kastner: I am always glad to talk with owners or their advisors on how the M&A process works, potential buyers or sellers, valuations/terms, and how to prepare a business for sale.

Beaulieu: *Tom, it's always a pleasure talking with you. Thanks for taking the time today.*

Kastner: My pleasure. PCB



Dan Beaulieu's "It's Only Common Sense" column can be read every Monday in the [I-Connect007 Daily Newsletter](#). To read past columns or to contact Beaulieu, [click here](#).

Tom Kastner is the president of GP Ventures, an M&A advisory firm focused on services for electronics and technology companies. To contact Kastner, or read past columns, [click here](#).

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Catching up with LinkedIn Expert Bruce Johnston



by **Dan Beaulieu**

My friend and business associate Bruce Johnston was named one of the LinkedIn Thought Leaders—The USA & Canada List (100+) by Andy O’Hearn, an expert LinkedIn coach and social media analyst. When you consider that there are over 467 million LinkedIn members, being in this list of approximately 100 is a pretty big deal.

Bruce is the owner of Practical Social Media Marketing, our industry’s first and foremost social media consulting firm. His expertise is centered on LinkedIn, where he focuses most of his time teaching his clients how to greatly improve their marketing and sales efforts by fully using the power that LinkedIn can provide them.

As Bruce says, “If people are willing to do the work, LinkedIn can be an invaluable resource for growing their sales. As the saying goes, I can teach them how to fish but I can’t do the fishing for them.”

Bruce sat down with me recently to explain why LinkedIn is a much better database than yours, and why PCB salespeople must embrace social media or go the way of the dodo bird.

Dan Beaulieu: Bruce, can you tell us something about your background?

Bruce Johnston: I started in high-tech sales in 1985, working for a small manufacturer of telecom test equipment. After a couple of years sell-

ing the company’s low-end products through catalogues, I was sent to Chicago to open the company’s Midwest sales territory. It was the proverbial desk, a phone, and me all alone. After a good stint in the Midwest, I was moved to our Atlanta HQ and tasked with building the company’s rep network across the U.S. So I found, hired and trained a dozen rep firms and went everywhere with them on sales calls. I think I have called on prospects and customers in 44 or 45 states.

After a couple of years, the company was sold, so I moved back to Toronto. In Toronto, I got together with an old mentor who had a rep firm and he hired me and immediately shipped me to Vancouver! I spent a couple of years doing the now familiar “build the territory for us” routine. Once I got the territory on solid footing, I was brought back to Toronto to start a separate division of the company. We had landed the exclusive rights to a very promising product line of local area network protocol analyzers. In four years, we went from a few people selling that product line part-time and bringing in \$300,000 a year to 14 full-time staff bringing in \$8 million a year. We were so successful the company we were representing bought the whole division from us and turned it into their Canadian subsidiary.

I then spent several years building the rep and distributor channels for another test equipment company based in Chicago, and after that spent several years as my own one-man rep firm.

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By this time, I had experience doing just about everything—I had worked as a direct sales rep, an independent rep, and as a distributor. I had managed direct sales people, distributors and rep firms. And I knew what it was like to work in the head office, but also be a regional manager working out of my apartment.

Beaulieu: *How and why did you start Practical Social Media Marketing?*

Johnston: In the usual way things go, I was doing some consulting for a PCB manufacturer in Toronto when events came together and I was offered the job of general manager. I spent several years as the GM of a PCB shop. But PCB shops were falling on hard times and the company I was with was not immune. Thus, I found myself looking for what was next.

Beaulieu: *Why LinkedIn? How did you find yourself focusing on this area of social media?*

Johnston: I found LinkedIn completely by mistake. An employee had encouraged me to join LinkedIn. So I did like most people do: I did a rudimentary job filling out my profile, connected with some friends, colleagues, and customers. I would log in occasionally, go look at a few LinkedIn profiles and wonder what all the fuss was about.

Beaulieu: *How did you get from there to being a LinkedIn guru?*

Johnston: Well, when I left the PCB company, I figured I should have a better look at this LinkedIn thing and decide whether I should use it or quit it. And I think I took a day and just kind of explored the menus to see what you could do and that's when I figured out that LinkedIn was a database of all the possible B2B customers you could ever want. I did a search and found—almost six years ago, mind you—that 30,000 people in North America had LinkedIn profiles



with the term “PCB” in them (today that figure is close to 140,000). I had found a sales rep’s Holy Grail. This was what I had wished I had had in the field for the past 25 years. And what was apparent to me was that almost no one knew about it. That’s when I knew that this was what I wanted to work with. I could teach salespeople how to use this tool to increase their sales.

Beaulieu: *Like so many other people who start a new company, you must have had some challenges. Can you give us some examples?*

Johnston: Wow, that question brings back some nasty memories! Easy answer, though: no one else made that connection. LinkedIn and other social media like Facebook and Twitter had to overcome the same hurdle that other new technologies had to overcome. Remember trying to talk people into the idea that everyone should have a smartphone? Or every company should have a website? Or that a company should be using this email thing? Or before that, that individual sales reps should have their own PCs? It’s exactly like that. And it’s going to end up the exact same way. Social media will be integral to every company’s sales strategies and tactics. In a couple of years, a company that ignores social media will be looked on like a company would that doesn’t use email. Clueless. Luddites. Dinosaurs.

Beaulieu: *Let’s talk about your company. What are some of the services you provide?*

Johnston: My focus is LinkedIn. If you are in B2B sales and marketing, it’s the one place that your prospects are. My core services revolve around three activities: First, using LinkedIn Advanced Search capability to find exactly the right person or people at your target companies. The depth of LinkedIn’s database, combined with the power of their advanced search, is amazing. Sitting at my desk in Toronto I have used Linke-

dIn to find prospects in St. Louis that the rep who had worked in St. Louis for five years didn't know were there. I do this all the time because the bottom line is, LinkedIn's database is better than yours. When someone leaves a company and goes somewhere else, they change their LinkedIn profile to reflect the change. Your email list doesn't do that. I like to say that LinkedIn is a database that updates itself. That's a powerful concept.

Then, once you find a prospect, you have a decision to make. So the second aspect is teaching clients how to decide the best way to approach a prospect. Often this is via LinkedIn, but there are several ways to approach someone on LinkedIn. Sometimes, using LinkedIn is not the best way to go. I teach my clients how to make the right decisions and come up with the best way to approach a prospect that will result in the highest probability of the prospect responding.

Third, I coach my clients on how to write LinkedIn messages that prospects will reply to. This is the area that most companies ignore and it hurts them. They use LinkedIn, find the right person and they just cold call them and that's that. They get a couple of percent response rate. And if they had used LinkedIn they could be getting two, three or four times as many leads.

Beaulieu: *Do you offer coaching for other social media outlets?*

Johnston: I also work with companies on Facebook, Twitter, YouTube, Google Plus and blogging. Blogging is becoming critical these days. So many companies resist writing content for their prospects and customers and they could make such huge gains that it's a shame they feel that way. I will advise and help clients with all of those.

Beaulieu: *You mentioned that you offer personal coaching as well as webinars. Please talk about that.*

Johnston: I use screen sharing or webinar style software over the web. I have found two big advantages to this: Clients don't have to cover my travel costs, and the client's team can log in from anywhere. If the client has people all over the country, great; just pick a time they can all log in and away we go. I have never met over 90% of my clients face to face. Welcome to a new age.

Beaulieu: *What makes your company unique and outstanding?*

Johnston: My depth of experience in sales. I have more than 30 years in sales. I have experience selling in recessionary times. I know what it's like to be a manufacturer's rep, a direct rep and a distributor. I know what it is like to work for a \$10 million company when your main competitor is Hewlett-Packard. I have been there and done that.

Beaulieu: *LinkedIn guru Andy O'Hearn recently selected you for his top 100 LinkedIn Thought Leaders list. How did that come about?*

Johnston: Curiosity mostly. I don't accept things at face value. I look at LinkedIn features and the first thing I want to do is turn them on their head and use them in a different way to my advantage. And I'm also suspicious of the party line. If everyone says you should be doing A, then I want to start investigating B. So while other people are concerned with 20 key points on how your LinkedIn profile should look, I am

figuring out how to send messages to prospects via some little known (but free) method.

Beaulieu: *Tell me how you can help a company. What is the process?*

Johnston: There are two main paths. Starting from no experience with social media or LinkedIn is the first one. In that case, I instill the basics, but at the same time, instill basics that lead to immedi-



ate results. For example, here are how the LinkedIn menus work. Got that? Good. Now, let's use these menus to start hunting for prospects. I am always cognizant that the bottom line here is more sales.

The second path is the classic, "We know what we are doing but we aren't getting the results we expect." This is usually the result of some erroneous assumptions and can be fixed easily. These companies are gratifying to work with because they get results fast.

Beaulieu: *OK. A company calls you to help them with LinkedIn. What do you do?*

Johnston: I have a good conversation with the sales VP and the marketing people, if they have them. We talk about what they want to do, review what they are doing now, and set a course to get them where they want to go. I have been in sales a long time; I don't get surprised very often.

Beaulieu: *You have told me in the past that you can only help companies who want to help themselves. Can you please explain?*

Johnston: Sure. LinkedIn and social media may get a lot of press, but it's not magic. You don't open a Facebook account and turn your prospects into zombies, shuffling towards you with purchase orders in their hands. All these social media networks are tools. Other cool tools are email and smartphones, but they're just tools. And to be successful, you must figure out the right way to use those tools and practice to get good at using them.

Beaulieu: *How do you see social media in general and LinkedIn specifically, helping companies increase their sales?*

Johnston: Social media isn't a shortcut, it's just a different path from A to B. But since many of your customers are on that path, you should be there too. A hundred years ago you had to



make face to face calls. The telephone broadened your options, as did email. Social media is the next step. More ways to accomplish the same goal.

Beaulieu: *What do you see as the future of LinkedIn, especially now that Microsoft bought them?*

Johnston: A lot of integration with Microsoft products. The obvious tie-in will be with their CRM product Microsoft

Dynamics. But the possibilities are endless—you open Outlook, enter an email address and up pops a LinkedIn profile for that person. You have instant access to all their professional background. The same goes for Skype. And you must figure LinkedIn profiles will get very favorable placements on Bing's search results.

Beaulieu: *How do people engage you to help them with their social media marketing?*

Johnston: They can find me on LinkedIn, but the best way is to go to my website at practicalsmm.com. There's a tab for "schedule an introductory call with Bruce" that will take them to my calendar where they can choose a time for a free 15-minute introductory phone or Skype call. I get a couple of those calls every day.

Beaulieu: *Bruce, that is some pretty fascinating stuff. Thanks for spending the time with me today.*

Johnston: My pleasure. PCB

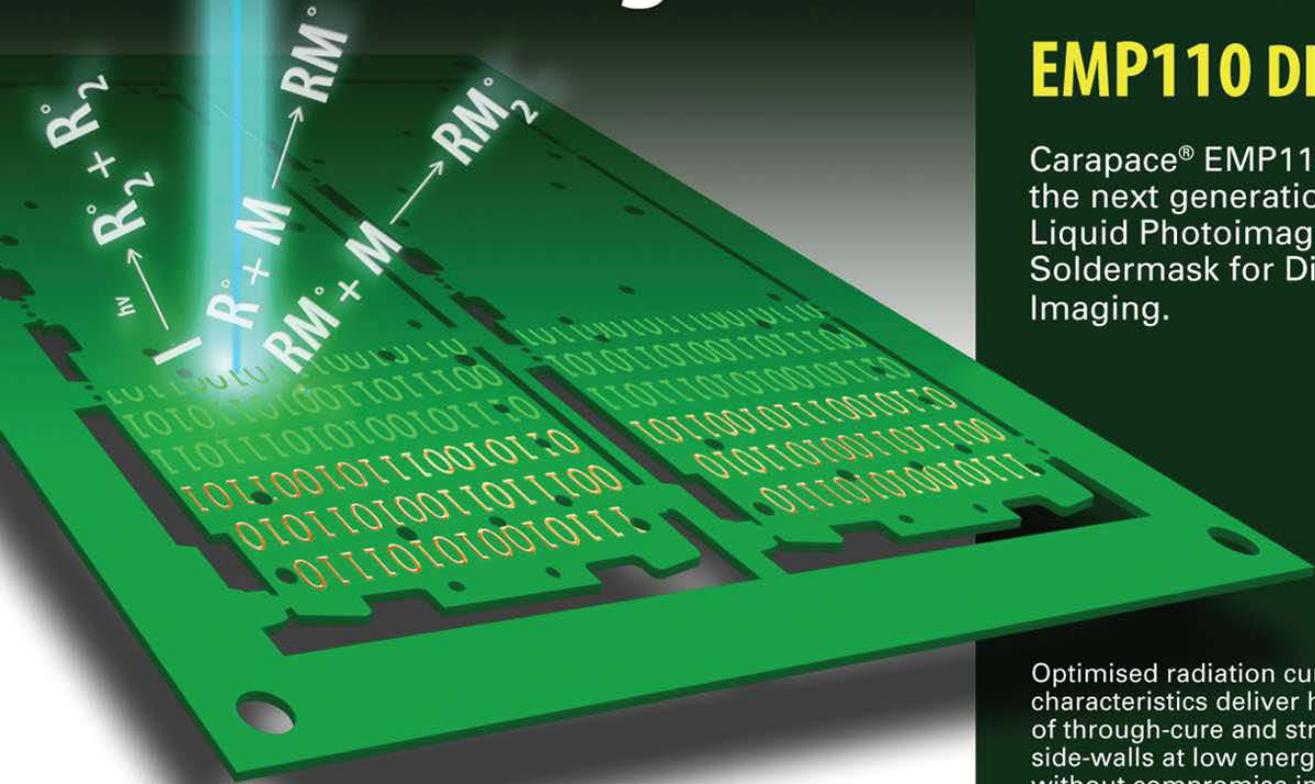


Dan Beaulieu is a 30-year PCB industry veteran, and sales and marketing expert and writer who has contributed to numerous industry publications, on topics ranging from sales and marketing, to board shop performance. His column, It's Only Common Sense, appears weekly at PCB007. To contact the author, or to read past columns, [click here](#).



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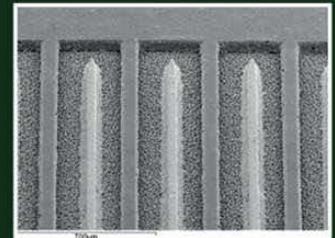
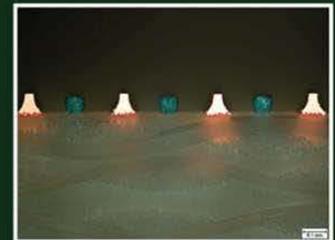


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Programs, Not Projects

by Barry Lee Cohen

LAUNCH COMMUNICATIONS

Sometimes, an uncontrollable tick in my neck begins to emerge. The wrinkle in my forehead that now has no boundaries slowly makes its way to my balding scalp. My porcelain china doll-like complexion gradually transforms itself to resemble a Honeycrisp, and ultimately, a Red Delicious apple. Finally, the irrepressible urge to take an enormous breath instinctively follows. My need to suck up all the air in the room allows me to self-edit what would otherwise certainly be my preachy remarks.

Fellow marketing communications peeps, you know what I'm talking about. You've been there every time a valued colleague gallops into your office and states, "I need an advertisement." "We require a basic brochure." "Let's do a video." "I've gotta get me some scintillat-

ing trade show trinkets." All separate silos, as if the marketing plan was intended to collect dust on the shelves and generated because it was included as a mandatory field in the business plan template. For those of us that take pride in our craft, we'd like to scream, "Stop the insanity! Think about your programs, not projects."

To be completely truthful, my colleagues have had the unique experience of hearing me rant about this subject repeatedly over the last three decades. And now, I share the meaning behind my mantra with you...

Blast Off

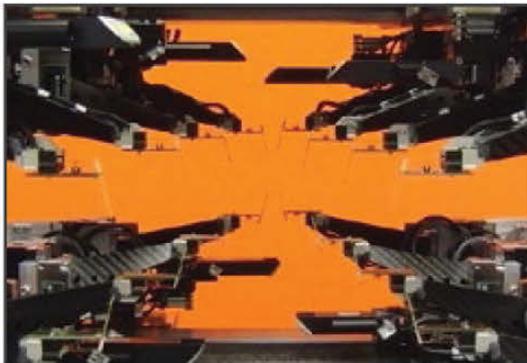
Very few, if any, communications should ever be confined to one tactical project. Introducing a capability such as a new product,



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corporate initiative or participation at an upcoming technical conference can and should be executed as part of a strategic program that will elevate your company's image and enable thought leadership by utilizing a mix of both digital and traditional media.

There does not need to be a "Sophie's Choice," made on which tactics to use, regardless of budget or if the offering is revolutionary or evolutionary in nature. An impactful and powerful market launch or singular corporate communication looks beyond the obvious news release and employs an integrated program that is relevant to your targeted customers and markets, where the product or service will create engaging and differentiated value. Although marketing may be driving most of these programs, the sales team should be key disciples that can introduce and address questions that any successfully deployed program will elicit.

“Now, of course there are occasions where the one-off projects are needed, but quite often they become the rule.”

Now, of course there are occasions where the one-off projects are needed, but quite often they become the rule. These "need it now" projects should be viewed as potential launching pads for new and emerging programs. Instead, these tactical executions are rarely shared, expanded or repurposed to benefit a strategic marketing campaign or redeployed as a sales tool. What's worse, the core value proposition and overall tone for the same product or service as presented in each silo sometimes contradict one another. This should never be the case. A project that is generated out of necessity should not be cast off like some unwanted, orphan child when the immediate need ceases. The project should be carefully cultivated and evaluated for future opportunities.

Well-crafted marketing programs require continuous collaboration with your team and

should result in the generation of a strategic and creative plan that clearly delineates milestones and deliverables. Every facet of the plan should bolster your marketing and sales activities, as well as include an understanding of your targeted audience's business drivers and technology roadmaps. This also includes a review of the industry and competitive landscapes, current and future market situation, customers' perceptions, keynote positioning, and other criteria that would take several more Launch Letters to detail.

Beyond meeting agreed upon objectives and addressing budget parameters prior to execution, the integrated tactics used to deploy your program must elicit the customer's voice. Based on the agreed plan, the tactics could range from web content and print materials to technology presentations, articles and more. The higher the increase in exposures and frequencies to targeted editorial, the better. With third-party placements come higher credibility. Keep the conversation going by employing social media, webinars, microsites, online surveys, and customer visits, to name a few.

Essentially, a strategic and creative plan becomes your bible for the program. Okay, maybe not "The Bible," but most definitely the plan should be viewed as a contract not to be broken unless agreed to by all the key stakeholders. If not vigilantly managed, changes in strategic messaging and creativity can increase time and costs, as well as sacrifice the delicate balance between the efficiency required to execute agile, go-to-market strategies and the mandated effectiveness to communicate compelling and relevant messages that offer value creation for your customers, applications, markets, and industries served.

Programs, not projects: A mantra worth memorizing and embracing. **PCB**



Barry Lee Cohen is president and managing director of Launch Communications. To read past columns or to contact Cohen, [click here](#).

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Market Highlights



[Europe to Surpass North America in IoT Sensors Market](#)

In the highly dynamic and fragmented arena of the global IoT sensors market, the leading players are aligning their strategies with rapid advancements in IoT technology, according to Transparency Market Research.

[Automotive Systems Forecast to Show Strongest Growth Through 2020](#)

IC Market Drivers 2017 shows that the market for automotive electronic systems is expected to display the strongest cumulative average growth rate (CAGR) through 2020, at 4.9%, highest among the six main electronic system categories. Safety and convenience systems are essential features that consumers look for and want in their new car.

[Communicating with Light](#)

As demand for mobile wireless services continues to grow, and the deployment of IoT technologies expands, Visible Light Communication (VLC) is emerging as a potential broadband transmission technology that may offer an unlimited bandwidth spectrum for high-quality wireless services.

[Manchester Graduates Hoping to Inspire with DIY Walking Robot](#)

Jack Scott-Reeve and Josh Elijah, who graduated with master's degrees in engineering from the University's School of Electrical and Electronic Engineering, have developed QuadBot, a 3D printable walking robotics platform. Their aim is to help as many people as possible to learn about robotics.

[Demand for Alternative Fuel in Automotive Sector to Stir Growth of Lithium-ion Battery Market](#)

TMR projects the global lithium-ion battery market to reach \$77.42 billion in 2024 from \$29.68 billion in 2015. Between 2016 and 2024 the market is forecast to exhibit a CAGR 11.6%.

[Gartner Announces Rankings of 2016 Healthcare Supply Chain Top 25](#)

Gartner Inc. has released its eighth annual Healthcare Supply Chain Top 25 ranking. The ranking

recognizes companies across the healthcare value chain that demonstrate leadership in improving human life at sustainable costs.

[OPPO Tops the Chinese Smartphone Market for the First Time](#)

According to IDC's latest Asia/Pacific Quarterly Mobile Phone Tracker, the China smartphone market grew 5.8% YoY and 3.6% QoQ in the third quarter of 2016, with OPPO and vivo overtaking Huawei for the first time.

[IDC: New Rules, Roles and Demands in the Era of Digital Transformation in China](#)

International Data Corporation (IDC), the world's leading provider of global IT research and advice, held its annual forum on Chinese IT market predictions on November 8 in Beijing.

[Asia Pacific to Dominate Uptake of Smart Manufacturing Technologies and Systems](#)

The global smart manufacturing market is expected to be worth \$548.14 billion by 2024 as compared to \$159.05 billion in 2015, according to Transparency Market Research.

[Semiconductor-free Microelectronics Now Possible, Thanks to Metamaterials](#)

Engineers at the University of California San Diego have fabricated the first semiconductor-free, optically-controlled microelectronic device. Using metamaterials, engineers built a microscale device that shows a 1,000% increase in conductivity when activated by low voltage and a low power laser.



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Via Formation and Mechanical Drilling, Part 2

by Michael Carano

RBP CHEMICAL TECHNOLOGY

Introduction

In [November's column](#), I articulated the need to provide a quality drilled hole. I stated that a less than optimum mechanically drilled PTH will negatively impact the metallization processes as well as potentially affect the quality of the wave soldering of the PWB. In this month's installment of Trouble in Your Tank, I will further explore the critical drilling parameters required to drill a "good hole" and provide information on some little-known parameters required for this operation.

What is a "good hole?"

A good hole is one that has a uniform and smooth sidewall, with no defects outside the tolerances defined by applicable specifications such as: smear, burrs, nail heading, debris, glass fibers, foreign material inclusion, etc. A good hole is drilled accurately with respect to size and location within the specified tolerances, and a hole wall perpendicular to the surface of the PCB. Deep drill gouges, torn-out glass bundles and the potential to create wedge voids severely impact the metallization process. When drilling is not optimized, many defects can and will occur. Unfortunately, if not recognized and corrected early in the PCB fabrication process, these drilling-induced defects may go undetected until the finished PCB has been sent to the assembly process! This is not a scenario you want to deal with.

Drilling-Induced Defects

One example that has many possible causes is the wedge void or wedging (Figure 1). One must be able to think about the entire fabrication process if wedge void is detected. A weak bond between the resin and copper, along with incomplete cure of the resin are two possible causes. However, excessive heat generated by the drilling process will also contribute. Generally, dull drill bits, excessive in-feed rates, and slow up-feeds contribute to the possibility for wedge voiding or wedging to occur.

Table 1 provides a concise overview with the causes and corrective actions when wedge voiding or wedging is occurring.

As one further studies Figure 1, the plating

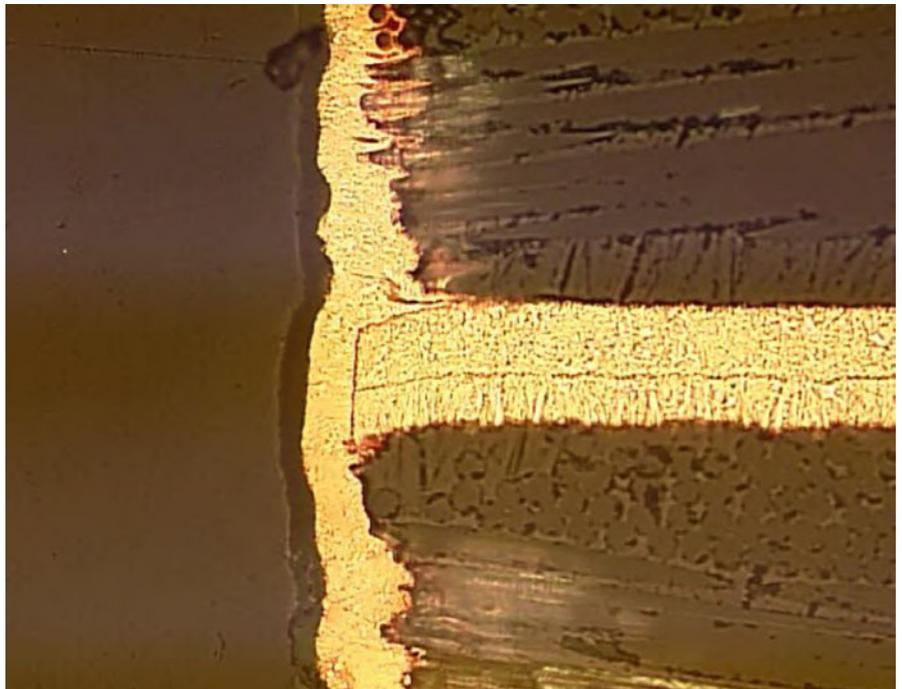


Figure 1: Wedge void created in part by poor drilling parameters.

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CAUSE	ACTION
Aggressive drilling	Reduce in-feed rates Replace drill bits Reduce drill surface feet per minute (SFM)
Incomplete cure resin	Ensure complete cure Adjust lamination cycle Increase time at cure temperature
Overly aggressive desmear process	Reduce rate of rise in multilayer lamination process
Possible delamination/poor oxide bond.	Post-drill bake prior to desmear/review oxide process parameters
Insufficient resin flow in multilayer lamination	Adjust lamination cycle/check age of pre-preg/review heat rise in pre

Table 1.



Figure 2: Close-up of plowing. (Source: IPC 9121.)

Another defect that is drilling induced is “plowing.” This defect is characterized by furrows or grooves in the hole wall (Figure 2).

Plowing is mainly caused by worn-out drill bit cutting edges, undercured laminate and excessive spindle speeds. Spindle speed is measured in RPMs. Therefore, check the spindle speed for that particular hole size and board thickness and adjust accordingly. The higher the RPM rate and the longer the drill bit stays in the hole, the more heat is generated. So, resin smear will also be an issue. If undercured resin material is the root cause, this issue resides within the lamination cycle, age of the pre-preg, moisture content and final cure temperatures.

Some Things to be Aware of

fold is evident due to the wedge creation. Thus, even if this finished circuit board passes in circuit test (ICT), there exists the real possibility that the thin plated copper will fail during thermal cycling or while in service. Secondly, the thin copper in the fold area will often rupture during wave soldering, allowing gas to escape. This in turn will lead to blowholes.

While engineers mostly focus the attention on drilling parameters such as feeds and speeds, there are other less obvious criteria that when not understood or maintained, will lead to poor hole wall drill quality. One such issue is spindle run-out. Run-out or runout is an inaccuracy of the drill spindle. In this case, the drill tool or shaft does not rotate exactly in line with the main axis. For example, when drilling, run-out will result in

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a larger hole than the drill's nominal diameter due to the drill being rotated eccentrically (off axis instead of in line) as opposed to concentrically (rotating in a very tight spiral). Excessive spindle run-out will cause the hole size to be larger than specified, lead to rifling in the hole wall and cause overall hole roughness. Rifling is a defect characterized by a groove or ridge in the hole wall. In general, when spindle run-out is affecting hole wall quality, the remedy is to clean out the spindle collet or replace the collet altogether.

Summary

It must be clear by now that there is more to drilling good holes than feeds and speeds.

If anything, the information presented here underscores the difficult nature of troubleshooting and getting to the root cause of defects. Defects such as wedge voids and plowing may also have additional contributing factors such as under-cured laminate, poor lamination practices and moisture in the pre-preg. **PCB**



Michael Carano is VP of technology and business development at RBP Chemical Technology. To read past columns or to contact Carano, [click here](#).

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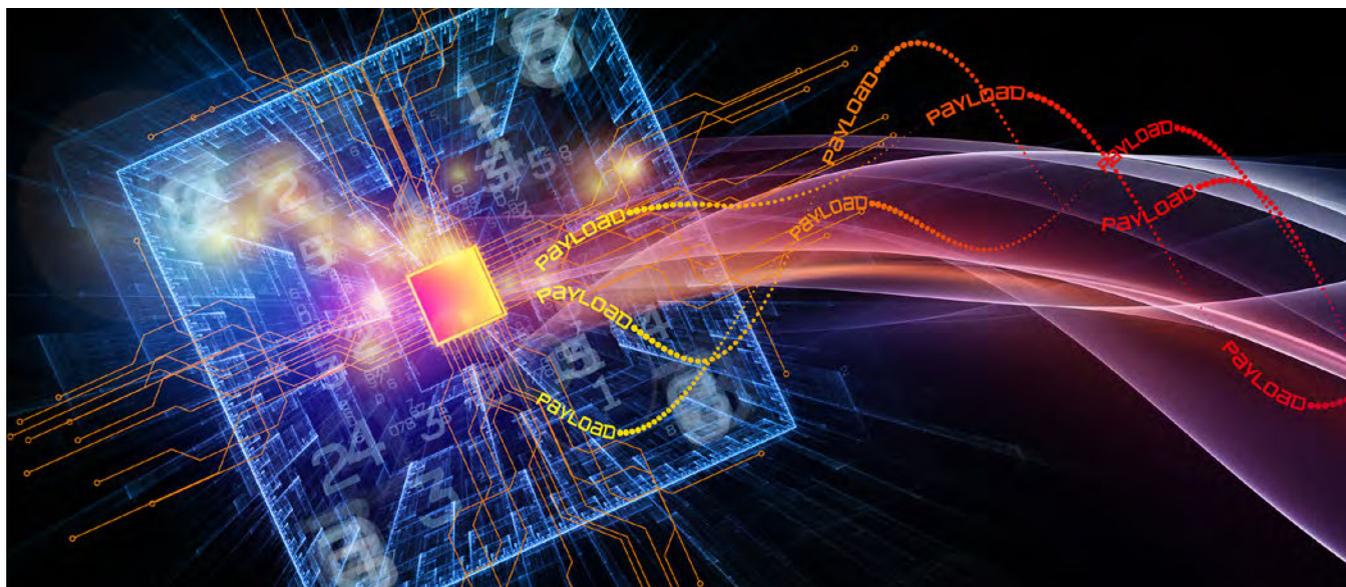
A lot of things are taken for granted nowadays. Even in our everyday lives, we order things, but are we always getting exactly what we've ordered? What we've paid for? Maybe... hopefully...but maybe not. In the testing world, we call this double-checking "supplier surveillance," and it can influence and affect anyone and everyone in the printed circuit board and printed circuit assembly supply chain.

In a nutshell, supplier surveillance is a set of steps that you've put in place to ensure that you are getting whatever it is that you have asked for. Whether that be a circuit board, a laminate material, some plating bath chemistry, a metal alloy...or whatever. A little bit of testing on the front end, to ensure that you're receiving what you think you're receiving, can go a long, long way in providing you and your customer some piece of mind. It's a small bit of due diligence that can pay off big. A small bit of testing or double-checking that allows you, with confidence, to know that you are getting what you've paid for and that a potential product or

field return from your customer is not due to your use of poor quality building blocks.

No matter where you are in the supply chain, if you are receiving defective material or product and are not performing any supplier surveillance, then there is a 100% chance that you are passing said defective material/product on to your customer.

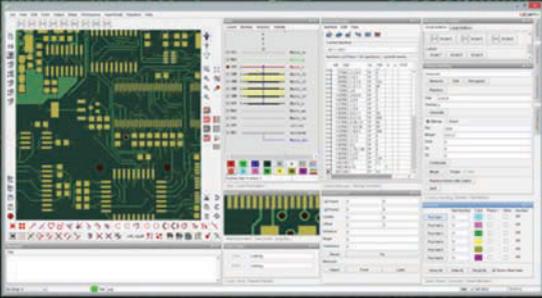
A successful supplier surveillance plan will ensure that you are receiving and then using exactly the materials/products that you want to build the widget you are selling to your customer. Supplier surveillance plans typically incorporate items such as product data sheets and/or certificates of compliance (CoC) to ensure that the material or product matches what you believe you are receiving. Product data sheets commonly contain information about the features of the material/product as well as chemical, electrical, and/or mechanical properties of the material/product, along with any testing history that may have been performed. Similarly, CoCs typically contain much of the same



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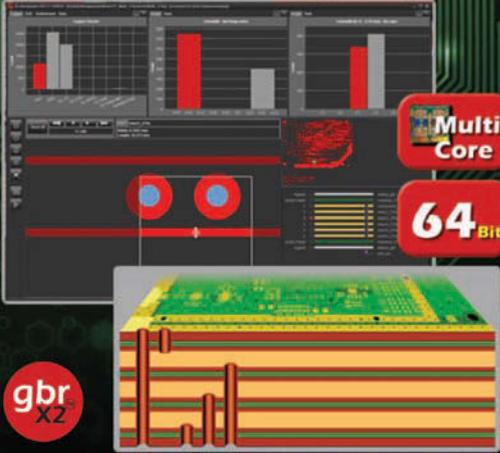
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information but also commonly link the particular material/product to a part number and/or lot number. Also, the CoCs might also include information related to when the material/product was tested and when it might expire, or no longer be suitable for use.

Both the product data sheet and the CoC, and even your own drawing or specification regarding exactly what it is that you want, are important documents when performing supplier surveillance as it gives you the specific details about what your material/product is and is not, or should and should not be. Test plans can be developed around these documents to provide some reassurance that you're getting what you've paid for.

The tests performed as part of your supplier surveillance plan are obviously important, but just as important as the testing is the plan that you've developed to assess the risk involved. Knowing your final product, what it is that you deliver to your customer, will allow you to optimize your supplier surveillance strategy to focus on those materials or products that are most critical to your end product's success. You should understand the factors that most affect the quality of your materials/products. Maybe it's a raw material in which product data sheets and/or CoCs are the most important pieces of documentation? Maybe it's a product in which

design factors should be scrutinized and investigated? Maybe you've purchased from a non-OEM, and the widget could be counterfeit? These are just some of the questions that you might need to investigate to ensure that your final product is exactly what you've told your customer it will be.

If you're not performing supplier surveillance, what happens when your customer does and discovers that they're not getting what they've asked for? Whatever does happen in this case, it probably won't be something good and if their investigation finds that the culprit of the issue(s) was something that you would have found doing your own due diligence, it's likely the outcome will be bad for you and/or your company. They say a penny saved is a penny earned...in the world of supplier surveillance, a few pennies spent testing a couple of samples on the front end, could easily save millions of pennies on the back end. **PCB**



Keith M. Sellers is operations manager with NTS in Baltimore, Maryland. To read past columns or to contact Sellers, [click here](#).

Designing Agile Human-Machine Teams

Military operations are dynamic and complex—in-fantry squads carry out their missions simultaneously in the 3D physical world, the cyber domain, and across the electromagnetic spectrum. As artificial intelligence becomes more advanced, the future of kinetic, cyber, and electronic warfare envisions humans and intelligent machines working together. A challenge, however, is determining how best to meld human cognitive strengths and the unique capabilities of smart machines to create intelligent teams adaptive to rapidly changing circumstances.



To address this challenge, DARPA today announced the Agile Teams (A-Teams) program, which sets out to discover, test, and demonstrate predictive and generalizable mathematical methods to enable optimized design of agile hybrid teams. A-Teams seeks to fundamentally challenge the current paradigm of human-intelligent machine systems design by changing the focus from simply using machines for automation and substitution of human capacity to an integrated fabric enabling superior collective problem solving.

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Understanding Predictive Engineering

by Happy Holden

New product realization and design for manufacturing and assembly (DFM/A) have now started to become more visible as programs that can improve a company's time-to-market and lower product costs. Many programs are underway by many companies and what is now needed is a *framework* to coordinate the application of these programs. This column will cover the interactions of DFM/A and the need for development of a new framework to coordinate the trade-offs. These trade-offs cover six key design topics:

- Optimization of PCB design grids and layout
- Minimization of assembly costs
- Analysis of test coverage
- Minimization of PCB substrate costs
- Use of preferred parts
- Partitioning of ASIC pinouts

Concurrent engineering has been the basis for electronics design. Its one-way interactions

with manufacturing constitute the old way of thinking. This column will propose a new framework, *predictive engineering*, patterned after the manufacturing software framework of *concurrent manufacturing*. This framework will provide the inner-operability for manufacturing capabilities and characteristics to be planned into electronic assemblies before the traditional CAE/CAD processes. As part of this framework, the basis for trade-offs will be the basic DFM/A metrics that have been developed by different companies. Predictive engineering is complementary to the growing application of computer integrated manufacturing (CIM) software and product data management (PDM) software used in electronics manufacturing.

Introduction

We have all seen how electronics technologies' capabilities are growing at an ever-increasing rate. Unfortunately, those of us in manufacturing have also seen a corresponding increase in the complexity of packaging. Modern EDA



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tools and concurrent engineering are primary drivers of this phenomena. What we have not learned to do in this era is to develop an effective technique to feedback manufacturing experiences and wisdom. The data flow is all one direction, from design to manufacturing.

The Opportunity of Design for Manufacturing (DFM/A)

There are five compelling reasons that predictive engineering is essential to the design of electronic products:

1. Products have become increasingly complex. Not only must products meet increased expectations from customers but they must be environmentally friendly, energy efficient and conservative of resources. All of this must be done in ever shrinking product life cycles.
2. Minimizing cost is imperative. DFM/A has been shown in benchmarking and case studies to reduce assembly costs by 35%^[1] and PWB costs by 25%^[2].

3. 75% of the manufacturing cost of a product is determined by all the design drawings and specifications.

4. In the electronic product design process, 60% of the manufacturing cost is determined in the first stages of design when only 35% of the design cost has been expended. As shown in Figure 1, the product definition process includes specifications and partitioning. This is a technology tradeoff analysis (the balance of loss and gain in various domains' performance versus costs).

5. Finally, a common language needs to be established that links manufacturing to design and R&D. This common language defines *producibility* as an intrinsic characteristic of a design. It is not an inspection milestone conducted by manufacturing. Producibility scores form a non-opinionated basis that allows for a team approach that results in a quality, cost-competitive product.

The Nature of the Problem

Current practice is that design data travels in only one direction—towards manufacturing. As shown in Figure 2, there is no provision for the capabilities, experiences and wisdom gained in manufacturing to flow back to the design environment. Hence, many companies use concurrent engineering to bring experienced manufacturing personnel into the design process, to try and impart some of that wisdom. Unfortunately, these experienced manufacturing people are getting rarer and it takes far too long to gain that experience. The difficulties don't just end there, most of the time the manufacturer is far, far away. Under the best of circumstances, the wisdom and experience must be imparted as opinion. And opinions are difficult to defend.

This might be a working solution for small, vertically integrated companies with vast experience in manufacturing. But in the last

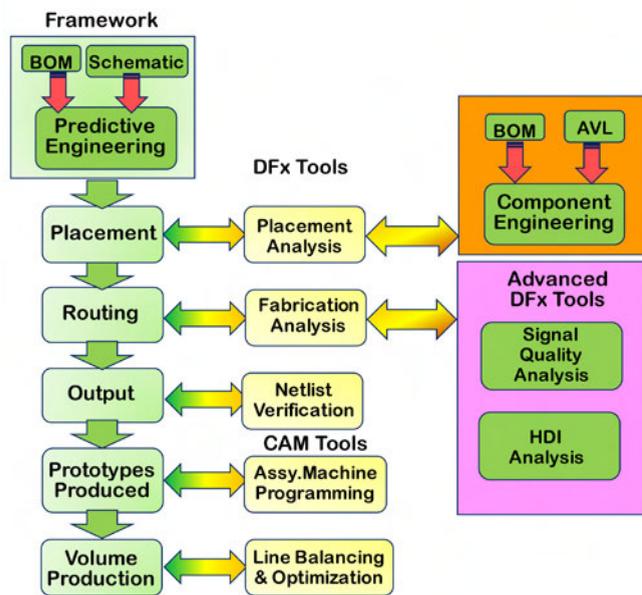


Figure 1: Predictive engineering contains more than just 'density modeling'; it provides caution on 'failure-prone components' and 'suitability for test,' as well as optimizing electrical performance and minimizing signal integrity problems.

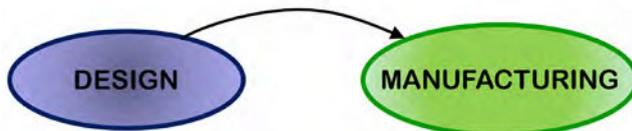


Figure 2: Current product data movement.

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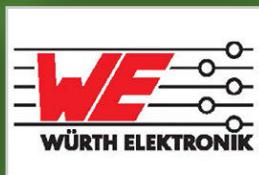
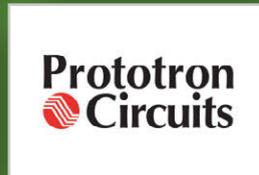
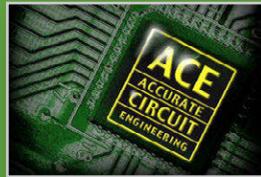
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yields before it can be estimated accurately. Two key metrics were developed to bring about this price/performance tradeoff. They are:

- *Complexity Index (CI)* to characterize the complexity of physical characteristics (size, layers, holes, traces, etc.) of this particular PWB so that first pass yield can be calculated.
- *Relative Cost Index (RCI)* is an artificial currency that indicates the magnitude of price changes between two or more design alternatives.

SMT Assembly

The major metrics of SMT assembly are:

- *Assembly Report Card* is a predictive and very comprehensive set of metrics. The ten (10) factors are based on a total point scheme derived from assembly costs. The points affect quoted prices to the extent:

0 - 45 points	+20%
46 - 60 points	+10%
61 - 75 points	-10%
76 - 100 points	-20%

A second typical metric is assembly complexity^[8,9]. This is defined as leads per square inch (LPI). The article cited provides the data for a regression model of average cost per lead versus assembly complexity.

Proposed Approach

Emerging assembly and fabrication CIM systems such as CIMnet and CIMBridge^[10], CAD-Master and individual software solutions offer a new opportunity to implement DFM/A. These are modern frameworks that I call *concurrent manufacturing (CM)* to differentiate them from *concurrent engineering*. The framework of CM is shown in Figure 4.

The important role CM plays in DFM/A is illustrated by the module Product Information Exchange (PIX). Its role is to:

- Communicate information between: Design engineering to manufacturing; manufacturing to design engineering and other manufacturing; subcontractors
- Automate: CAD data exchange; revision archiving
- Provide: Product data tracking; packaging completeness checking; supports standard industry networking
- Design for Assembly: Analyzes part placement; supports multiple machine configuration; analyzes machine capacity; and provides production engineering documentation.

The emerging data transfer environment is from the enterprises central data base called product data management (PDM)^[11]. Figure 5 illustrates this new data movement condition. PDM software integrates all data required to design, manufacture and support a product. Data such as:

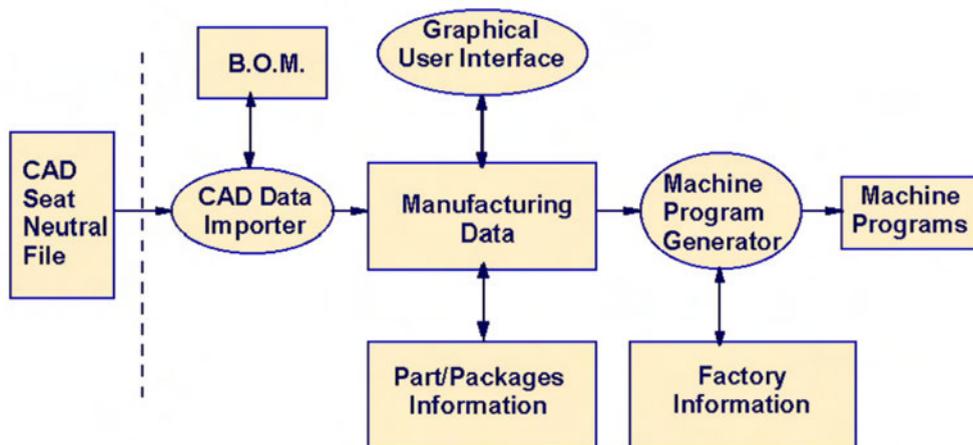


Figure 4: Concurrent manufacturing framework.

- Simulation & models
- CAD & CAE data files
- Materials, processes & characteristics
- ECOs, revisions, parts, etc.

- Layout and CAD system setup
- PWB fabrication design rules, yield optimization and cost tradeoffs
- SMT assembly process, packaging component and test tradeoffs
- Specifications and documents
- Standards and regulations

Predictive Engineering

Predictive engineering (PE) is the activity of doing trade-offs. It focuses on:

- Product definition and system partitioning (technology tradeoff)

Over the years I have taken various predictive models and coded them into Excel spreadsheets. This allowed me to see the effects of various parameters on events. Eventually, using macros, I have linked these 14 spreadsheets into one predictive system that allows me to prototype a proposed schematic and look at its performance and costs without ever actually building it. As shown in Figure 6, this allows the user to improve on any product development or product change process.

One key element is missing from this list: the global assignment of custom ASIC pin locations. This would help to reduce PWB and assembly complexity and costs, while assuring better system performance and the best “time-to-profits.”

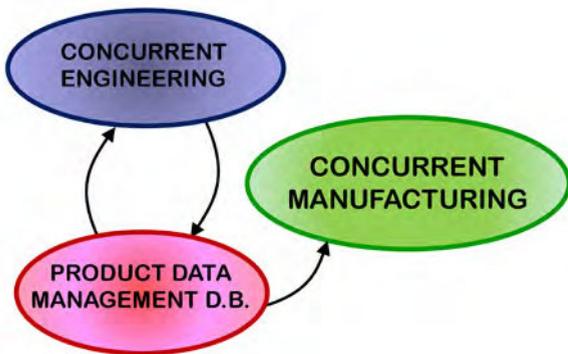


Figure 5: Emerging data transfer environment.

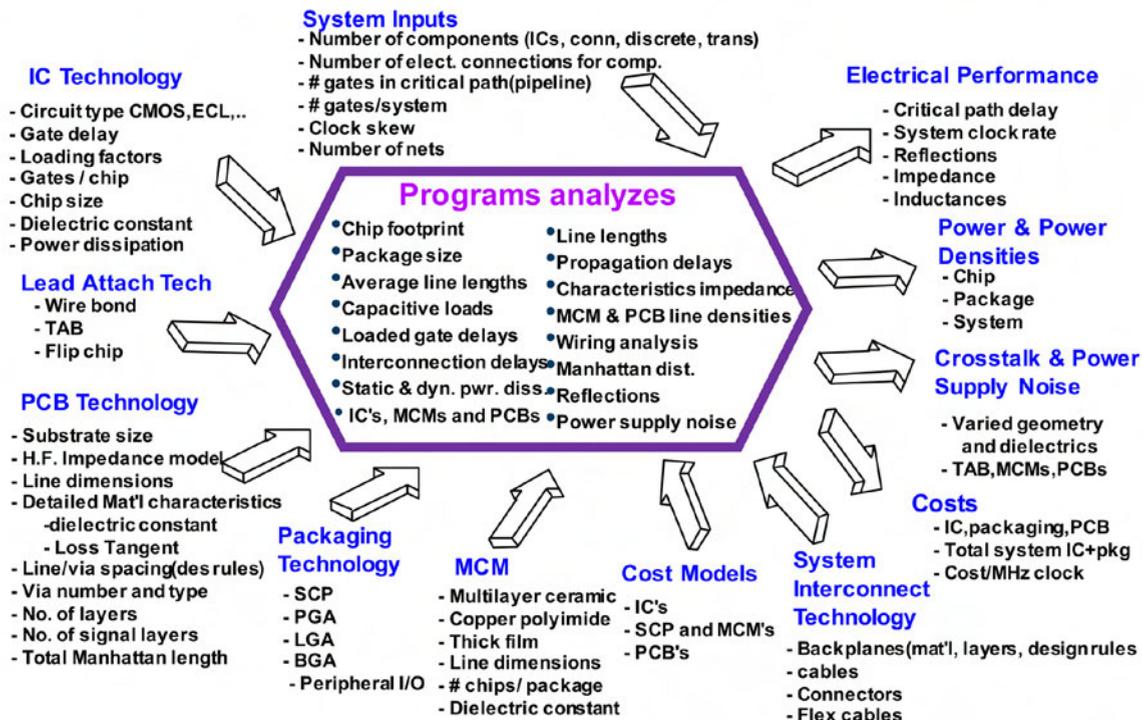


Figure 6: For predictive engineering of a PCB, there should be simulations and tradeoffs that cover all the domains that a user finds critical: costs, manufacturability, density, signal integrity and reliability.

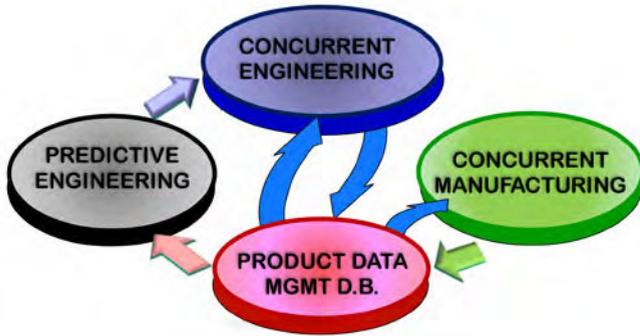


Figure 7: Proposed predictive engineering framework.

The PE framework (Figure 7) imports critical metrics and data from manufacturing through the PDM database^[11]. Since concurrent engineering has such a short product focus, the wisdom and experience acquired in concurrent manufacturing can be archived in PDM.

The PE software architecture of tradeoff models and supporting software (Figure 8) provides the user with global information. As features are selected, they can be placed back in the PDM database. Selection of layout factors,

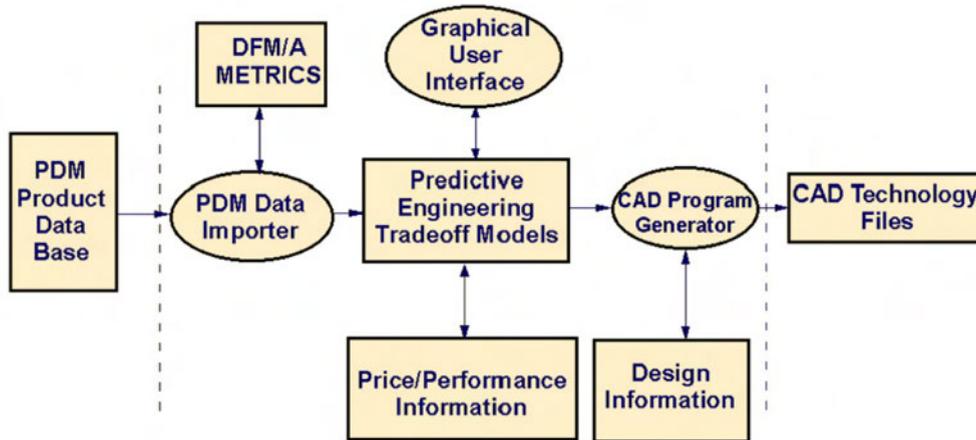


Figure 8: Proposed predictive engineering architecture.

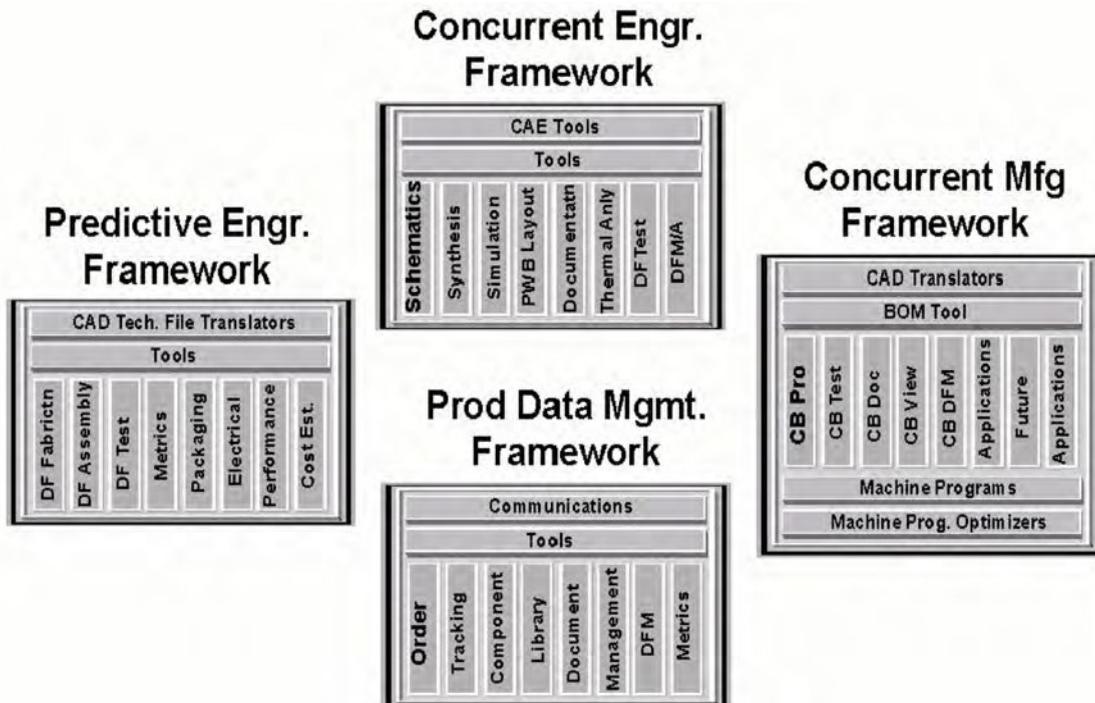


Figure 9: Product generation framework.

sizes and design rules can be used to create technology files that drive modern CAD programs.

Conclusion

If companies want to reduce product generation time to market, development costs and production costs, then DFM/A needs to be integrated into a product generation framework. concurrent engineering, concurrent manufacturing, product data management and predictive engineering all are essential elements. The tools, software and elements of such a vision are shown in Figure 9. All that remains is to find a software environment to add predictive engineering. **PCB**

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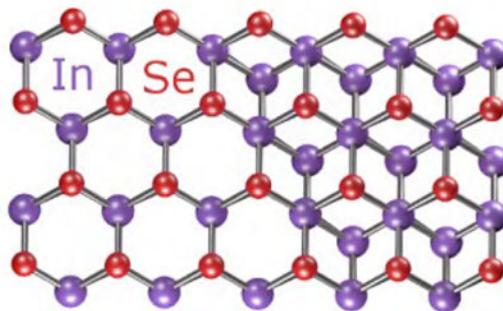
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Printed Circuit Handbook, 7th Ed. To contact Holden, [click here](#).

New Ultra-Thin Semiconductor Could Extend Life of Moore's Law

Following a decade of intensive research into graphene and two-dimensional materials, a new semiconductor material shows potential for the future of super-fast electronics.

Indium Selenide (InSe) is only a few atoms thick, similarly to graphene, and reported in *Nature Nanotechnology* this week by researchers of The



University of Manchester and their colleagues at The University of Nottingham.

The new research shows that InSe crystals can be only a few atoms thick, nearly as thin as graphene. InSe was shown to have electronic quality

higher than silicon, which is ubiquitously used in modern electronics.

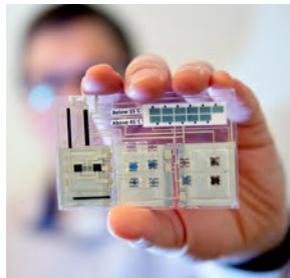
TOP TEN



Recent Highlights from PCB007

1 **EPTE Newsletter: Printable Electronics— A Practical Solution?**

I attended a printable electronics workshop in Japan a couple of weeks ago. The 200-person crowd was made up of people from R&D organizations, material suppliers and machine manufacturers. No one there could be termed a customer; everyone was there to learn and discuss the latest printable electronics.



2 **Standard of Excellence: Let's Get Flexible**

Although flex and rigid-flex technology has been around for many years, it is only in recent years that it has come into its own. The reason for the increased requirements for the flex and rigid-flex technology is simple: Devices are getting smaller.



3 **Schoeller Electronics Present- ing a New Organizational Structure in North America**

At the recent SMTA International show in Rosemont, Illinois, I met Padraig McCabe at Schoeller Electronics Systems' booth. It was obvious that they had a lot going on so it was good to be able to sit down and get the full story of their new organizational structure, name change and the recent acquisitions of PCB companies.



4 **Streamline Circuits: The Importance of Being a Sales-Driven Organization**

I recently had the pleasure of catching up with Tom Doslak, senior VP of sales and marketing for Streamline Circuits. We discussed how the company got started, technologies that seem to be driving the marketplace, critical equipment for today's PCB fabricator, and how being a customer-centered, sales-driven organization serves as the key to their success.



5 **electronica 2016 Impressions**

Germany's third-largest city, and capital of the southeastern state of Bavaria, Munich was once more the host to electronica, which can justifiably claim to be the world's leading trade fair for electronic components, systems and applications.



6 **Weiner's World**

This year's TPCA (Taiwan Printed Circuits Association) show held October 26–28 seemed to have lighter attendance than last year. Robots were on display everywhere, with lot of loaders and unloaders as well as the multi-axis, multipurpose types.



7 **Walt Custer's Global Market Outlook**



With 2016 winding down, Walt Custer shared his end-of-the-year market research data with me at the recent electronica trade show in Munich, Germany. In our interview, Walt

breaks down his findings and offers insight into the changing trends as we head into 2017.

8 **IPC Standards Committee Reports—Printed Board Design, Testing, Flex Circuits, High-Speed/High-Frequency, Rigid Printed Boards**

These standards committee reports from IPC's 2016 Fall Committee Meetings have been compiled to help keep you up to date on IPC standards committee activities. This is the first in a series of reports.



9 **All About Flex: Specifying a Flexible Circuit**

IPC has created a specification document, IPC 6013, which is referenced for many flex circuit applications. This commercial document, in combination with the CAD data and print, is used as the product specification. Most flexible circuitry fabricators' internal quality standards are based on IPC 6013.



10 **Lenthor Engineering Adds Salina Galindo-Luna to their Executive Team**

California based designer, manufacturer and assembler of rigid-flex and flex printed circuit boards, Lenthor Engineering, announces the addition of the newest member of their executive staff, Salina Galindo-Luna. In her new position, Salina will help Lenthor improve their services by streamlining production processes and eliminating waste to promote sustainable change.



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