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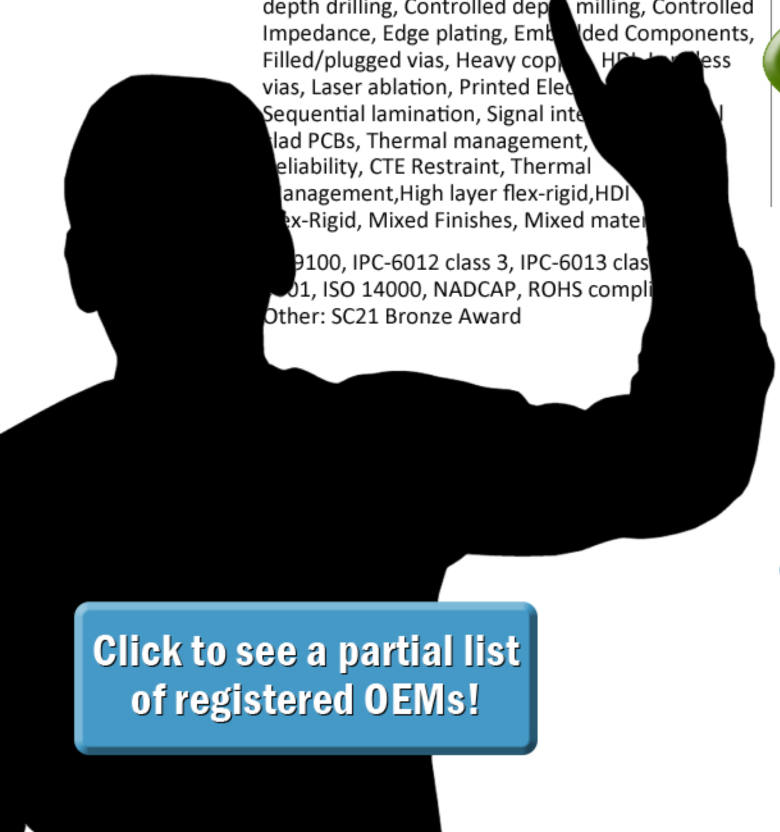

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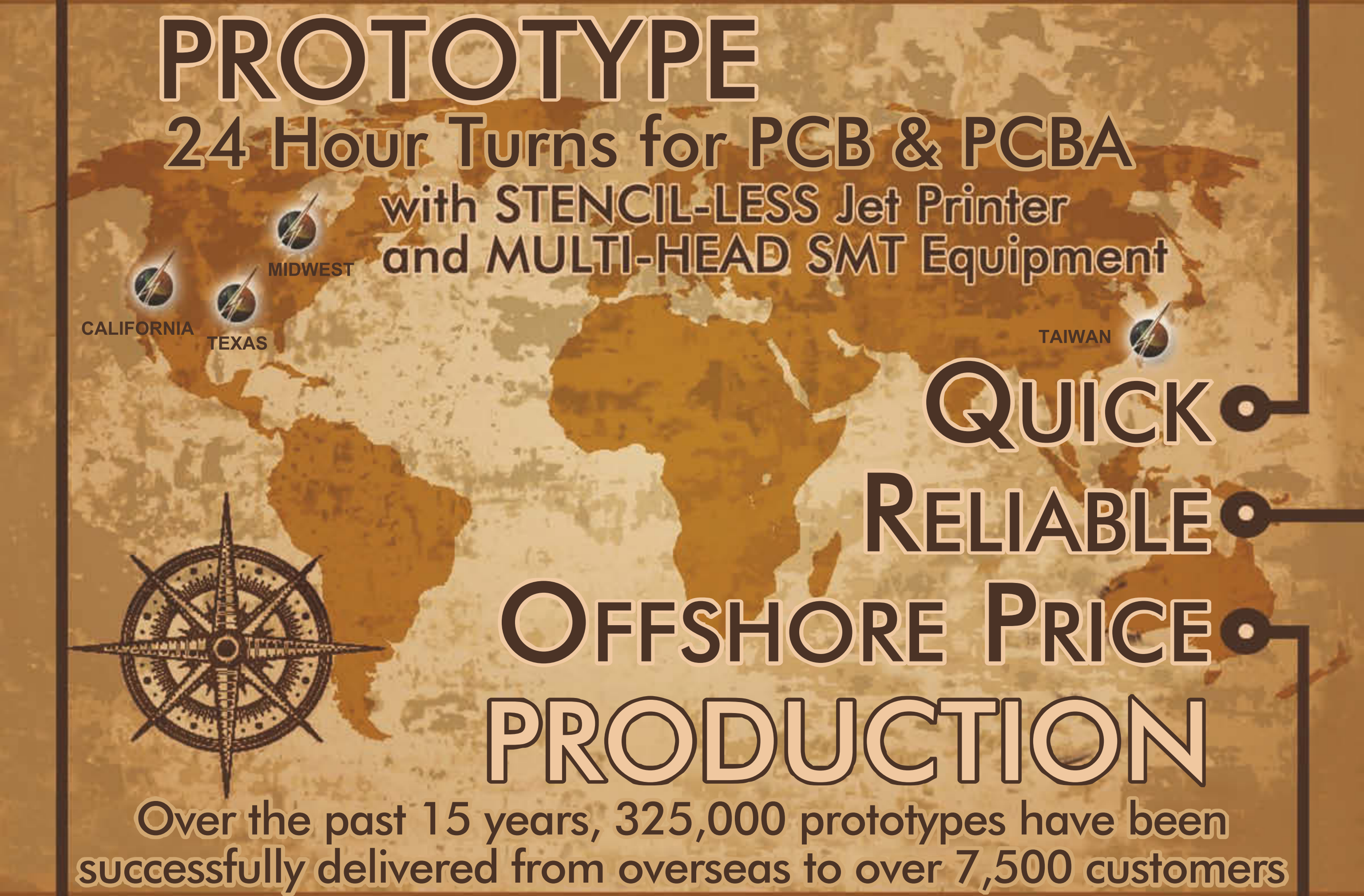

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Sales & Marketing

This month, *SMT Magazine* examines the myriad challenges facing sales and marketing execs in the PCB assembly industry. Our feature contributors offer winning sales and marketing methods, and describe key attributes of sales strategies from their unique perspectives.

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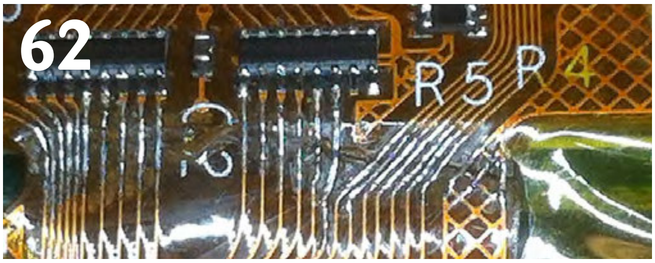

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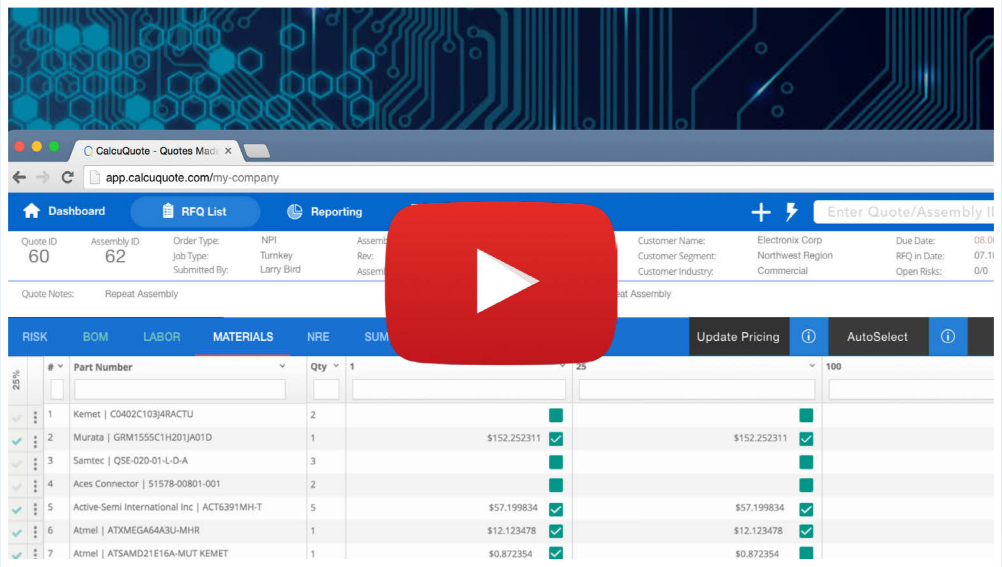
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2	Murata | GRM1555C1H201JA01D	1	$152.252311 ☑	$152.252311 ☑	
3	Samtec | QSE-020-01-L-D-A	3	🟩	🟩	
4	Aces Connector | 51578-00801-001	2	🟩	🟩	
5	Active-Semi International Inc | ACT6391MH-T	5	$57.199834 ☑	$57.199834 ☑	
6	Atmel | ATXMEGA64A3U-MHR	1	$12.123478 ☑	$12.123478 ☑	
7	Atmel | ATSAMD21E16A-MUT KEMET	1	$0.872354 ☑	$0.872354 🟩	

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Selling Success in the PCBA Industry

by Stephen Las Marias
I-CONNECT007

I am neither a salesperson nor a marketing person, but over the course of my editorial work, and through speaking to technology and systems providers in the electronics manufacturing industry, I have learned a few things when it comes to sales and marketing, namely, the importance of collaboration, positive relationships, and technical knowledge. For example, the sales and the marketing teams must work together to make sure deals get closed and contracts are awarded.

I don't know if this can be considered a marketing/selling process, but in numerous media panel interviews I have attended, the sales and marketing guys are almost always together. The marketing executive gets us editors interested in the company or the technology that they are creating—so that we attend said media event—and the sales guys sell the idea to us, so that we write a good story about their technology.

Another thing I have learned is the importance of creating and maintaining a good relationship. Many a time I have joined clients (in my previous work) to visit their customers to write customer success stories. In my observations during these visits, I saw that both parties enjoying a genuinely good relationship—almost a friendship—and not just the obligatory vendor-customer relationship.

And I think this tends to happen, customers becoming your close friends in the industry. In our recent survey on sales and marketing, majority of the respondents said it takes around six to 12 months before a prospect becomes a customer. Technically, there are other aspects to consider, such as the scope and complexity of the project, and the qualifications by the customer. Others even answered more than a year

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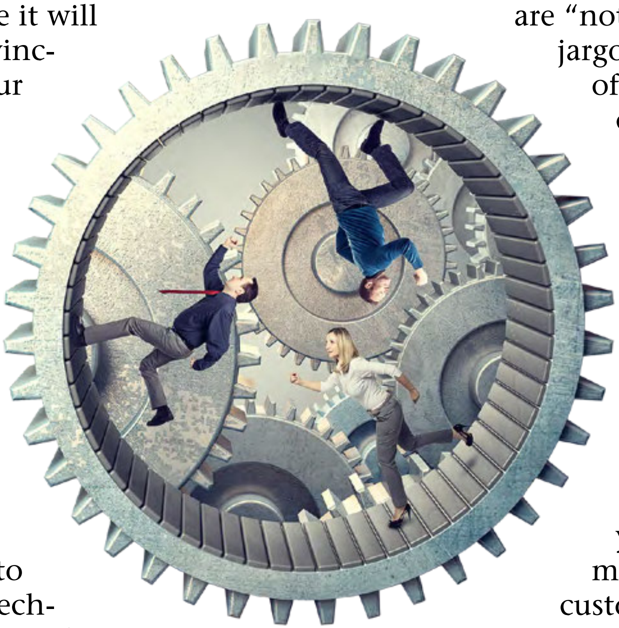
to convert a prospect, cautioning against customers who are easy to convert. (By the way, you can read more about the results of that survey on page 44.)

My point is, during those six to 12 months of talking to your prospects and finding out their needs and challenges, and then working closely on solutions that could help them address their manufacturing issues—friendships will be formed—and deals will be closed. That is, unless you are strictly trying to hit your quota, when I am sure it will take one helluva time convincing prospects to buy your product or service.

One more thing I've learned when it comes to sales and marketing is that you must be well-versed in your product lines. According to our survey, when it comes to salespeople, one of the serious challenges employers have is the lack of technical knowledge. From my perspective, it is important to have someone with the technical knowledge to explain the innovations included in products and how these developments may help customers address their greatest challenges.



This month's issue is focused on sales and marketing strategies, and features the challenges for sales and marketing executives in the electronics manufacturing industry. This issue aims to highlight the key attributes of a salesperson, and provide effective sales strategies to use to be successful in this industry. We find it apt to talk about such issues to make sure that as we enter 2017, you will have some insights on how to adjust or further improve your sales and marketing process and make the new year an even better one.

First, we have Jay Gorajia of Mentor Graphics Corp., who discusses the larger involvement of a younger generation in the workforce, the digital transformation in the industry, and how the move toward smarter manufacturing are all presenting new and unique challenges to today's PCB assembly industry. He notes that while many of the common sales and marketing best practices apply to the PCB assembly industry, deep manufacturing and electronics design expertise is required to truly drive customer interactions from one-off transactions into long and sustaining relationships.

Next, we have our new columnist, Craig Arcuri, an EMS industry veteran, writing about real sales, which, according to Craig, are "not pop sales ideas, not sales jargon of the day, not flavor of the month tactics." Arcuri provides simple steps to build a sales foundation, and how organizations can generate more sales out of having that solid foundation.

After that, we have Dan Beaulieu providing a review of the five new books that can directly influence the way you think about sales, marketing, customers and customer service.

I was also able to interview Matej Krajnc, of National Instruments, about sales and marketing challenges and strategies. He said sales strategies always have to change because you only have a sales strategy according to the situation and requirements one currently has.

Next, we have NEA's Shannon Allard, with her perspective on what makes a good salesperson when it comes to pre-owned SMT equipment.

Susan Mucha of Powell-Mucha Consulting Inc., meanwhile, explains why sales and marketing strategies vary widely in the EMS industry. She provides sort of a case study of four EMS firms and their approach to the sales and marketing process.

We also have a couple of interesting articles this month. First, we have Thomas Wenzel and Enrico Zimmermann of Goepel electronic writing about some fundamental aspects of the combination of boundary scan and functional test, as well as new technological solution approaches for embedded function tests, and their practical implementation.

Frederick Blancas of Integrated Micro-Electronics Inc., on the other hand, writes about sustainability, and how EMS companies, as well as every stakeholder in the supply chain, can do their part to help address societal and environmental issues.

SMT Magazine is not complete without our columnists. So for this issue, we have Tom Borkes writing about controllable cost contributors presented by indirect, overhead, and general and administrative costs as a function of organizational structure. He provides an example of a new organizational model and its economic impact to an EMS company.

Then we have Bob Wettermann writing about updates being done on rework and repair standards in printed boards and electronics assemblies.

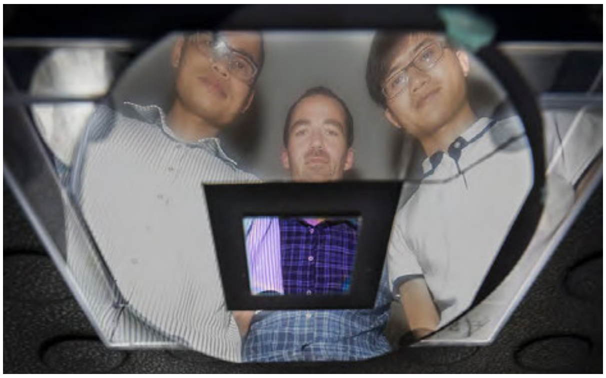
To round things up is my interview with Mycronic's Thomas Bredin about the latest developments in jet printing technology as well as Mycronic's recent acquisition of China-based Shenzhen Axxon Automation Co. Ltd.

As always, I hope you'll enjoy this month's issue of *SMT Magazine*. Another year has passed. I hope it has been a good year for all of you.

On behalf of my colleagues here at I-Connect007, we wish you very happy holidays and a prosperous New Year. Thank you very much for your support throughout the year; we look forward to working more with you in the year ahead. **SMT**

Stephen Las Marias is managing editor of *SMT Magazine*. He has been a technology editor for more than 12 years covering electronics, components, and industrial automation systems.

New Way to Make Low-Cost Perovskite Solar Cell Technology



Researchers at The Australian National University (ANU) have found a new way to fabricate high efficiency semi-transparent perovskite solar cells in a breakthrough that could lead to more efficient and cheaper solar electricity.

Dr. Tom White from the ANU Research School of Engineering said the new fabrication method significantly improved the performance of perovskite solar cells, which can combine with conventional silicon solar cells to produce more efficient solar electricity.

"The prospect of adding a few additional processing steps at the end of a silicon cell production line to make perovskite cells is very exciting and could boost solar efficiency from 25% to 30%," Dr. White said. "By combining these two cells, the perovskite cell and the silicon cell, we are able to make much better use of the solar energy and achieve higher efficiencies than either cell on its own."

The new fabrication method involves adding a small amount of the element indium into one of the cell layers during fabrication. That could increase the cell's power output by as much as 25 per cent.

The development builds on the state-of-the-art silicon cell research at ANU and is part of a $12.2 million "High-efficiency silicon/perovskite solar cells" project led by University of New South Wales and supported by $3.6 million of funding from the Australian Renewable Energy Agency. Research partners include Monash University, Arizona State University, Suntech R&D Australia Pty Ltd and Trina Solar.

Sales and Marketing in a Digital Transformation Reality

by Jay Gorajia
MENTOR GRAPHICS CORP.

The PCB assembly industry is going through interesting times. In addition to the traditional price pressures from overseas partners and rapid consolidation that has plagued the industry for decades, digital transformation presents new and unique challenges to today's PCB assembly industry. Whether you are a software solutions provider, hardware equipment vendor, or a contract manufacturer, these challenges are prevalent and must be addressed to improve growth opportunities. Sales and marketing exists to provide growth for an organization and must navigate around these challenges to ensure the success of their organizations.

An effective sales and marketing program at any organization comprises three factors: people, process, and technology. Missing any one of these as part of a sales and marketing strategy represents opportunities to improve. In addition to these three important factors, sales can be built around "hunting" and "farming" strategies.

Hunting represents looking for "new kills," that is, new opportunities. In most cases, this approach may include opening new doors, landing new logos, and mining contact databases for accounts in which no previous sales have been successful. Farming entails expanding business at existing accounts and clients until strategic partner status is achieved. Organizations should be doing both hunting and farming to achieve growth; however, key characteristics particular to the PCB assembly industry need to be addressed, including future-proofing, the digital thread, RFP to quote velocity, transparency and visualization expectations, and leveraging analytics and the cloud.

The Basics

From Hunting to Farming

All client/vendor relationships start with a hunting exercise. Effective strategies for hunting are different than those of farming. Most hunting starts with effective marketing. Some of the key facets of creating an effective and compelling marketing campaign, especially re-

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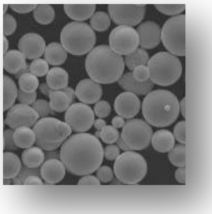

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lated to the PCB assembly industry, would include:

- Effective contact management infrastructure
  - Having an environment so data mining and analytics can be performed
  - Tracking activity levels and marketing interactions
  - Managing and evaluating marketing interactions to understand interests
- Understanding unique offerings that may appeal those clients of specific profiles. Profiles may include:
  - Client product complexity requirements
    - Type of equipment
    - Type of products designed
      - Need for flex, rigid flex, microvias, large boards, multiple thermal cycle needs, board density, iTAR, quality levels, etc.
  - Client business levels
  - Client size (revenue, number of people)
  - Volume (of purchasing, requirements, etc.)
- Ability to add and manage social interactions, mobile access to information, and self-help capabilities. This is vital as the millennial generation and digital transformations hit the market space.

Once the marketing infrastructure is in place, effective sales campaigns and sales strategies can be applied. This should help organization answer these questions:

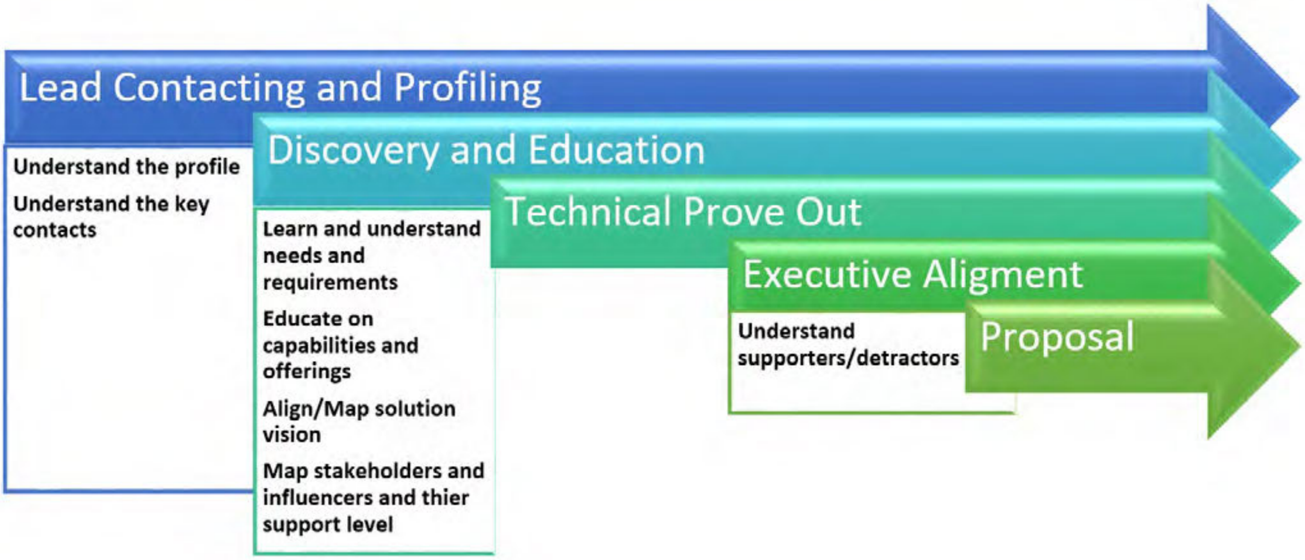
1. Who is aligned to my "ideal client"?
2. What is the total addressable market?
3. Can I run marketing campaigns for my largest opportunity targets?

The initial opportunity may arrive through either on-line campaigns or direct sales interaction. Then the sales organization (internal or external) takes over and works to land the initial deal.

The PCB assembly industry tends to be more margin-sensitive than others. Contract manufacturers' margins are typically tight, which drives the others in the ecosystem to behave and react similarly. Personal interaction is still king. Direct communication, understanding needs, providing a holistic solution, and conveying a knowledgeable, customer-solution-focused approach normally wins.

Process Is the Same for Everyone

Hundreds of resources recommend a strategy for a sales process after a lead has been attained from the marketing activities. Most have the following elements (Figure 1):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Understand the key contacts
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Align/Map solution vision
Map stakeholders and influencers and thier support level
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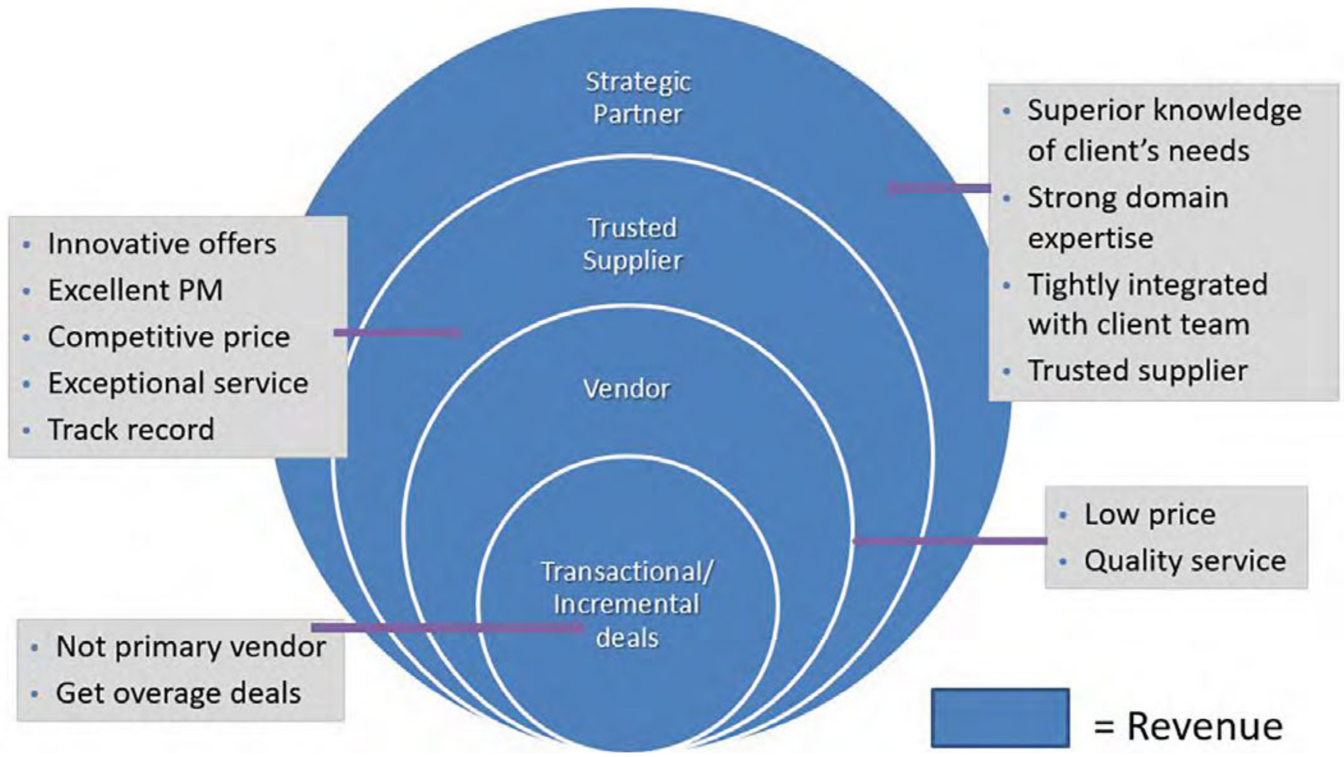
Executive Aligment
Understand supporters/detractors
Proposal

Figure 1: Typical sales process from lead generation to proposal.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Competitive price
Exceptional service
Track record
Superior knowledge of client's needs
Strong domain expertise
Tightly integrated with client team
Trusted supplier
Low price
Quality service
Not primary vendor
Get overage deals
= Revenue

Figure 2: The transition from one-off deals to establishing long-term, sustaining relationships.

Becoming a Strategic Partner

Effective farming allows organizations to attain strategic partner status. This is somewhat of an ideal state, in which your organization is tightly integrated with client teams. They approach your organization as the proven experts and take your consult without hesitation; and for that trusted supplier status, you are rewarded with business as a primary choice. Repeat orders, additional optional services, and new opportunities continue to reward that partnership. Figure 2 outlines this the journey from an initial deal (as a hunting deal) to strategic partner.

No Shortcuts

As with any other profession, sales people have varying degrees of effectiveness. By the law of averages, you may have some high-performers and some low-performers. Most prospective clients will immediately know if a sales professional truly understand their challenges. In that initial discussion, they get a feel for whether you can solve their problem. A knowledgeable sales person, one who understands clearly the internal offerings and capabilities and the market space, is required. Frequently, professional sales people from non-related industries are hired, but it takes time to build this unique knowledge before they can succeed.

One key variable with organizations is size. The amount a larger contract manufacturer or hardware vendor can invest in people, technology, and process significantly differs from smaller contract manufacturers. However, the principles of the basics described above still hold regardless of size. A tool may be a MS Excel or simple database organized marketing platform vs. a CRM software solution (although cloud services such as salesforce.com are relatively less expensive now than ever before). Or engineers in the organization may be doing some of the internal sales calls, rather than an organized internal sales organization. Whatever the execution of the basic principles, they are still required.

Contract Manufacturers

Now that the basics are covered, what is unique related to the PCB assembly contract manufacturers? The coming of the millennial generation into the workforce as well as digital transformation creates new challenges for contract manufacturers. After interviewing several sales and marketing professionals at various contract manufacturers, I found that the following seem to be the leading challenges (not-prioritized):

- Margins
- Getting noticed—online presence driving leads (SEO)
- B2B enabling
- Accelerate RFP/RFQ to quote, accurately
- Customers wanting more transparency and visibility
- More self-help to understand capabilities
- Ensuring their capabilities are "future proof"

Although not a very scientific survey (with only a dozen or so phone interviews), these issues seem to cross multiple-sized organizations.

Increasing proficiencies and efficiencies within contract manufacturing organization would address the continuous drive for maintaining margins. Investing in an online presence, with a website that has strong search optimization capabilities is ideal. These tools drive marketing interactions to the site, and inquiries turn into leads. In a competitive environment, volume drives opportunities. However, a good internal contact management system needs to be in place to leverage a strong online presence.

> "Investing in an online presence, with a website that has strong search optimization capabilities is ideal."

One of the biggest struggles is the time to produce a quote from an initial RFP/RFQ. Sales engineering teams can review bill of material (BOM) files for cost estimations, obsolescence risk, RoHS and environmental compliance, and lead time. This can be done with integrated solutions that connect the DFM tool or quote tool to various component database aggregators such as IHS Caps Universe SiliconExpert, or the sales team can get the information from direct Google searches. However, yield and process risk must be done by process or manufacturing engineering groups who take the design files (eCADs/Gerbers) and BOMs and run automated DFM tools (such as Valor) or semi-automated DFM checks to ensure it can be built with the required quality levels.

Sometimes customers may require a Class 3 quality product, but the design data won't support it for various reasons. Effects of multiple thermal cycles, distribution of component types and board side, surface finish type, and metallurgy of the lead types all have dramatic effect on the producibility of the product. This needs to be identified, up front, as quickly as possible, so customers can be consulted. In many cases, the DFM tools have been further automated to accelerate this function, and key statistics are extracted and identified quickly based on predefined risk models. Finding that out during production has detrimental effects on customer's confidence, future orders, and costs, because it would be too late.

The challenges of visibility as well as future proofing are related. In the age of analytics, cloud enablement, and access to information, most OEMs prefer some visibility to their product manufacturing. Providing this capability is a great differentiator. For example, a contract manufacturer in the San Jose, California, area provides the ability for their customers to log into a secured site and have immediate information for KPIs such as running final yield, units produced, and units in production with quantities at each operation. They also offer a custom mobile app, so access is further personalized. These are add-on services that many OEMs are happy to pay for. The equipment that enable these services needs to be future-proof so that standardizations of machine-to-machine communication and machine-to-human communication (such as with the Open Manufacturing Language) can communicate to analyt-

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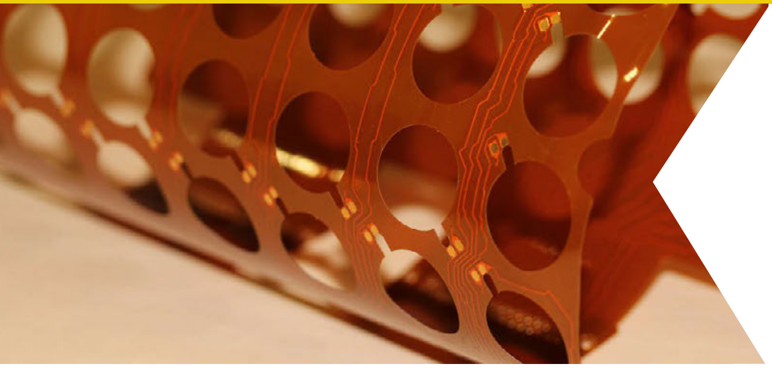

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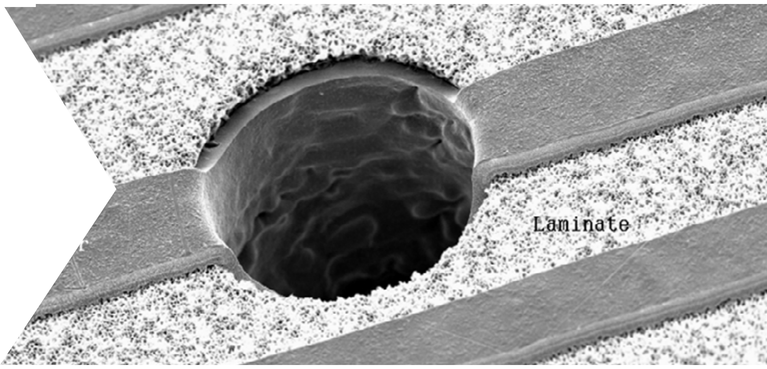

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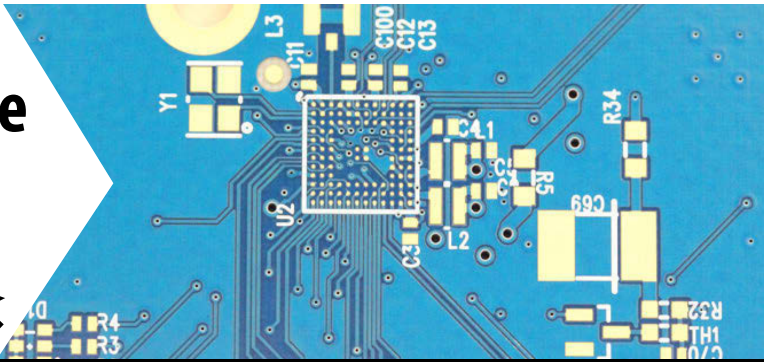

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ics platforms or software in a standard and intelligent way, ready to serve up the information at will.

Finally, in the age of social media and mobility, more organizations are looking for self-help opportunities. They want to be able to order online, get statistics online, get testimonials, and references online, and do overall research, way before a personal interaction is initiated. OEMs that are ahead of the curve with digital transformation are looking for partners to define and be an active part of this digital-thread strategy. A digital thread means having a lot of information about their products, parts used, defect information, trace information, and manufacturing parameters and outcomes (yield, costs) available through an electronically secure analytics service, with the information modeled and available for consumption by the OEM. Feedback to design, in an automated fashion, further tightens the relationship and the drives to becoming a strategic partner. Most OEMs don't have manufacturing, but they are responsible for their products, and this ease of accessibility would be an additional key differentiator for a contract manufacturer.

A good understanding of capabilities, types of organizations you want to attract, differentiators, and strong online presence needs to be purposefully designed and available.

Both Hardware and Software Solution Providers Need to Be Smart

Knowing all the above, hardware and software solution providers are looking to enable capabilities and solve these challenges for their customer, the contract manufacturer.

One of the main strategies used currently is to ensure products and software are "Smart" enabled, addressing the desire for manufacturers to invest in hardware or software that is future-proof. Hardware suppliers know this will be required at some point, depending on where the contract manufacturer is in their journey to become a Smart manufacturer. However, it is almost a requirement now to ensure all investments won't be short-term. Most hardware providers are scrambling to enable their products to be part of a Smart eco-system. The sales and marketing teams at hardware suppliers are positioning themselves with Smart solutions, and "integrated" solutions, which is evident at tradeshows, websites, and blogs. Core functionality is still needed, but this additional layer of requirements must be part of the portfolio.

Software vendors can be more agile in their development and offerings. Sales and marketing organizations look to not only offer solutions to enable Smart manufacturing execution or manufacturing operation systems, but also to combine with some industrial Internet of things (IIoT) boxes that normalize machine interface data across a factory into a Smart services and analytics layer that allows contract manufacturers to enable even legacy machines to become part of the digital transformation eco-system. This needs to be done in conjunction with solving the core challenges of having strong machine vendor interfaces, providing good quality and trace capabilities, strong recipe generation capabilities and Smart analytics, and pushing alerts and information to the key personnel when things are out of control. No sales or marketing organization at a software supplier would succeed if the base capabilities and offers are not there. "Smart" is now part of a larger discussion.

The PCB assembly industry is going through interesting times with the larger involvement of a younger generation in the workforce, digital transformation taking hold, and Smart manufacturing as active part of discussions. These changes are driving sales and marketing organizations at contract manufacturers and hardware/software vendors to adjust to the new paradigm and related challenges. Many of the common sales and marketing best practices apply to the PCB assembly industry; however, deep manufacturing and electronics design expertise is required to truly drive customer interactions from one-off transactions into long and sustaining relationships. **SMT**

Jay Gorajia is director of consulting, PCB design and manufacturing services, for the Consulting Division at Mentor Graphics Corp.

SMTA
Surface Mount Technology Association

2017 EDUCATIONAL PROGRAMMING

CONFERENCES

Pan Pacific Microelectronics Symposium
February 6-9, 2017
Kauai, HI

South East Asia Technical Conference on Electronics Assembly Technologies
March 28-30, 2017
Penang, Malaysia
**Abstracts due December 16, 2016*

Contamination, Cleaning & Coating Conference
May 23-24, 2017
Amsterdam, Netherlands
**Abstracts due December 16, 2016*

International Conference on Soldering & Reliability
June 6-8, 2017
Markham, Ontario
**Abstracts due January 16, 2017*

Symposium on Counterfeit Parts & Materials
June 27-29, 2017
College Park, MD
**Abstracts due March 6, 2017*

SMTA International
September 17-21, 2017
Rosemont, IL
**Abstracts due January 27, 2017*

International Wafer-Level Packaging Conference
October 24-26, 2017
San Jose, CA
**Abstracts due April 10, 2017*

Pan Pacific Microelectronics Symposium
February 5-8, 2018
Big Island, HI
**Abstracts due July 14, 2017*

CERTIFICATION

SMT Processes
January 18-20, 2017
Guadalajara, Jalisco

SMT Processes
September 19-21, 2017
Rosemont, IL

SMT Six Sigma
September 19-21, 2017
Rosemont, IL

...More locations to be announced.

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Supply Lines Highlights

Chintan Sutaria: CalcuQuote Aims to Disrupt EMS Quoting Status Quo

Chintan Sutaria of CalcuQuote speaks with I-Connect007's Judy Warner about what inspired him to develop CalcuQuote. He also explains how CalcuQuote supports capturing customers' requirements to coming up with labor and material costs, allocating overhead, markups, and following up with the customer.

Electrolube's Alistair Little on Thermal Management in Automotive Electronics

At electronica 2016, Alistair Little, technical director of Electrolube's Resins Division, sits down with Editor Pete Starkey to discuss thermal management challenges in the automotive industry, and how their resin solutions are helping customers address those high-temperature requirements.

Siemens to Acquire Mentor Graphics for $4.5B

Siemens and Mentor Graphics have entered into a merger agreement under which Siemens will acquire Mentor for $37.25 per share in cash, which represents an enterprise value of $4.5 billion.

ACE Production Technologies Launches New Fully Responsive Website

ACE Production Technologies Inc. has launched their new, corporate website.

Terry Morgan Appointed Sales Manager for Dry Tower at Super Dry Totech

Industry veteran Terry Morgan has joined Super Dry Totech as sales manager for the Dry Tower product group for European territories.

Caltronics Purchases MIRTEC's MV-6 OMNI 3D AOI Machine at SMTAI 2016

Caltronics Design & Assembly, Inc., a PCB manufacturing and electronic design company, has purchased MIRTEC's award-winning MV-6 OMNI 3D AOI machine during SMTA International in Rosemont, Illinois.

Nordson ASYMTEK Welcomes eXelsius and neutec electronic as Switzerland Distributors

Nordson ASYMTEK welcomes two distributors to provide sales, service, and support for Nordson ASYMTEK's fluid dispensing, jetting, and conformal coating equipment to customers in Switzerland.

Altron Partners with Mirtec to Provide Total Quality 3D AOI Solution

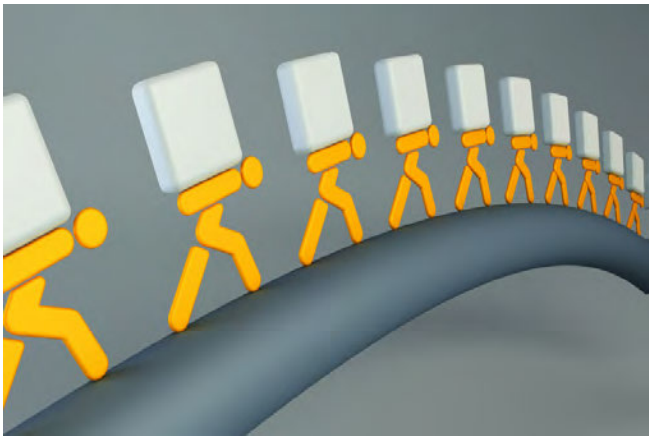
Altron Inc., a veteran-owned, service-orientated, contract manufacturing company specializing in high-quality circuit board and mechanical box build assemblies, has selected Mirtec as its 3D AOI partner with the purchase of six MV-7 OMNI 3D AOI machines.

SMT Hautes Technologies Selects Mirtec for Leading-edge 3D AOI Technology

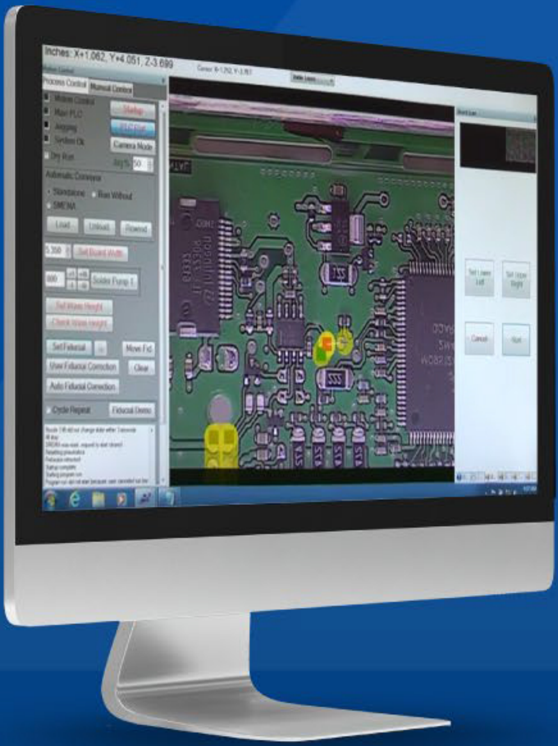
SMT Hautes Technologies has selected Mirtec's MV-7 OMNI as their future 3D AOI platform of choice.

Alpha Leads Industry Discussion on Advancements in PV Module Assembly

Alpha Assembly Solutions, the world leader in the production of electronic soldering and other joining materials, has launched a new technology-focused group on LinkedIn for Advancements in Solar (PV) Module Assembly.



2 new ways we are adding value while keeping soldering simple.



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Sales: a.k.a., Trench Warfare!

by Craig Arcuri
BIZREMODEL.COM

Editor's Note: New columnist Craig Arcuri will offer expert advice on running and growing a successful EMS company—or any company.

Part 1—Build the Foundation

I was in Kinko's the other day, and while waiting for the copier to finish printing, I was pacing out of boredom. I stumbled upon a rack filled with candy and treats on one side and a few dozen paperback books on the other. Nearly every book covered one of two subject areas: how to get organized or how to close a sale. I found it interesting, because I was just putting the finishing touches on this article about sales. As I thumbed through a few, I found lots of good ideas I could relate to, many of which I have used myself. Yet none provided step-by-step instructions—at least, not the kind that take you deep into the trenches of real life.

Let's get some basics out of the way. I will presume for the moment that if you are reading this, you already know what you are selling and who the likely buyers are. You've memorized the features and benefits of your products, and you've done your homework on both your customers and your competition. You've read about the art of selling, and you've refined your sales pitch. I will further assume that once you close a sale, you can do what you said you could do. Lastly, I will assume that in return for money, you performed a service or delivered goods that were well-received. You're totally prepared for trench warfare! Or are you?

Let me back up and provide some background about myself. I have started and sold several companies, some large and some small. Most were in the crucible that is Silicon Valley. The largest of these companies was $150M in annual revenue and the smallest $5M. Some were manufacturing companies and some were service companies. I have built big sales teams, and at other times I have *been* the sales team.

Now, you might think Silicon Valley, where money falls off the light poles (it doesn't), and customers line up to throw money at you (they don't) is the land of opportunity. Well, it is, but those same truths attract hundreds of competitors just itching to scoop up all that money. So, kid, if you can make it here, you can make it anywhere. My MBA was earned in the field, making lots of mistakes. I do not claim to be anything other than old, experienced and battle-scarred, but nonetheless, a survivor. I've spent my life in the trenches, and along the way, I've learned a thing or two.

My resume would tout my decades of experience as a successful CEO. But what does being CEO have to do with sales? Everything! As CEO, you are always selling—to peers, banks, investors, employees, customers, prospective team members, etc. In fact, I would argue that the CEO position of a company of any size is, or must be, the chief master sales person.

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Visit http://www.omlcommunity.com and join the community!

I'm sure you already know that the word 'sales' doesn't mean just closing a deal or getting a purchase order. And certainly, it doesn't mean winning by outsmarting the buyer. A successful sale (let's say "deal") is where both parties get good value out of the transaction. Convincing somebody to buy or accept something that is not in their best interest is not sales; its deception, at best and theft at worst. And in the long run, you'd better get very good at finding new customers, because the old ones will never come back a second time.

> "Convincing somebody to buy or accept something that is not in their best interest is not sales; its deception, at best and theft at worst."

So let's talk about sales—real sales. Not pop sales ideas, not sales jargon of the day, not flavor of the month tactics. Let's talk about sales in the trenches. Real people. Real products. Real life. I promise you, if you follow these simple steps to build a sales foundation, you will generate more sales.

After hanging out my shingle as a Business Consultant, I can tell you that every single prospective client answers my, "What do you need?" question with the same answer: "We need more sales." Clients, of course, want me to focus on exactly that end goal. But when I dig into the operation of the sales organization, if there is one, I quickly discover that what is actually needed are the myriad foundational things that must be in place first. I have tried many analogies, but the one that I think resonates the best is this: You can't build a house by starting on the second floor.

Together, let's start digging the foundation. I'll use real examples, but the names of individuals and companies have been made up to protect the guilty. The stories are real, and they are current. One more caveat... If you're a fan of the movie Office Space, or of Dave Barry, you'll easily recognize my sense of humor. If not—take my word for it—sometimes, ya just gotta laugh!

Ready to start working on the foundation? Hang on, because we're heading down into the trenches.

Foundation Pillar #1: Building a Sales Database—A Story of 0 to 1000

You should have one place where you keep information about your customers, partners, and prospects. Basically, anybody that you can sell to, or who can help you sell your product or service. I am talking about the basics: company name, contact name, address, phone, email, etc. Of course, you have that...right? Well, over a dozen clients later, I can tell you that you probably don't. What you probably have is lots of islands of information, stored in email folders, paper folders, stale databases, your cell phone contacts, slips of paper, notes on paper napkins, and of course, the big pile of business cards on your desk or in your drawer. Some people even have them neatly organized in plastic sleeves and folders. We all love our business cards, don't we? We hand them out, and people politely take them. We take theirs. Now what? Did you ever look at a business card in the bottom of your drawer and wonder who that is?

I recently asked one of my clients: "Do we have a sales database?" With great pride, the owner proclaimed that he did. I was excited. I hurried into the office to look over his shoulder, and watched him click on the icon for Sales Contact Manager, circa 2007. Hmmm. This is 2016, isn't it? My excitement was already beginning to wane. As the program opened, I saw before me 195 people in his database. For a company that's several decades old...I'm guessing you can do the math. My shoulders slumped further. I left with a muttered request for him to please export it to a .csv file and email it to me. It wasn't much, but it was a start.

After deleting the obvious personal contacts, and a variety of obviously non-business-related junk, I was left with 90 or so potentially real contacts. I sent that off to my team to research, and a few days later, that list was reduced to 40. Decades in business, and 40 contacts?!? The good news is they need me, and I can help.

Next, I asked for a copy of the .pst file of the person impersonating a salesperson's email box. A few tense conversations about privacy later, I was rewarded with a gigabyte or so of data. One quick and dirty app, several days of Excel magic, and some manual effort later, I had 800 names and email addresses of customers. Several more days of sleuthing and sorting later, I had 300 new people to add to our database. My shoulders are recovering. Note to all: No POs yet. Remember, POs are the second floor. We're still building our foundation.

I had noticed in my travels around the office the many manila job folders. I couldn't help myself, and I peaked at a few after everyone was gone. Lo and behold, what to my wondering eyes should appear, but another treasure trove of information. I recruited an intern for three days, sent the results through the research mill, and voila: 250 more people in our database.

While all this sleuthing was going on, I was preaching from the 'put everything in the database pulpit,' and that netted another 50 people. If you are counting, we are now up to 600. I am happy. Remember, we started with just 195 and quickly found that 155 of those didn't pass muster. By the way, while we were getting this done, my research staff had discovered 300 or so folks with whom we had previously done business, who were now at new companies. Do you think I added them to the database as leads? I sure did.

Just like that, three weeks later, we had nearly 1,000 people to reach out to, to ask for business. Just having all this information in one place was a big accomplishment, but once you plant a database, it needs constant attention. Why? People move around, they advance, they change companies; and those folks are your potential 'ins' with new companies. Now that you have this shiny new database filled with great information, it needs to be continuously updated so that it remains current. As you might expect, we started that task in the background, and it will remain an ongoing background task. (Sort of like the pilot who walks around his airplane before every flight, even though he just did it yesterday!) If this is not done, your database will quickly become sloppy and stale. Picture a beautifully-carved Halloween pumpkin, two weeks after Halloween. Not a very attractive decoration for the front porch.

Closing comments on the sales database: Keep it fresh, use it daily, and get buy-in from those who use it—even if you have to beat them. It doesn't matter what tool you use, from Microsoft Excel to salesforce.com (my favorite). One advantage to a cloud-based tool like salesforce.com is that you can access it from anywhere. Oh, and one more thing. I have a toolbox full of answers to, and solutions for, people in the organization that are "too busy" to enter data in the database. Being too busy to enter new data is like being too busy to stop and add gas to your gas tank.

Foundation Pillar #2: Face-to-Face does NOT Mean Looking in the Mirror

I will admit, I am bewildered by any organization big or small that does not embrace the opportunity to see customers face to face. I am sure many books quote statistics illustrating the effectiveness of face-to-face versus all other forms of communication. I have decided for myself that face-to-face is 1,378.5 times better. Possibly even 1,378.9.

> "I am sure many books quote statistics illustrating the effectiveness of face-to-face versus all other forms of communication."

I once had a jr. salesperson working one of our accounts. His name was Eager Beaver Eddie. He was a bright, wonderful, energetic young man, full of excitement, yet unbruised by years of sales rejections. As I often did, I wandered over to his cube, and in rapid-fire questions, asked, "Eddie, what are you doing? Who are you emailing? How is it going?" With bright-eyed enthusiasm, he reported, "I'm emailing Joe at Super Best Widgies company." Unfortunately, I had left my tack hammer in my office prior to starting my walkabout. Why such a violent reaction, you ask? Well (and I am not making this up), Super Best Widgies company shared a parking lot with our company. Really? Go see the customer!

Maybe it's human nature. If you think the customer might say "no," perhaps it's a softer blow if they just ignore your email. Here's the other side of that coin: It's much easier for a customer to ignore your email than to say "no" to your face. So I have to ask: Where should your face be? In front of your computer or in front of your customer?

Another real-and-not-even-slightly-embellished anecdote: I have a beat-up car just so I can drive to San Francisco once a week to visit one or two customers in person. Every week. Why a beater? Because the half-life of a car window in that city at night is about 47 seconds. Why not email? Because it's not face-to-face, period.

If you positively cannot be face to face, then make a phone call. But go see them in person as soon as you can. If a phone call isn't possible, then email and LinkedIn are a last resort. Be aware though, these will give the poorest returns in the sales process. Yes, it is true that if you email enough people, you will get a sale, but its mighty low odds.

Want to know a simple truth? People prefer to buy from people they like. People don't learn to like you because of your emails, or even your phone calls. Relationships are built face to face.

My rule of thumb is every customer, every quarter, at a minimum. This doesn't have to be a two-Martini business lunch or a long dinner engagement—just a quick, "I was in the area" visit. Or, save the shipping folks the work, and when your company has something to deliver, deliver it yourself! I have made many deliveries personally, and reaped the rewards having a few minutes of personal interaction with a thankful customer.

And whether it's a face-to-face meeting, a phone call, or an email, record the results in that fancy new database we were just talking about, and then set a follow up action.

Foundation Pillar #3: If You Track it—it Will Improve

Metrics, data, big data, little data, industry 4.0...whatever the heck you want to call it. If you don't keep metrics to measure how you are

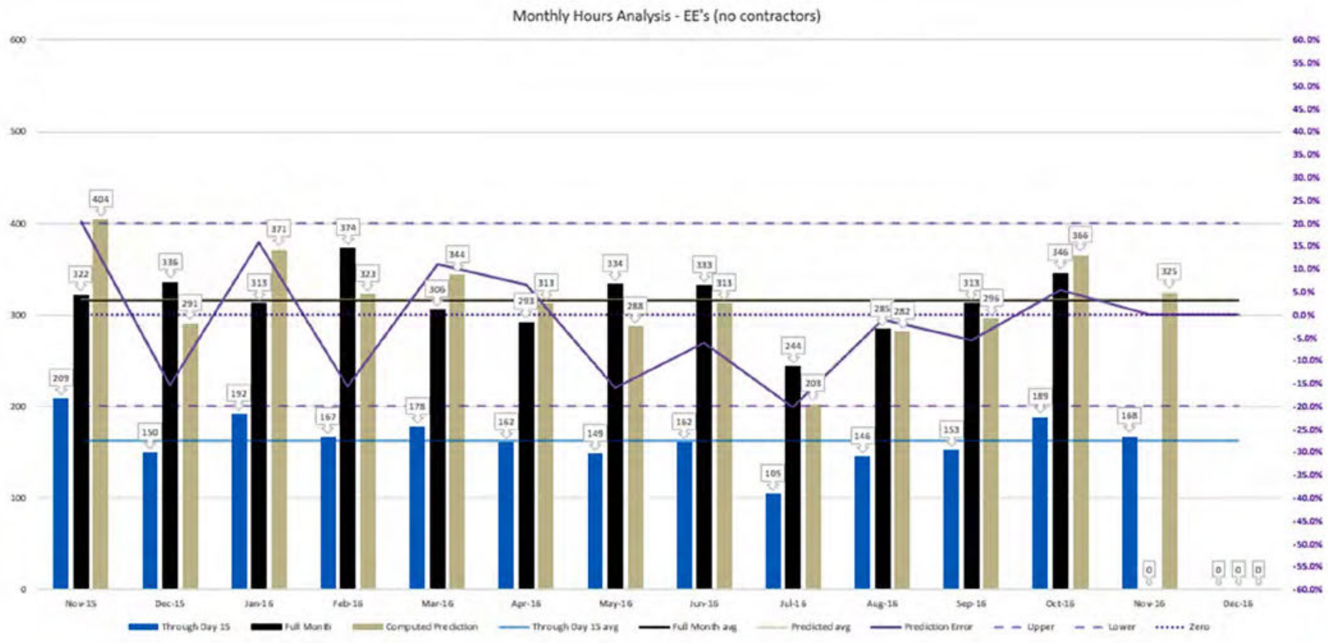
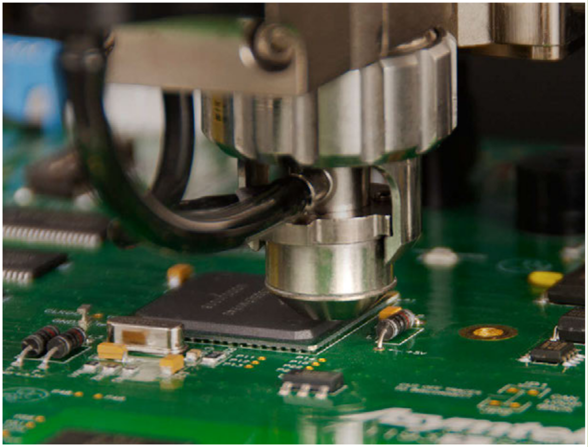


Figure 1.



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doing, how will you know? How will you see patterns and be able to make predictions? I am passionate about this. I measure everything I can measure. Any office I ever occupy has lots of charts and graphs taped to the wall. It's not window dressing. It's not for show. It's not to cover up the nail holes in the wall. I look at the data EVERY DAY. I look for trends. I learned how to use SQL and instantly discovered why Larry Ellison is a billionaire. Unfortunately, I am a decade or two late on that one.

> **“I look at the data EVERY DAY. I look for trends. I learned how to use SQL and instantly discovered why Larry Ellison is a billionaire.”**

Each and every accounting system can output revenue data. With just that data, I can tell more about a company's customers after few days of analysis than they knew from years of running the business. It is sooooo easy to collect data that NOT doing so should be a sales felony. Perhaps even a capital offense.

As I type this I am looking at a chart that shows that the data can predict, within 20%, what the month's billings will be for a small service company, at the half-way point of any given month. That is plenty of time for this business to kick it up a notch if the prediction in lower than desired. I could fill this magazine with charts and graphs that I keep for just this one company.

I could, if I had any talent whatsoever, write a book on just this topic. Every single client and prospective client I meet has the power to collect significant data and metrics, and not even one does so in any meaningful way. Even if they do collect data, the analysis of that data and creation of actions based on that analysis is nonexistent. It makes sense, in a way. After all, if you are passionate about making wagon wheels, and you make the very best wagon wheels, you might not take the time to track the metrics, which will clearly tell you people are buying car tires, not wagon wheels.

In most cases, I spend an hour or so talking about this to clients, and in most cases their eyes glaze over after about five minutes. I resort to jokes, outlandish statements and sometimes, I just plain shout. I even thought about donning a clown costume, but that seems to be frowned upon these days. The whole process reminds me of a cartoon where a pet is being scolded for doing something wrong, and all the pet hears is, “Blah blah blah Spot. Blah blah blah Spot.”

Recently, I transitioned to a simpler approach, which avoids all the yelling and arm waving. It is simply this: Just do it! If you're face to face with a seasoned and successful veteran of trench warfare, then just listen. Set up a system (Excel works just fine) to track the dollar-value (where appropriate), and quantity, of the following: leads, accounts (companies), contacts (people), opportunities, work in process (WIP), RFQs/quotes, POs, and revenue.

Track and chart those items and display those charts for all on the sales team to see. Look at that data daily. What is going up? What is going down? Why? This data will inevitably help you determine where to focus your sales resources. Those of you who have been reading those books from the Kinko's shelves will recognize this approach as a type of sales funnel. While not exactly on point, it is close. I gave up describing the sales funnel; most folks I know just make fun of me when I do.

Foundation Pillar #4: Force Multipliers—the New Math

You have vendors, right? Vendors of goods, services, materials, software, etc. Let's say you have a manufacturing company and you buy materials, tooling and supplies. Ask those vendors for a few referrals. Of course, they must appear neutral as they also sell to your competitors, but I have never had a case where, when asked, a vendor would not give me a referral or two. Multiply that by several vendors and whammo—you multiplied your sales force—commission free. Of course, if they scratch your back, you should scratch theirs. Shoot them a lead or two and you will be amazed at the good will that generates.

In my last manufacturing company, I invited our vendors in once a quarter to our sales meetings, and asked them to explain to our sales people what their strengths were, and what type of customers would be a perfect fit for them. Our sales folks would then refer such customers or prospects, when located. We of course would also have the opportunity in those meetings to define our perfect customer, which they would then keep an eye out for and refer when appropriate.

One of my service business clients spends almost $1M per year on out-sourcing manufacturing for products they have designed, but never once asked the vendors for referral business. One meeting and one request netted five prospects for the company and one customer. All we did was ask. No pounding the phones. No research. No cold calling. One introduction, and a few days later we had I nice sized RFQ on my desk.

Foundation Pillar #5: Secret Sales Weapon—the Best Place to Find More Business

I can't believe I am giving up this secret. I mean really, why would I let this proprietary golden nugget of sales information go? Would you be offended if I asked you to send me $100 if you use this secret sauce?

The best place, the single best place to find more business is…drum roll and fireworks please… your existing customers.

Duh, you say? Well, sip a little truth serum and then ask yourself: "When was the last time, while meeting face to face, I asked my customer for more business; for the name of other people or groups in the company; for friends they know in other companies that I might talk to?" Oh, you do that all the time? I can see we didn't wait for the truth serum to kick in, did we?

My experience has been that sales teams tend to focus relentlessly on new business. There's a subconscious, underlying assumption that all the current customers are automatically and happily giving you all their business. That if you just shoot them an email every once in a while, they'll continue doing exactly that. That their business doesn't change, even though, if you thought about it, you'd immediately know that it does. There is no "status quo" in business. You are growing, or shrinking, but you are rarely, if ever, staying the same. That's exactly the way it is for your customers. Things change by the minute. New sales reps walk through their doors every day. New technologies appear. You get my drift…while new customers are important, never stop seeing your existing customer base as a source of growth and opportunity!

There's an old story about a young salesman who had sold a very modest $1,000 life insurance policy to a young soap salesman. The young soap salesman did very well, and in a few decades, he was the head of his own multi-million-dollar business. So he purchased one of the first million dollar Life insurance policies ever written. But he didn't buy it from his regular salesman. He bought it from another salesman, from another company, someone he'd never even met before. Hearing this, the original salesman was hurt. "But why didn't you tell me you wanted a bigger policy?" he asked sadly. "Why didn't you buy that policy from me?" "Because," answered the man, "You never asked."

You must ask.

You may not have met with your customer face to face recently, but I can promise you, someone else has. Never assume you know what your customers need—ask. Never assume your customer will automatically give you his business—ask for it. You don't own your customers. You earn them. With every contact, you earn them.

Well, there you have it. We built the foundation. Now, and only now, we can start building the house… and getting more sales! Here is a teaser: My consistent experience is that within 90 days of creating this solid foundation, and then starting Part 2, you'll get more sales.

Life in the trenches isn't so bad after all. **SMT**

Craig Arcuri is a 30+ year business veteran and brings that knowledge to the clients of his newly formed consulting firm called bizremodel.com.

A New Organizational Model Using Logic, Cost Effectiveness and Customer Service

by Tom Borkes
THE JEFFERSON PROJECT

In the beginning, there was through-hole technology (pin-in-hole). Then, someone said, "let there be SMT," and the earth and firmament creaked and groaned as Atlas shrugged.

In 1980, Washington's Mount St. Helens erupted—an ominous harbinger prior to the mass arrival of the new technology, sort of like the kid's swinging banjo from atop the bridge in the beginning of the film, *Deliverance*—the two canoes passing under: "Stop, stop. Go back, go back."

But, no! Man (I mean, mankind; I wear my PC badge with pride) will take on and conquer nature. And, we all know how that turned out: "Aintry? This river don't go to Aintry."

It was as if the volcano cried out in nature's language, "Stop, stop!" as it belched and spewed a profusion of greenhouse gases. The dark foreboding this event created was an omen for more cataclysmic events to come. Seven years after Mt. St. Helens erupted, there was an earthquake in Whittier, California, near Los Angeles.

Two years later, in 1989, the Loma Prieta temblor struck the San Francisco Bay area, the epicenter near, you guessed it, the SMT epicenter of San Jose. The World Series at Candlestick Park was interrupted as Mother Nature continued her protest. Say it ain't so, Joe—as the earth rebuked man's (I mean, humanity's—I'm a sensitive guy, you know) attempt to make things smaller yet.

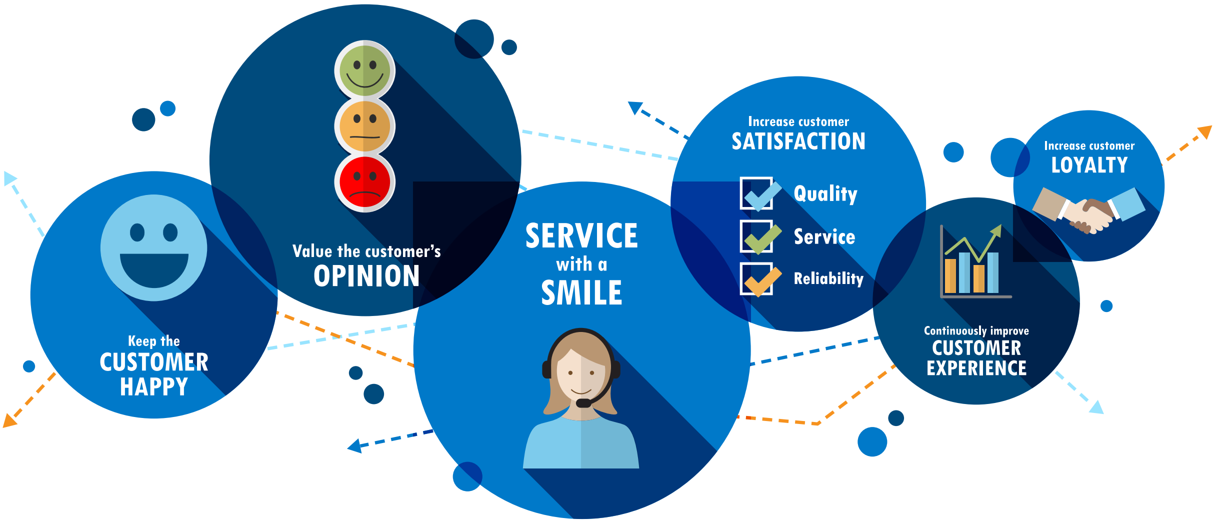
The Tower of Babel, you say –
just child's play.
"Pride proceedeth the fall," you warn.
Ha! We laugh at your scorn.
It's futile to try, so jump on our bus
because as you can see
there is nothing that will stop us!

"Smaller, Smaller," I say, as Moore (Gordon, not Clement) became our patron saint.

Those of us that were there at the creation asked, "This is good?"

But, it was. We went to sleep and when we awoke all was right with the world. Why, without it there would be no Pokemon GO, no portable social media, no ability to tell you in real time what I just had for lunch.

Probably more significant are the medical breakthroughs in monitoring and pharmaceutical delivery systems, endoscopic operating procedures, wearable electronics, "ingestible" electronics—nanobots in our bloodstream, and



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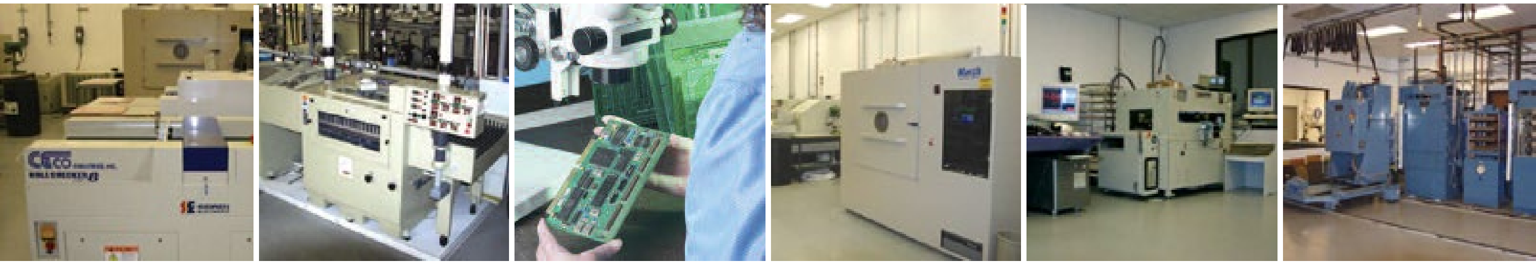

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other electronic devices and systems that will improve the human condition.

The dangers are just as provocative—the incredible processing speeds we have available to operate on the big data that is being accumulated with every credit card purchase we make, putting personal privacy at risk: technology meet the Constitution! Also, using genetic engineering to create creatures that would frighten Dr. Frankenstein's monster, and the ability to use robotics as a destructive force. These are just a few.

Kevin McCarthy don't fret
go to sleep, then awaken with a nod
your Luddite fears will have disappeared
as you emerge from your pod—
like those of high wire aerialists:
Mario & Luigi,
who discover below them a net.

For you youngsters, I want you to understand that SMT technology doesn't go back to biblical times, and it wasn't brought to earth by ancient alien astronauts.

However, I do remember back in the beginning, after the wheels of change (excuse the mixed metaphor) were put in motion with a gust of wind. A large computer company got the attention of component suppliers by asking, out of the blue, for quotes on millions of these new surface mountable electrical component packages.

Four Things that Haven't Changed Since the Advent of SMT

Nearly everything in the electronic product design and production business has changed since that fateful time. I can only think of four things that haven't:

1. The laws of physics
2. The laws of economics
3. The basic way we educate for our industry
4. The way we structure our design and production companies

The first one we don't have much control over. Personally, I've tried to levitate, but can't seem to advance past the flutter stage.

The second one pertains to all businesses (e.g., the value of a product or a service is based on what a customer is willing to pay for it—supply and demand—the ability to make a profit [cost management], etc.).

The third one I've studied, analyzed, talked and written about. A new educational strategy to better serve the high-tech electronic design and assembly industry has been initiated. It will co-locate a college with a for-profit EMS provider. The EMS will provide the student with a real-world classroom for a four-year undergraduate program that will lead to a B.S. in Applied Electronic Product Design and Manufacturing Sciences.

That leaves number four.

Ironically, it is firmly linked to number three. How? An alternate production organizational model has not been available to us because graduates interested in design, manufacturing and assembly have been educated in our traditional educational framework—the Ivory Tower of academia, not the real world.

In other words, the skills needed for any alternative "lean" or "flattened" organizational model can only be taught in the real world—soft skills such as working in self-managed teams, conflict resolution, aligning constituencies, and the art of rhetoric and persuasion as they apply to team dynamics. In past columns, we focused on the technical skill gap between academic preparation and industry need. However, the ability to reduce labor cost by organizational reform requires a real-world classroom, as well.

Before volume manufacturing and assembly opened on the global stage, it didn't much matter. The severe international competitive pressure wasn't there. Production labor rate competition was locally based. Protectionist tariff policies as well as concerns about low labor rate production skills and quality were used to resist these sources of low labor rate cost.

Having addressed reducing raw direct labor cost in past columns and papers through reducing labor content through automation and increasing yields by a drastic reduction in rework[1], we turn to the controllable cost contributor presented by indirect, overhead and general and administrative costs as a function of organizational structure.

Our Company

Let's look at the economic impact of a new organizational model by defining our mythical high-tech EMS company: Chips and DIPs (C&D).

One way to classify the size of our company is by its annual sales[2]:

Tier 1: greater than $2.0 billion
Tier 2: $500 million
Tier 3: $100–500 million
Tier 4: $30–100 million
Tier 5: less than $30 million

Material accounts for about $24 million, or 80% of sales. That leaves $16 million in direct labor, burden (indirect labor, overhead, G&A and profit).

Our company, C&D, is a Tier 4 EMS provider with annual sales of about $75 million USD. It is a low-volume, high-mix product portfolio. We have on the average six original product developer (OPD) customers at any time.

One of the things that has made contract manufacturing so attractive to a product developer is cost. Most OPDs have concluded that it is in their best interest to off-load the production of their products to a contract manufacturer (EMS). This enables them to defray the capital and labor costs they would incur by doing their own assembly.

Everything else being equal, this is largely untrue. However, in many cases it becomes the right decision for the wrong reasons. The logic used is similar to the decision an ODP makes to produce products remotely, using a source with low labor rates—also, generally wrong[3]. But, I digress—we'll save these subjects for future columns.

The EMS industry is incredibly competitive. I liken it to a supermarket: Store's margins are very, very slim. The store makes very little when it sells one can of peas, so to make a reasonable total profit it must sell lots of cans of peas.

C&D's Organizational Model

As a business unit, we at C&D had the choice of several standard hierarchal organizational models to choose from. All of them collected personnel with common and similar skill sets into departments. Each department has a manager. Some departments have group leaders and section heads. We have directors who lead groups of departments or have an area of specialized skill and responsibility. Finally, at the apex of the pyramid we have a CEO—the head of the fish[4].

We want to give our customer the feeling that their products get personal attention. So we form product teams by matrixing in personnel from different departments to form a program team. Each member of the team still reports to, and is reviewed by their department manager, but has specific program responsibilities as well. The program manger had dotted line supervisory authority over the team member.

The Labor Skills We Need at C&D

This is a partial list of the job skills and tasks that we had to fill and fit into our organization chart for both direct and indirect labor:

- Production planners
- Industrial engineers
- Automation engineers
- Electrical test engineers
- Personnel to load customer bills of material into MRP
- Procurement people to generate material quotes for sales & marketing
- Master scheduler and planners who plan and release work orders to production
- Program managers
- Material handlers (in-shipping, material inspectors, pack and ship)
- Inventory and stock room personnel
- Process engineers who develop assembly processes and generate ops sheets
- Kitting people who pull and kit material for released work orders
- People who deliver the kits to the appropriate equipment and work stations
- People who program stencil printers
- People who set up the stencil printers
- People who operate the stencil printers
- People who program the component placement equipment
- People to load tape and reel feeders and set up component placement equipment
- Component placement equipment operators
- Process people to develop reflow oven profiles

- Slide line operators
- Single station build operators
- Engineer or technician to develop and program the wave solder machine
- Wave solder machine operator
- Board cleaning operators
- Cleanliness testing personnel
- In-process inspectors
- Test engineers to develop ICT and functional tests
- Personnel to conduct the testing
- Engineers and technicians to troubleshoot failed circuit boards and products
- Technicians who troubleshoot automated equipment and process defects
- People who perform production equipment maintenance and repair
- Sales and marketing people
- Finance people
- Supervisors and managers for procurement, production, process engineering, test engineering, and quality assurance, finance, marketing, sales
- Human resources
- Factory safety officer
- Office and manufacturing cleaning personnel
- IT people to maintain and upgrade computer equipment

Whew!

Other Costs

In addition to the salaries and hourly wages for each of the employees used to meet the task requirements described above, the following costs and benefits for each employee must be absorbed in the labor selling rate:

- Medical insurance
- Unemployment compensation tax
- Worker compensation insurance
- Social Security tax
- Medicare taxes
- Holiday pay
- Vacation pay
- Sick pay
- Pension or retirement plan contributions
- Training costs

Fixed overhead costs include:

- Building costs
- Utilities: power, natural gas, water, and sewer for the facility
- Computer and communication systems for the facility
- Spare parts for the operations and facilities
- Depreciation on the automated assembly equipment and the remaining facility capital equipment
- Insurance and property taxes on the assembly equipment and facilities
- Safety and environmental costs

Next month, we'll group all the personnel into an org. chart and assign individual labor costs. Then, look at an alternate organizational structure—one that permits a more efficient and cost effective way to manage electronic product assembly.

Hey, what do YOU say? I'd like to hear your thoughts and experiences. **SMT**

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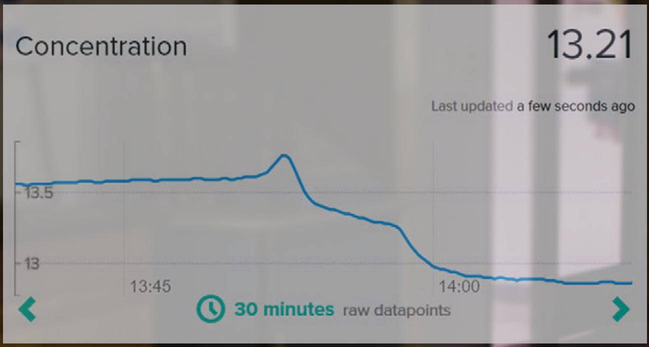
Tom Borkes is the founder of The Jefferson Project and the forthcoming Jefferson Institute of Technology. To reach Borkes, click here.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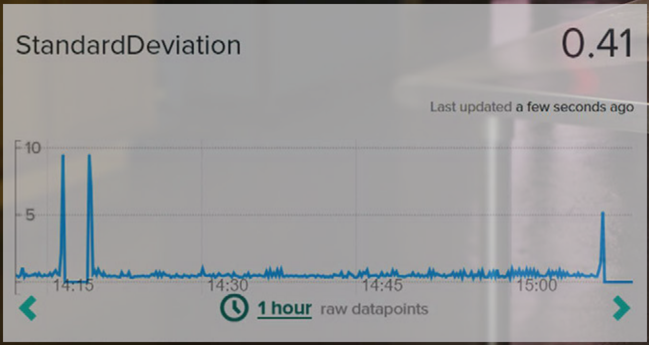
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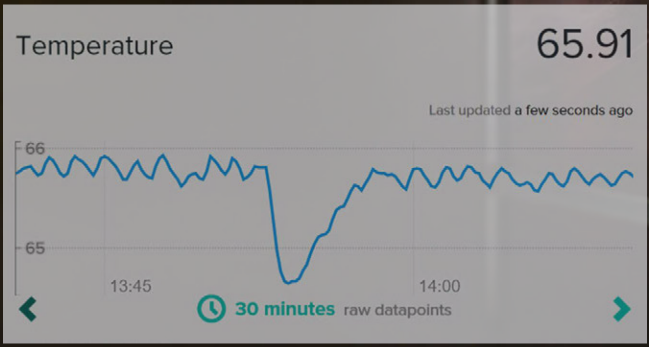
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Five New Books that Will Change Your Perspective on SALES AND MARKETING

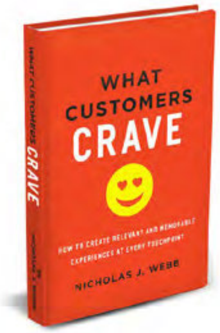
by Dan Beaulieu

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.

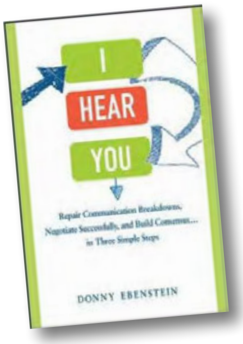
I would add one of my own and that is to do all of this as quickly as possible so that the situation is alleviated in the blink of an eye. Doing this will in fact make the customer respect you for life.

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


I
HEAR
YOU
Repair Communication Breakdowns, Negotiate Successfully, and Build Consensus… in Three Simple Steps
DONNY EBENSTEIN

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."

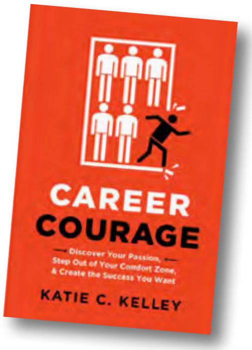
The key to what Ebenstein is writing about is flexibility to get in the other person's head, walk in their shoes, if you will, and see things from their point of view…but without giving up on your own. Not an easy task that. This is why we need techniques laid out here so that we can hold two points 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


CAREER
COURAGE
Discover Your Passion, Step Out of Your Comfort Zone, & Create the Success You Want
KATIE C. KELLEY

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.

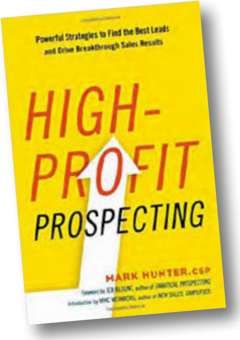
I especially appreciate the examples of real people that the author includes. Each chapter, on topics ranging from motivation and confidence to vision and harmony, expressively defines each step of the way, highlighting it with true life examples.

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
Amacom, 2016
Price $18.95


Powerful Strategies to Find the Best Leads and Drive Breakthrough Sales Results
HIGH-PROFIT
PROSPECTING
MARK HUNTER, CSP

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.

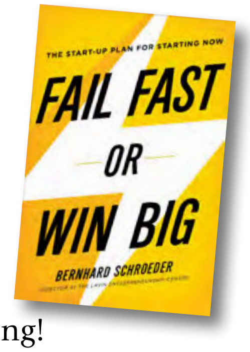
From why to prospect, to how to prospect, to choosing the right prospects and making sure they are the right ones, this book has everything a salesperson novice or old timer needs to be successful.

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. **SMT**

Millennials in Manufacturing: A Long Term Career Prospect

The next millennial to be featured in the Millennials in Manufacturing column is Alex Johnson, an associate engineer at Saline Lectronics. Alex has been with the company for over two years, and so far, he is genuinely enjoying it. He's gained a better understanding of the manufacturing process and enjoys addressing the challenges that come along with manufacturing.

"There are a lot of tasks to be completed before production, and a lot of issues that arise during manufacturing, especially if you manufacture as many different assemblies as we do at Lectronics. Organizing these tasks, and ensuring nothing drops off the list has proven to be an ongoing challenge. I'm always looking for ways to improve my organizational system," Alex said.

Read More About Alex Here.

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MilAero007 Highlights

MC Assembly Expands Market Reach

MC Assembly has signed new business contracts across its three North American manufacturing facilities this year that give the company an expanded reach in the aerospace/defense, industrial and telecommunications market sectors.

Sparton and Ultra Electronics JV Awarded $4.1M in Contracts

Sparton Corp. and Ultra Electronics USSI, a subsidiary of Ultra Electronics Holdings plc, announce the award of subcontracts valued at $4.1 million from their ERAPSCO/SonobuoyTech Systems joint venture.

Celestica 3Q Revenue Up 10% YoY

Celestica Inc. has reported revenues of $1.55 billion for the third quarter ended September 30, 2016, an increase of 5% sequentially and 10% compared to the third quarter of 2015.

IEC to Cut 73 Jobs in Newark Facility

IEC Electronics Corp. has confirmed a workforce reduction of approximately 73 full time employees at its Newark, New York facility.

Sparton Releases 1Q FY2017 Results

Sparton Corp. has announced net sales of 100.4 million, with gross profit margin of 17.2%, for the first quarter of fiscal year 2017 ended October 2, 2016.

Kitron Posts Stable Top Line and Continued Operational Improvements

Kitron's revenue in the third quarter amounted to NOK463 million, compared to NOK468 million in the third quarter last year.

Plexus Reports FY2016 Revenue of $2.6B

Plexus has announced financial results for its fiscal fourth quarter ended October 1, 2016, and guidance for its fiscal first quarter ending December 31, 2016.

NEO Tech Invests in New Capabilities and Expands Capacity at Otay Mesa Site

NEO Tech continues to invest in infrastructure, equipment, processes, and personnel at its Otay Mesa manufacturing site in Tijuana, Mexico.

Cirtronics Installs Powerful 3D AOI Solution for Accurate Inspection Results

Cirtronics has added Viscom's S3088 ultra blue AOI system to each of their production lines in its facility in Milford, New Hampshire.

Kitron Lands IBA Contract for Lockheed Martin's F-35 Program

Kitron has received a multimillion dollar contract from Lockheed Martin for production of Integrated Backplane Assembly (IBA) for the F-35 Low Rate Initial Production program, LRIP 11.

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- IPC J-STD-001 w / Space
- AS9100
- ISO-9001
- ISO 13485

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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.

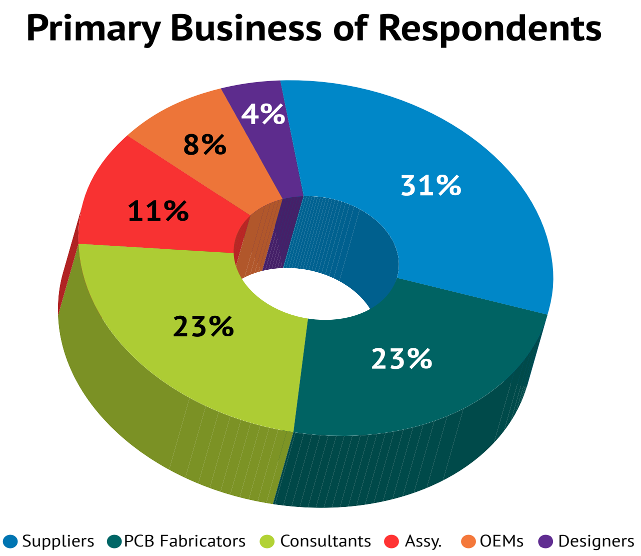

Figure 1: Primary business of respondents of the 2016 I-Connect007 sales and marketing survey.

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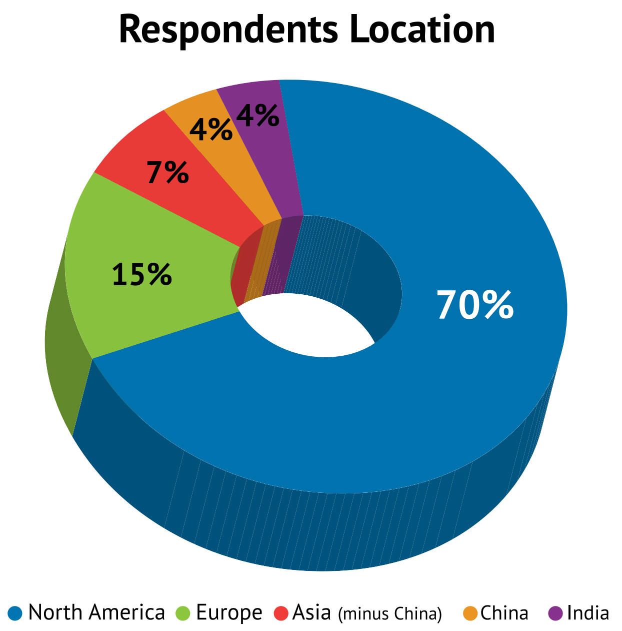


Figure 2: Location of respondents to the sales and marketing survey.

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.

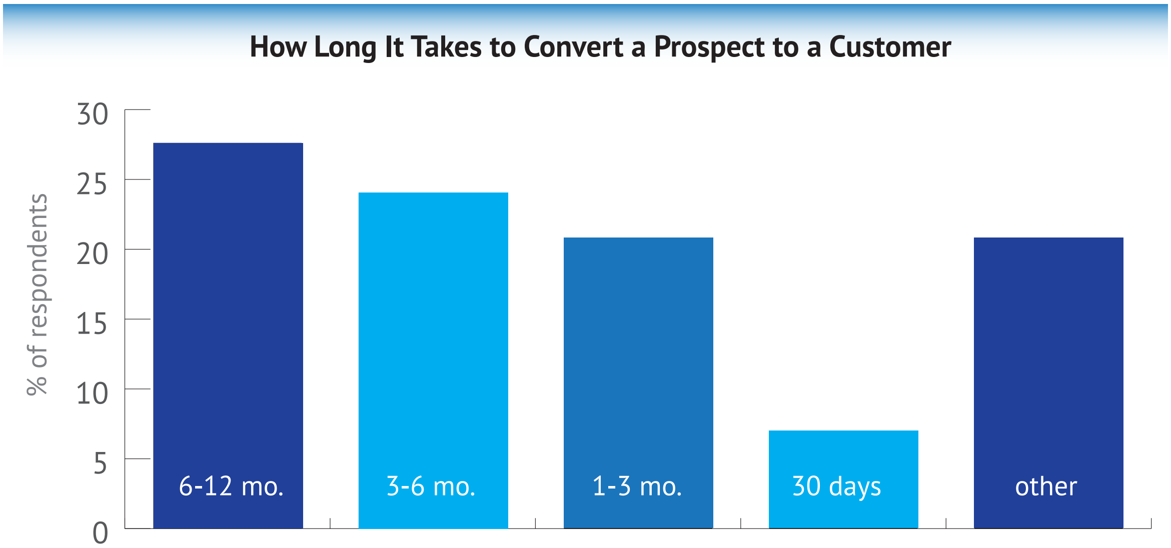


Figure 3: Length of time to convert from prospect to customer.

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?

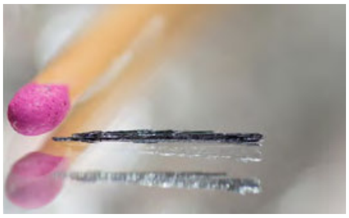
This question had the greatest number of responses, with most distilled into this list:

- 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. **SMT**

New Perovskite Could Lead the Next Generation of Data Storage



Ecole Polytechnique Fédérale de Lausanne (EPFL) scientists have developed a new perovskite material with unique properties that can be used to build next-generation hard drives. The work, which describes the first ever magnetic photoconductor, is published in Nature Communications.

The lab of Laszló Forró, in a project led by postdoc Bálint Náfrádi, synthesized a ferromagnetic photovoltaic material, which exhibits some unique properties that make it particularly interesting as a material to build next-generation digital storage systems.

"We have essentially discovered the first magnetic photoconductor," says Náfrádi. This new crystal structure combines the advantages of both ferromagnets, whose magnetic moments are aligned in a well-defined order, and photoconductors, where light illumination generates high density free conduction electrons.

Though still experimental, all these properties mean that the new material can be used to build the next generation of memory-storage systems, featuring higher capacities with low energy demands.

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Electronics Industry News
Market Highlights

China's Semiconductor Sector to Undergo Rapid Consolidation in 2017

Numerous major participants in the global semiconductor sector are engaging in deal-making to make themselves larger and more competitive. In China, consolidation will take place within the three broad sections of the semiconductor sector, namely foundry, IC testing/packaging and fabless design, according to TrendForce.

Europe to Surpass North America in IoT Sensors Market

The global IoT sensors market was valued at $6 billion in 2015 and is poised to rise to $34.75 billion by 2023, expanding at a tremendous CAGR of 24.5% from 2016 to 2023. Geographically, North America will continue to dominate the market by revenue until 2020, but Europe is expected to overtake the US by 2021.

Automotive Systems Forecast to Show Strongest Growth Through 2020

The market for automotive electronic systems is expected to display the strongest cumulative average growth rate through 2020, at 4.9%, highest among the six main electronic system categories, according to IC Insights.

Enterprise Wearables Find First Inflection in Industrial and Field Service Markets

The warehouse and manufacturing vertical, along with field services, represent one quarter of the wearable devices shipped to enterprise end users in 2016. ABI Research forecasts shipments to these segments will more than triple to top 35 million units in 2021.

Average PC DRAM Contract Price Jumped Over 20% Sequentially in October

The average contract price of 4GB PC DRAM modules increased over 20% between September and October from $14.50 to $17.50 as DRAM suppliers completed their fourth-quarter contract negotiations with first-tier PC-OEMs, according to DRAMeXchange.

Demand for Alternative Fuel in Automotive Sector to Stir Growth of Lithium-ion Battery Market

Transparency Market Research projects the global lithium-ion battery market to reach $77.42 billion in 2024 from $29.68 billion in 2015.

3D Printing of Electronic Devices to Generate Over $420M in 2022

3D printing in the electronics industry is forecast to generate $428 million in revenues by 2022, and go on to achieve $2.8 billion in revenues by 2025, according to a new report by SmarTech Publishing.

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. The Asia Pacific region will show a significant CAGR of 13.6% during the same period, driven by the growing awareness of better manufacturing technologies and growing investments in manufacturing activities.

Power IC Sector Stood Out in an Overall Declining Power Semiconductor Market in 2015

According to a new forecast report from IHS Markit, while power discretes and modules products both declined about 10% in 2015 compared to 2014, the power semiconductor sector significantly under-performed in comparison to the overall semiconductor market.

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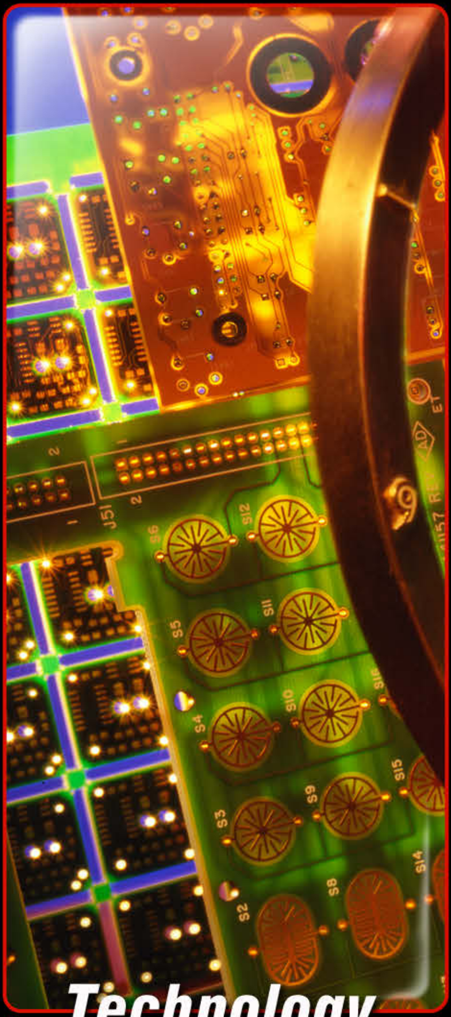

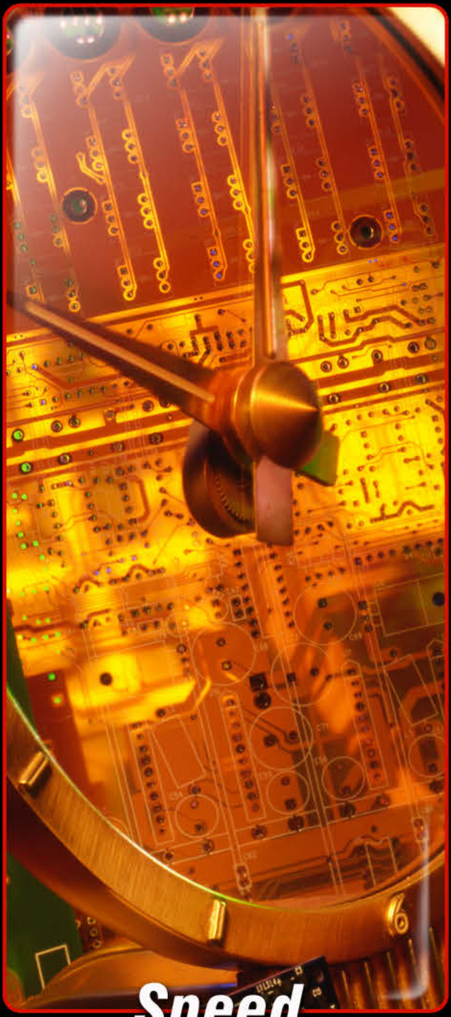

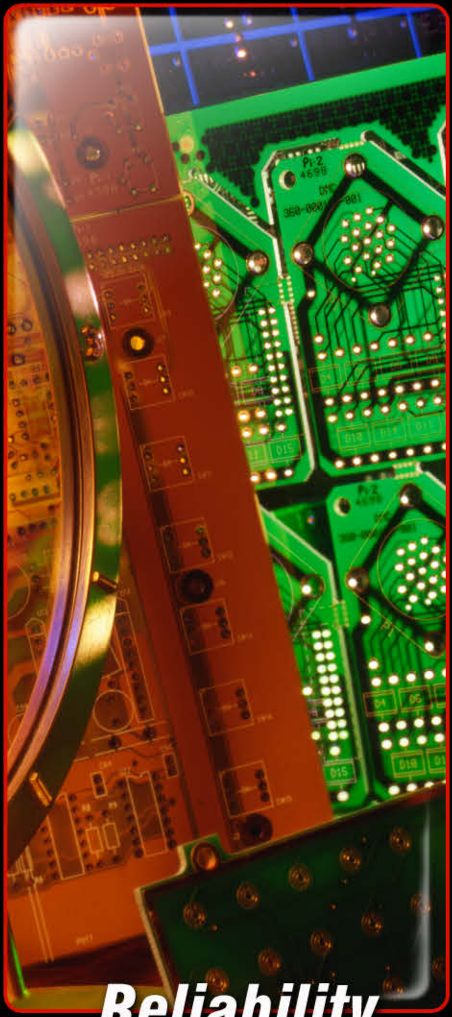

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Matej Krajnc

Successful Sales Strategies

By Stephen Las Marias
I-CONNECT007

National Instruments (NI) is one of the leading providers of automated test equipment and virtual instrumentation software. For the past 40 years, NI has worked with engineers and scientists through its open, software-centric platform that takes advantage of modular hardware to provide solutions to the world's greatest engineering challenges.

At the recent NIDays 2016 event in Singapore, I spoke with Matej Krajnc, Managing Director ASEAN/ANZ of National Instruments, about the challenges for sales and marketing executives in the electronics manufacturing industry, effective sales strategies, and key attributes of a sales person. He also shares his outlook on some of the key technology trends next year.

***Stephen Las Marias:** Matej, what do you think are the greatest challenges of working with direct sales people and sales representatives or partners?*

Matej Krajnc: Both have pros and cons. When you deal with direct sales people, you are more in control about how you reach your customers and how you sell your products. When you work through the partners and representatives, you use them as a channel to that. In most countries where we use our direct sales presence and our direct sales engineers the first thing that we really want to know is that the engineers are very proficient. We spent quite a significant amount of time developing the proficiency program. They need to be proficient in the products or at least have a very high understanding of the industries that they are serving and potentially also application areas that they are targeting.

The other part, as you know for our region, is that the geography is extremely challenging. You have the Philippines on one side made up of so many islands, and we cover many of them, and on the other side you have Australia as a continent and country where life is surrounded along the coast. You have to be very efficient in providing the coverage for both. One of the biggest challenges covering such territories is understanding their culture and being able to address their needs in the various languages.

***Las Marias:** We recently did a survey to learn what technology suppliers and providers are saying and what their challenges are when it comes to sales and marketing. Having a good technical knowledge of the products that they're selling is one*

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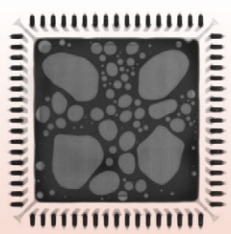

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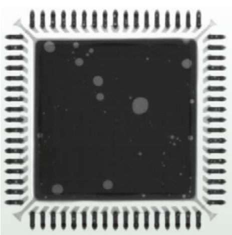

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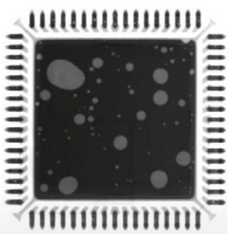

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of the biggest challenges when it comes to doing sales, according to our survey. That is, unless people know the product, or know the customer that they're selling the product to, or the requirements of the customers, it will not work out.

Krajnc: For us, product knowledge is the ultimate condition for successfully selling products. I mean, you can sell it, but successfully selling is a different thing, especially because we have a platform that can be applied to so many different things. We need to understand what the capabilities of the product are and where that platform can be applied. You can't do this without really understanding how the product really works on a low level, as well as what the reliability is for industry-specific applications. I would say everything starts there.

Then having technical knowledge in terms of understanding and knowing the environment, or the industry customers, is another part of it. We tend to sell our products in a way that we can help customers to solve their problems. In order to help someone solve something, you need to understand the problem that person has.

Las Marias: *What advice or strategy would you give a salesperson in this market?*

Krajnc: One is to know what customers to target. You need to give a clear direction of where to go. Then also, let's say if engineers are selling to our customers, they really need to bring value to the customers. Because if they don't bring value, why would the prospect be willing to meet with them? That needs to be pretty evident. Also, they need to show where we differ from others and what benefits the prospect will be getting after buying our products or our platform, because that drives the sales. If customers don't see that, normally they don't sell.

The other part is really fine-tuning and tailoring solutions to meet customer expectations. The expectations might change during the process, because we all understand each other now. We do this by having and developing strong relationships with our customers. It's establishing a partnership. If you approach from that side, you get a lot of information that helps you tailor the offer to your customers and increase the success for both you and the customer.

Las Marias: *Do you have a sales training program for your salespeople? If so, why do you think it's important, and do you think it's effective?*

Krajnc: We do have a sales training program because, in most cases, we hire engineers. I'm an engineer as well, and I didn't get that sales training at the university. National Instruments has a well-established and developed sales training program that we provide for our sales team across the globe. Initially, before someone is assigned to be a seller, they have to go through extensive technical training, which is a part of the application engineering process. We have so many products, so many technologies, that the only way to really understand the product is to teach customers how to use LabVIEW and to take part of some prototyping in respect to proof-of-concept. Building some setups to understand what the real challenges are that our customers are facing when using our product.

Once that knowledge is there, the best will be selected and we teach them about how to communicate, how to manage sales meetings, for example, and how to sell. Once someone graduates from that program, we continuously improve their proficiency in sales skills with additional trainings in new sales approaches and concepts, because in sales there is always a lot of innovation happening. How we sold products 15 years back might not be the best way right now, so we always have to evolve and we need

Chandran Nair
Matej Kranjc
Kevin Ilcisin

to keep an eye open and see what's happening in the industry and try to apply the best new methods and practices.

Las Marias: ***How should a sales plan be developed?***

Krajnc: The sales plan should be developed together with the manager, for instance, from a certain territory. That will take into consideration industries that are served, and it has to be done in conjunction with marketing because marketing is key to building awareness. Then the plan really should have clear objectives about what someone wants to achieve. You need to have a clear list of activities to do, because activities are the one thing that we can really manage. The rest of the outcomes are practically uncontrollable.

Las Marias: ***Speaking of marketing, how should you get the story about the company or the story about your product out there to support sales?***

Krajnc: We use different ways of doing marketing, because marketing is a pretty large part of the organization within NI, so we have different groups that care about different activities. One group runs events like this, which is an event that requires a lot of publicity and a lot of information about the products. It requires also that we bring quite a large portion of the ecosystems of our partners so that customers not only listen and hear from us, but that they also have a chance to listen to some of the customers speak on what their ecosystem does on top of or in parallel with our product. This is one type of event, but we have seminars and a lot of electronic media like webinars, which is pretty strong, and we collaborate with people by advertising in magazines.

Las Marias: ***How should a company like NI target or select customers?***

Krajnc: Marketing is really a place where we first of all develop products so that we can sell those products to the customers. It's all centered around a platform. As you have seen, we can target so many different industries. Really, there's no one single industry that would really stand out. We do some analysis about a country's potential or the strongest industry areas in each of the countries and the application areas that we can target in those. When we compile all that information, then we can somehow develop our compass about where we go with that.

***Las Marias:** There always has to be data as well, right?*

Krajnc: At the end of the day, it's all about data. There's a lot of data that you have to crunch to get some good outcomes and once you have the data and you analyze it, then you have to execute. So you need a very strong and skillful team that acts and executes on all the data.

***Las Marias:** Matej, what do you think are the three most important attributes of a great salesperson?*

Krajnc: To be a good listener, have empathy, and to really be someone that contributes and not someone who is pushy and just trying to sell. If a salesperson can do that, it's perceived on the customer's side as a real readiness and willingness to help address the needs, and it can accelerate the development of the partnership between the seller and the customer, and that's what you want.

***Las Marias:** Is there any particular sales strategy that you can recommend?*

Krajnc: I would say sales strategies always have to change, because you only have a sales strategy according to the situation and requirements which you currently have. If you just say, "This is the most effective sales strategy that we can use," and put it there on the wall, that might be so for a specific case or a specific industry, but if you move somewhere slightly different it might not be the best. Considering the world we are in, that has to be continuously adjusted and updated according to the situation.

***Las Marias:** Matej, what do you think are some of the key electronics manufacturing industry challenges to expect next year?*

Krajnc: If I talk about my region, for some time there has been the movement towards manufacturing in areas that provide lower cost manufacturing, and I've seen that significantly in Australia for the last ten years. On the other side, Vietnam, Thailand, Malaysia, and part of our territory have seen benefits on this side. Ultimately, I think we need to always look for new opportunities and shift resources, where necessary. The real challenge is to be on top of all this.

***Las Marias:** Do you think there is one trend in the electronics industry next year that stands out?*

Krajnc: There are a lot of trends happening right now that pretty much everyone talks about. One is related to the industrial Internet of Things. The other one is related to new communications like 5G, because there's a lot of research happening, and not only in big countries. We've seen it even in countries like Indonesia, for example, where they've done some impressive research in 5G. It's happening everywhere, because everyone wants to contribute and use different algorithms and different parts of the 5G that they want to work on. That will continue to be a big focus in the industry.

The other part I see is related to the automotive industry. If you look at cars right now, they are so intelligent. There is so much high-end technology built in and, at the end of the day, everyone wants to have that self-driven or fully autonomous car, but we've seen that it will require a much better communication infrastructure. That's why 5G will play a very important role in that, as well as the Internet of Things.

On the other side, there are other technologies like radar, V to V, V to X, and what we'll see in the future is that cars will be communicating between each other, using global navigation systems, communicating with road signs, traffic lights and will have all the sensors built in to detect the proximity of other cars or people walking in the street and so on. In my view, I would say those are the three areas that we will see much of the excitement and development in.

***Las Marias:** Okay, great. Thank you very much, Matej.*

Krajnc: Thank you. SMT

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The Hunt for the Best Pre-Owned SMT Equipment Supplier

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by Shannon Allard
NORTHERN ELECTRONICS AUTOMATION (NEA) OF NH LLC

When the time comes to increase capacity on the production floor, it doesn't always come with the necessary budget to buy new equipment and your options are limited. This is where buying pre-owned equipment is often considered by many as unfortunate guesswork, dependent on your team and the source in which you decide you can trust to create an honest buying experience.

Saving money upfront and receiving the equipment much earlier are only two of the main reasons why our customers normally decide to buy pre-owned equipment over new, including all peripherals. For example, feeders for your pick-and-place machines, carts, racks and platform tray feeders are all essential to start up or increasing your capacity for production.

It seems that there are many SMT equipment resellers out there, some with many years of experience and others that are merely intermediaries between a company that's trying to sell their surplus equipment and you. With that in mind, think of what you can afford not only in terms of the cost of equipment, but also regarding installation, training and support. Most reliable companies will have an experienced sales team and technicians available in-house through the entire buying process.

Expectations for a Pre-Owned Equipment Reseller

A responsible equipment sale begins with the knowledge of each piece of equipment, by your vendor, prior to bringing them back into the marketplace. Having hand-picked all pre-owned equipment prior to conducting the sale of each unit eliminates a lot of the guesswork for you.

With the exception to buying pre-owned equipment at an auction or gambling with a "used/as-is" condition, your vendor should gather as much information as possible when purchasing pre-owned equipment for stock. Dealing with an experienced sales and technician team removes the risks that many buyers have come to know as "buyer beware" scenarios.

Look for a company that does the troubleshooting for you and always ask what services are provided post-sale. Make sure these are

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documented in your quotation and included with your pre-owned equipment purchase. Areas to cover with each sale include the services to each machine, acceptance, delivery, installation and warranty. Follow up training on-site has also become a valued expectation from pre-owned equipment resellers held to the highest standard.

You can bet if none of these expectations are offered with your pre-owned equipment purchase that anything you hoped for post-sale may be a big disappointment.

Knowing the Difference: Experienced Vendor or Peacemaker?

Pioneer companies are transforming the way they sell and showcase their experience to current and potential customers. Therefore, it comes as no surprise that most companies are focusing on their most powerful sales tool: Their website and turning it into a platform to engage current and potential customers in more than one way.

A company's website can no longer be only a digital catalogue. Nowadays, it must be a source of useful information about our industry and our products. It has to add value to your web-searching experience, not only exhibit their list of available equipment.

More and more frequently, customers are moving from a simple pit-stop on a website where they used to only look for lists of available equipment, to a longer search of valuable information about "How Tos" or "Dos and Don'ts" of pre-owned machine buying, trading and selling. It's become more than just a source for equipment.

Many companies' websites offer short, comprehensive articles that will help you understand how to decide between each category, such as, "Used as-is" and "Refurbished," or what equipment will do the best job for your specific application and which one may not. The websites are helping prove the companies are both helpful and experienced before they ask for people's next purchase. Think of this as where the cart is being filled, dumped, or possibly recycled. Customers expect a website to be a source of useful information and a sales team must be prepared with answers they don't necessarily find in a manual or a description catalogue.

Whether you're buying refurbished, reconditioned, or simply used as-is equipment, you and your team must consider the production rate at which you want to be, what type of equipment will give you those numbers and most of all, which vendor you can trust with this decision.

The vendors support and information maybe their strongest attribute than the actual sale of equipment.

What Makes a Good Salesperson?

Certainly, experience counts, but as we've come to learn from our many years in the market, it is not the most important merit of a sales person. After speaking to dozens of customers who have gone through at least one bad purchasing experience, it's not surprising that dependability is the most important attribute our customers are looking for. As both my Grandfathers once said, "you can't knock it!"

> "Finding a salesperson who will pick up the phone after the deal is done or not ignore an unpleasant email thread and answer questions like he did before the PO is not always easy."

Finding a salesperson who will pick up the phone after the deal is done or not ignore an unpleasant email thread and answer questions like he did before the PO is not always easy. But that is in part the reason why some of the old-time companies are still thriving. They understand that their sales force is the engine of their ship and that the best referrals they will get will come from satisfied customers who recommend their services among their peers or will bring a business card with them, from one company to the next.

During your pre-owned vendor hunting process you will probably speak to more than one salesperson, so trust your instincts. Work with the one that tries to understand your situation and helps you find the best solution for it before he tries to sell you anything.

More likely he or she will be the one who will offer the right piece of equipment and will address any after-sale issues with a better understanding of where you're coming from. The price is second or even third down the line.

Last but not Least

If you already have experience with one particular platform name, it is likely that you will need little to no help with the installation. Troubleshooting and new operator training will probably be part of your day-to-day process.

Whether you're buying refurbished, reconditioned, or simply used as-is equipment, landing a decision can seem overwhelming. You and your team must consider the production rate at which you want to be, what type of equipment will give you those numbers and most of all, which vendor you can trust with this decision.

Fortunately, knowing your variables and the different options out there will make your life easier. Once costs associated with the purchase of previously-owned machines are identified, you're already on the right path. Most important: Identifying what category (reconditioned or refurbished, serviced, used as is) suits you best will reduce the risk of getting an unpleasant surprise when the machine arrives at your floor.

A reliable vendor should deliver pre-owned machines and peripherals that have been handpicked, supported and maintained. The equipment you buy should be priced according to market value and able to be delivered back onto your production floor with confidence that it will perform. Let your vendor take the guesswork out of buying pre-owned SMT equipment and work with someone you will be confident with who will not disappear after the sale has been completed.

"Pick and place" your relationship carefully with your pre-owned SMT equipment dealer to increase efficiency and profitability. **SMT**

Shannon Allard is a global sales executive at Northern Electronics Automation (NEA) of NH LLC. He may be reached at shannon@nea-llc.com.

Rework and Repair Standard Getting Updated

by Bob Wettermann
BEST INC.

The IPC-7711/21 *Rework of Electronic Assemblies/Repair and Modification of Printed Boards and Electronic Assemblies* is being "upreved" from version "B" to version "C" and will soon be released to the industry. There are a couple of notable changes that strengthened, modernized and brought together changes from the previous "B" version, which was approved in 2007.

Several of the changes from the previous version deal with the manner in which leadless devices are being reworked. Leadless devices have become the most widely placed in terms of units worldwide. In addition to the methods previously described when the initial version of the IPC7711/21 "B" came out, the new "C" version includes three new methods, summarized below:

- **Method 5.8.1.1:** Prebumping the leadless device using a polyimide stencil
- **Method 5.8.1.2:** Prebumping the device using polyimide stencils with the "bumped" component then fitting in to stay-in-place capturing stencil on the rework location on the PCB
- **Method 5.8.1.3:** Hand bumping center ground and hand soldering the IO connection method

Another area in which some newer rework techniques are memorialized in the new "C" version are the various pad repair techniques including:

- **Method 4.7.4:** Land repair land with integral via repair film method which leans on the previous repair film method for pad repair
- **Method 4.7.5:** SMT/BGA land repair with integral via repair circuit extension film adhesive method

Other areas of change for this "C" version include:

Method 3.9.1.2 focused IR for BGA rework and **Method 5.7.12** focused IR placement of BGAs. These changes mirror the inroads that IR rework have made since the B standard as the focused heating is important for ever higher board part densities and the continuing proliferation of underfilled devices, very small devices and highly temperature sensitive devices finding their way onto PCBs.

In addition to the above procedure upgrades there are a variety of other changes due to operations running in a mixed alloy environment of both lead-free and tin-lead solders. One of the changes with the IPC 7711/21 has to do with the segregation of the hand soldering equipment limiting cross-contamination. These changes are due to there being significant rework differences between the processing

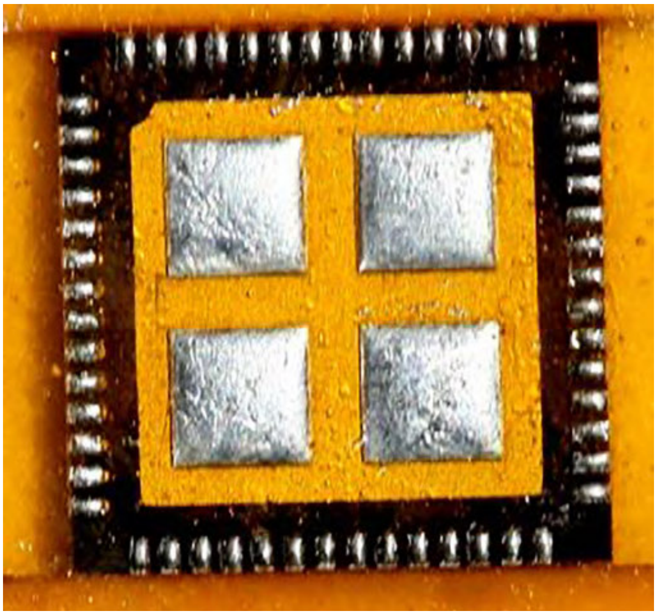

Figure 1: Prebumping of QFN for rework.

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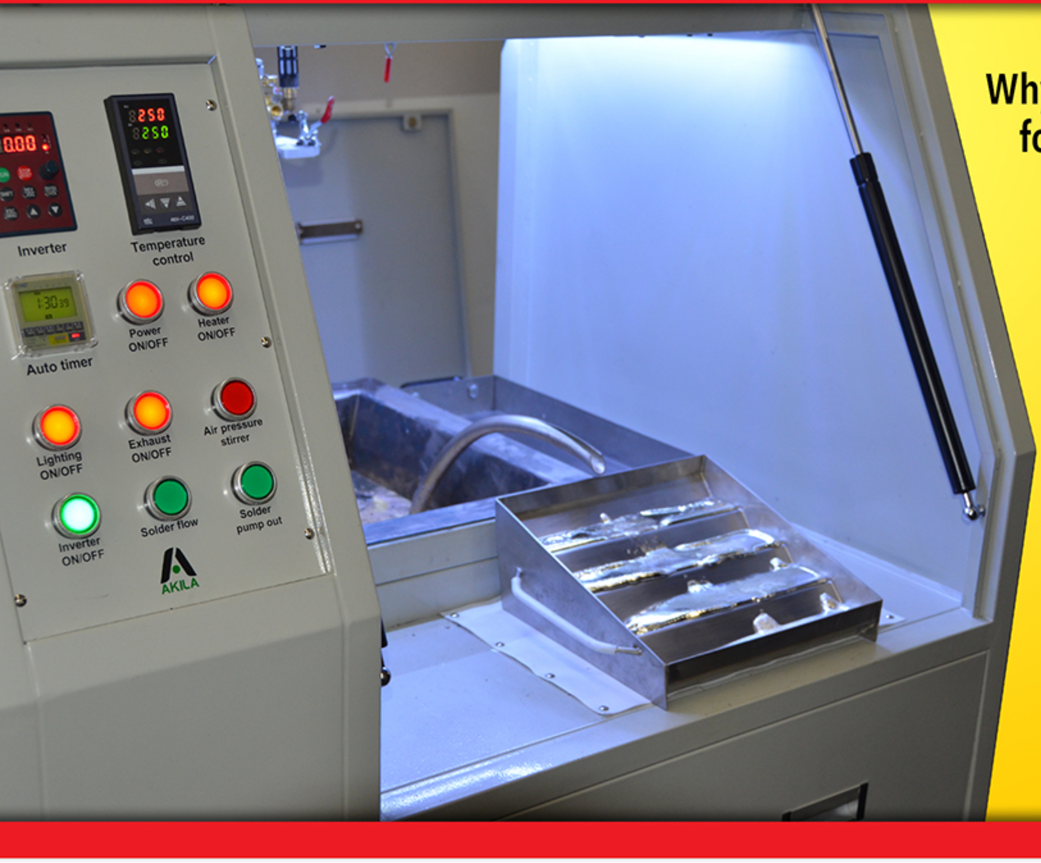
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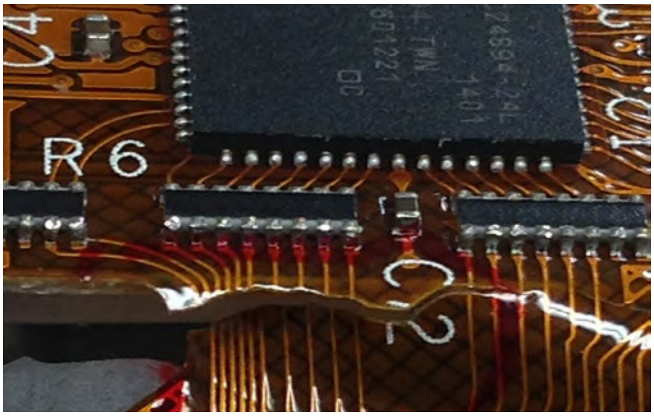

Figure 2A: Example of a damaged flex circuit.

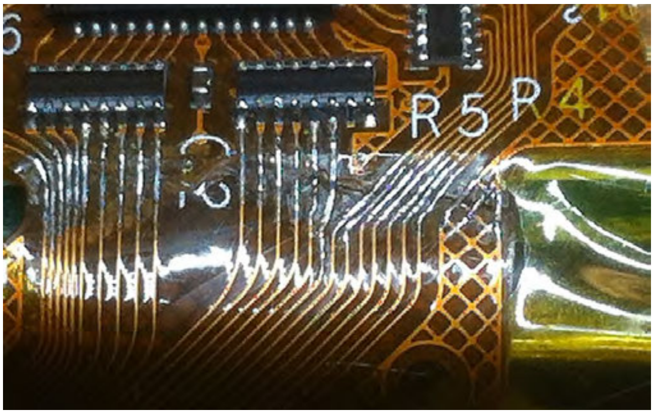

Figure 2B: Example of a repaired flex circuit.

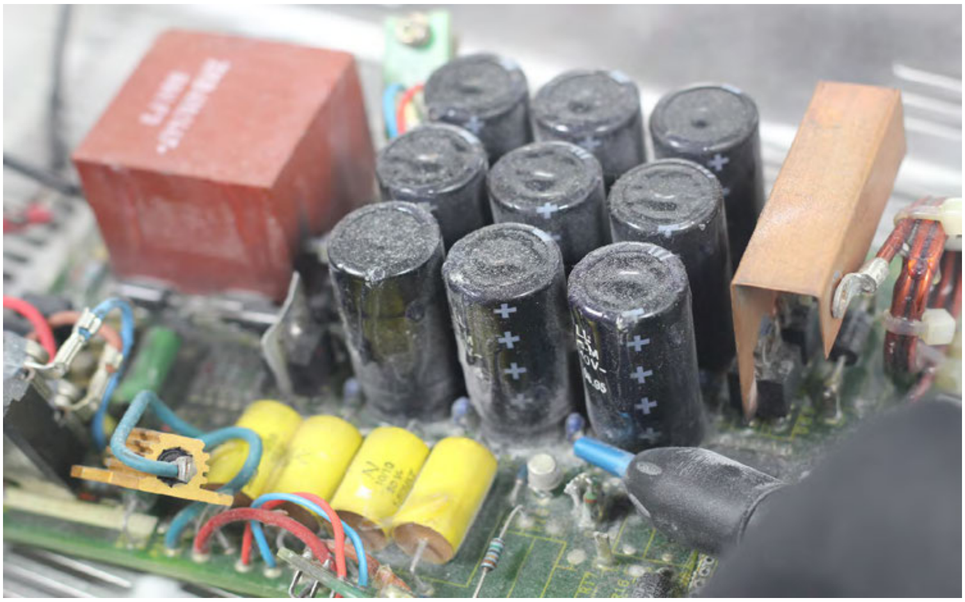

Figure 3: Coating removal using micro blasting technique.

of these two alloy types. The major differences in processing these alloys which impact rework operations are the fluxes being used, the cleaning materials being used and the longer soldering dwell times which may or may not require the addition of the nitrogen in to the rework/repair operations. The higher reflow temperatures of the lead-free solders requires that the device in proximity to the rework location needs to be protected from thermal damage.

There are also a couple of newer proposed methods up for consideration which did not make this version of the standard and will have to wait for Version "D" or beyond. These include:

- Flex circuit repair
- New micro blasting method for coating removal
- New method for solder mask replacement

Keep a watch out on the IPC website as this revised standard makes its way to being available or speak with your training services provider. **SMT**

Bob Wettermann is the principal of BEST Inc., a contract rework and repair facility in Chicago.

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CHOOSE YOUR
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EMS Industry Sales and Marketing: Why Strategies Vary Widely

by Susan Mucha
POWELL-MUCHA CONSULTING INC.

Decades ago, executives in the Tier One segment of the electronics manufacturing services industry were predicting that the industry would consolidate into two or three big players. While merger and acquisition activity helps keep names changing in the top 10 EMS providers, the consolidation down to a handful of companies hasn't happened.

There are two big reasons. First, market entry and business growth is still primarily controlled by original equipment manufacturers (OEMs). That severe an industry consolidation would limit their options and ultimately increase pricing, so they source business in ways that always keeps diversity in Tier One and options in the lower tiers. Second, the range of support needs varies widely within the market in terms of capabilities, response speed, demand frequency, product size and preferred lot size. This opens the door to multiple tiers of service providers specializing in different regional and industry market segments. This diversity of business models also drives diversity in sales and marketing strategy.

To better illustrate some of the differences, this article looks at four different EMS companies in the global and regional space. I've consciously focused on companies outside of Tier One, because while Tier One reflects the largest share of the market in terms of total revenue, the sheer size of these players drives their sales and marketing strategies in ways different from what is typically found in the far larger number of companies in the lower tiers.

Generally, every EMS companies' core marketing value propositions aligns in some way with one or more of the bullets on the list below:

- Access to shared manufacturing capacity at a fraction of the cost of in-house capacity
- Ability to level load internal production capability
- Improved financial inventory turns as product may be generating revenue before invoice is paid
- Access to wider range of expertise
- Access to lower cost labor markets
- Access to specific manufacturing technology

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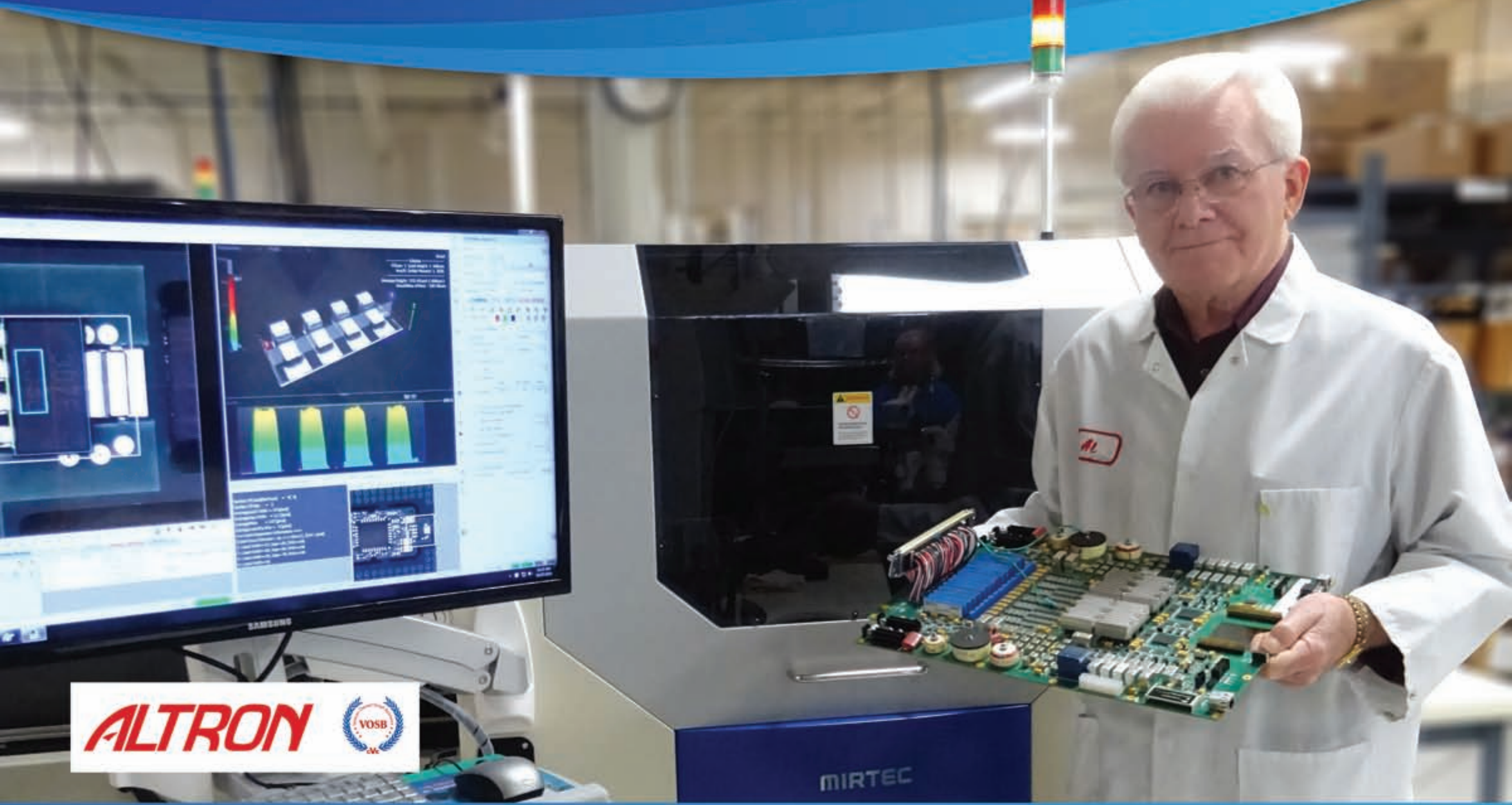

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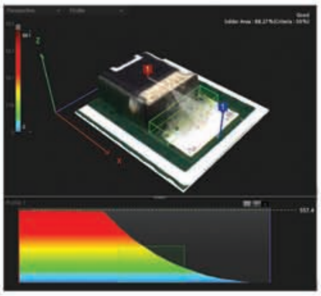

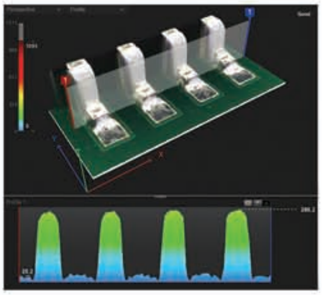

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- Convenience/proximity to an OEM team's location.

The way most EMS companies differentiate themselves is typically through business model focus. Typically, EMS providers focus their capabilities on one or more of four key areas:

- Lifecycle expert
- Service expert
- Systems/infrastructure expert
- Manufacturing expert

Marketing strategy may be further differentiated by focusing on specific industry segments with specialized needs. However, even when this is done, the value propositions and business model focus tend to align with lists provided earlier.

So how does this translate to actual sales and marketing strategy? These four examples illustrate different approaches to differentiation and addressing the needs of target customers.

Firstronic

Firstronic is headquartered in Grand Rapids, Michigan and operates a wholly-owned facility in Juarez, Mexico. It has expanded its global footprint beyond that via joint venture (JVs) in China, India and the Czech Republic.

Its largest customer segment is automotive and that industry's desire to have its suppliers be able to launch product globally in multiple facilities was the primary driver of its rapid expansion via JV.

"We saw the JV option as the best way to expand geographically as rapidly as our automotive customers wanted us to without having to tie up large amounts of capital and management resources in starting multiple greenfield facilities around the globe. We were fortunate to find JV partners with the same commitment to Lean manufacturing and superior performance, and have set speed records for project launch on some of our joint production projects," said Firstronic President and CEO John Sammut.

Firstronic's Lean manufacturing business model provides customers with more schedule flexibility and suppliers with more predictable demand, while delivering best-in-class metrics on inventory turns.

That said, its North American facilities also support medical, consumer and industrial customers and those could also be supported via the JV facilities should the need arise. In terms of business models, its commitment to Lean manufacturing aligns with both the Manufacturing Expert and Service Expert categories. Additionally, it has adopted a systems strategy that both force multiples its program management team and enables both staff and customers to have 24/7 visibility into project status. Its value propositions include:

- Convenience/proximity to an OEM team's location (specifically, automotive design teams in Detroit)
- Access to lower cost labor markets (Juarez and strategic alliance locations)
- Reduced time to market (systems and Lean manufacturing both reduce product delivery lead-times, while increasing schedule flexibility)

Firstronic took a rather unique approach defining its target markets and ideal fit customers very narrowly. It actually "leaned down" its customer base when the current management team took control. In conducting this customer rationalization strategy, the management team utilized the Boston Consulting Group (BCG) matrix. Each customer was analyzed and assigned a favorability score based on the following criteria:

- Volume (100K unit per year)
- Mix (# of assemblies)
- Complexity (BOM line items)
- Auto placements
- Procurement challenge (end of life, sole source, allocation issues, etc.)
- Product life cycle (years)
- Customer's internal PCBA capability
- TAM (rev. potential)
- Manageability (documentation, systems, logistics, internal support, etc.)
- Margin potential (throughput %).

Customers with low revenue and a low favorability score were encouraged to transition to other suppliers. Customers with low revenue, but a high favorability score were classified as "up or out." Customers with high revenue potentials and a high favorability score were classified as keepers and customers with high revenue and a low favorability score saw an increase in pricing as a motivation to exit.

Because of the rationalization process, the business base went from more than 20 customers and over 5,000 unique part numbers to less than 10 customers and under 1,000 unique part numbers. This significantly reduced the complexity of the business and enabled more focus on the needs of preferred customers and targeted customers with high favorability scores.

The team then rationalized its supply base to a core group of suppliers willing to align their systems with the company's Lean model. It then positioned itself as a higher value customer within its supply chain because its customer base fine-tuning combined with its Lean disciplines minimized the amount of "work" it represented to the supply chain.

From a marketing perspective, the company does little outside of articles and press releases. Its industry leading metrics have resulted in a string of awards for operational excellence including recognition from Frost & Sullivan, the Small Business Administration, Circuits Assembly's Service Excellence Awards and Michigan Celebrates Small Business.

From a sales perspective, it has a sales force of one and some support from manufacturer's reps. The bulk of its growth comes from customer and supplier referrals.

The metrics driving this performance include:

- On-time delivery: 99.6%
- Inventory turns: 12 to 14
- Gross margin: >21%
- Compound annual revenue growth rate: >50%.

Milwaukee Electronics

Milwaukee Electronics is headquartered in Milwaukee, Wisconsin and has additional manufacturing facilities in Portland, Oregon and Tecate, Mexico, plus an International Purchasing Office (IPO) in Singapore and a Business Process Office (BPO) in India. A key point worth noting is that the company is one of the oldest EMS companies in existence, having celebrated its 60th anniversary in 2015. While there are a few older companies who evolved into EMS providers, Milwaukee Electronics' focus has been contract engineering and manufacturing services from day one.

The company's primary focus has been addressing gaps in EMS service delivery process. In doing so, it aligns closely with the Service Ex-

Milwaukee Electronics' business model includes product design engineering capabilities, and in some cases, ODM capabilities utilizing proprietary motor and control technology.

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pert, Manufacturing Expert and Lifecycle Expert business models. For example, it pioneered online rapid prototype ordering with its Screaming Circuits business unit and continues to fine tune that model.

"We saw OEM product development teams losing resources as budgets got cut. We set out to create a 'fast food restaurant' model that would always have a table when one of those teams needed a prototype. We've made it easy for engineers to customize their orders and understand the lead-time associated that process. Creating this capability was challenging operationally, but provided an excellent point of differentiation," said Jered Stoehr, Milwaukee Electronics' VP of Sales and Marketing.

Design engineering is also a strong component of the business model. While most regional EMS providers offer some level of engineering support in terms of design for manufacturability/testability (DFM/DFT), this EMS provider's model includes a product development team and in some cases, original design manufacture (ODM) capabilities utilizing proprietary motor and control technology.

A third area of potential differentiation ties to the ability to provide access to low cost regions. The company has invested heavily in its Tecate, Mexico facility. Its quoting model is similar to models used in Mexican shelter operations which predominately rely on manning tables as a precise measure of anticipated project labor cost. This type of methodology makes it easy to accurately quote virtually any type of mechanical or electromechanical project and opens the door to opportunities for projects that OEMs may not have thought of outsourcing.

From a marketing standpoint, the company relies on a strong web presence, industry trade shows, some public relations and alliances with entities also supplying the engineering community. While its prototyping business is industry agnostic, its volume production business is predominately focused on medical, industrial, specialty consumer, defense and automotive aftermarket.

From a sales perspective, the company currently has a sales team of two with regional support through manufacturer's reps. Much of its new business comes from projects that start out as design projects and evolve into production projects.

SigmaTron International

SigmaTron International is headquartered in Elk Grove Village, Illinois. The largest of the four companies we are profiling, it also operates a product development facility in Elgin, Illinois, a manufacturing facility in Union City, California, three manufacturing facilities in Mexico, a manufacturing facility in China, a manufacturing facility in Vietnam and an IPO in Taiwan.

The company focuses on providing Tier One breadth of services and geographic locations to OEMs whose projects are a better fit for a lower tier provider. Their business model includes elements that relate to Systems/Infrastructure Expert, Service Expert, Lifecycle Expert and Manufacturing Expert. In particular, their systems strategy includes a suite of proprietary software tools that maximize the ability of both their internal team and customers to view project status 24/7. It also optimizes the ability of their supply chain management team to efficiently manage a global pipeline of materials.

Industries supported include: medical, industrial, consumer, appliance, gaming, automotive and aerospace/defense.

The interesting dynamic of their value propositions is it that they vary by geography. Convenience and proximity to an OEM's team location is often a factor in their U.S. projects. In some cases, availability of a Midwest and West Coast facility has resulted in dual facility projects that support a customer's Midwest and West Coast operations. The US operations are also ITAR-registered to support aerospace and defense customer requirements. Union City is also AS9100C registered in support of aerospace requirements. While Vietnam and Mex-

SAIS Envios QC SMT

SigmaTron's systems strategy includes a suite of proprietary software tools that maximize the ability of both their internal team and customers to view project status 24/7.

ico typically represent access to a low cost labor market, China is increasingly becoming a facility of interest to companies selling in China who see building in China as the lowest cost way to penetrate the Chinese market. The facility recently added ISO 13485 to support its Chinese medical customer base, as well as companies building for export to other countries. This now enables the company to offer an ISO 13485 registered facility in the US, Mexico or Asia for companies pursuing a globally regionalized strategy to medical product manufacturing. The company's Tijuana facility just added ISO/TS16949 to support the needs of its automotive customer base, as well as overall growth of that industry in Mexico.

From a marketing perspective SigmaTron advertises, participates in medical-related trade shows, has a strong online presence and publishes several informational articles and whitepapers each year.

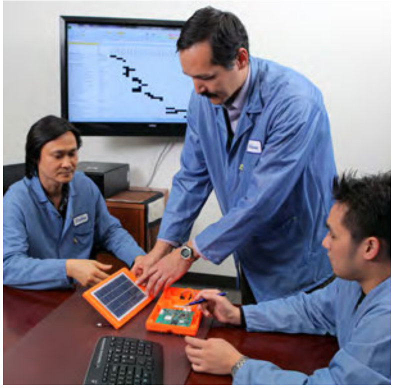
Its salesforce varies by region. The US salesforce is based out of the California and Midwest facilities and sells all facilities. There is also limited use of manufacturer's rep firms in both the US and Mexico, plus some engagement with Mexico economic development personnel. China has one direct salesperson focused on selling to companies within China, plus supporting sales activities with US customers in both the China and Vietnam facilities.

"We look at how our different markets are evolving and adjust our approach and service offerings to best serve our target customer bases," said Curtis Campbell, SigmaTron's VP Sales West Coast.

Spectrum Assembly

Spectrum Assembly Inc. (SAI) is located in Carlsbad, California. Although it originally started as a cable and harness manufacturer, it has evolved into a one-stop shop for cables, printed circuit board assembly and system level assembly.

Its business model focuses heavily on service expert and manufacturing expert, particularly in the cable realm. And while its major value proposition has traditionally been convenience and proximity to companies in the San Diego market, it is now seeing customers from all across the globe.



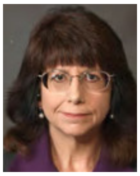
SAI works closely with customers to understand their requirements and provide the solution that best aligns with that customer's needs.

"We try to be as flexible as possible with our customers. The traditional EMS model has a lot of structure that limits the ability of a customer to tailor a solution to exactly what they need. We will do labor-only projects if needed. We also let customers be an integral part of the production team and structure the project in ways that incorporate their team's in-house knowledge of the build," said Alexandra Topp, SAI's sales and marketing manager.

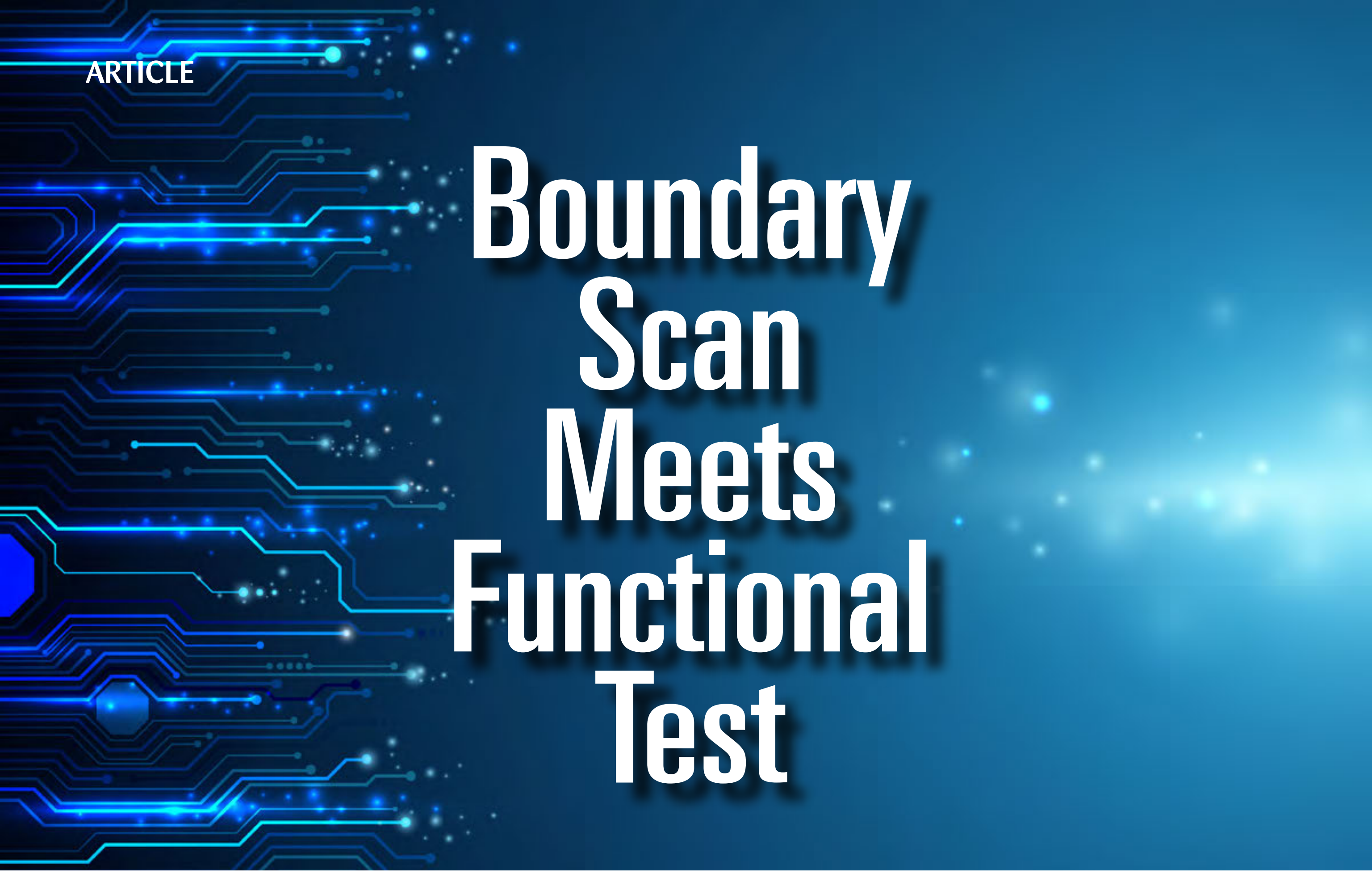
From a marketing perspective, the company does little marketing outside of trade shows.

It has a salesforce of one. Much of its box build business growth comes from existing customers expanding their programs. New projects typically come from customer and supplier referrals. The high service, one-stop shop formula seems to be working, driving record sales and keeping the factory near or at capacity.

The common element in each of these approaches is a strong understanding of target market customer needs, partnerships with key elements of the supply chain and an ability to adapt service needs to target market preferences. In each case, these companies are an extension of their customers' manufacturing organization, and in a few cases, their customers' only manufacturing organization. In some cases, they are also an extension of their customers' engineering teams or logistics organizations. In all cases, they are helping their customers get product to end markets faster, better and cheaper than if the project had remained in-house. **SMT**



Susan Mucha is the president of Powell-Mucha Consulting Inc. To reach Mucha, click here.



ARTICLE

Boundary Scan Meets Functional Test

by Thomas Wenzel and Enrico Zimmermann
GOEPEL ELECTRONIC

One of the most serious problems in testing is the continuous decline in physical access. Across a range of markets, users unanimously report slumps of up to 20% within the last five years, which inevitably leads to discussions on test methods that can be used in future. JTAG boundary scan has gained a good reputation in this context, but this process alone cannot provide a solution to all problems either, and partners are needed. The main focus of interest is the functional test. This report analyses some fundamental aspects of this combination and introduces new technological solution approaches for embedded functional tests, as well as their practical implementation.

The Interplay Between Structure and Function

No matter which of the common electrical testing strategies are examined, they all fall into two basic categories—structure test and functional test. According to table 1, both adhere to completely different principles to trigger and diagnose a fault. While the structure test attempts to test the design through access on the element level, the functional test aims to test connected components.

However, the success of the structure test is based on securing the required access to the elements, and techniques such as ICT, MDA or FPT are becoming less and less useful in this context. The functional test on the other hand typically uses the native connections of a Unit Under Test (UUT) as the basis for access, thereby circumventing this problem.

As a result, it is no surprise that users are again increasingly focusing on this technology. The so-called cluster test is a subgroup of the functional test. Cluster tests are basically the result of insufficient access, as they include the testing of a partial circuit via the test points that are available at the edge of the partition. The logical consequence of diminishing test access is ever increasing cluster size, as far as the complete loss of meaningful clustering.

The question if the structure test makes the functional test redundant or vice versa, is also a frequent, hotly debated topic. The main reason behind this is the objective to test as little

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Test category	Basic operating principle	Typical equipment
Structural test	- Structural integrity test of one or several independent connections or signal paths - Measurement of individually isolated components - Fault diagnosis through the evaluation of dedicated vectors, or measurements	- Manufacturing defect analyzer - Flying prober - In-circuit tester - JTAG boundary scan
Functional test	- Test of the overall circuit, or a partial circuit (cluster) with a series of vectors or analog waveforms - Fault diagnosis through the evaluation of the response vectors, or waveforms	- Functional tester - Cluster tester - Emulation tester - Parent machine tester

Table 1: Characterization of fundamental test principles.

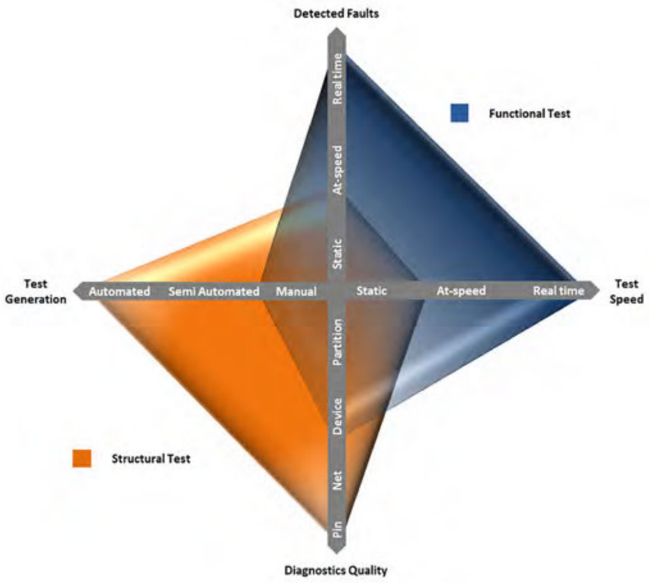


Figure 1: Performance potential of selected structural test and function test properties.

as possible due to costs, and where testing cannot be avoided, it would be beneficial to at least agree on one primary method.

Several fundamental factors play a role in answering this question. These are discussed in the following.

A structure test can prove that the integrity of the circuit is present on an electronic physical level. The tests are typically of a mainly static nature, partially at-speed. It can also provide precise fault diagnostics in this context. It does not, however, test any functions and is therefore not able to detect a malfunction of the circuit in operating mode. This limits the fault coverage, when measured against the entire range of possible faults. Thus, structure tests are ideal as indirect process sensors, but by no means replace the functional test.

The functional test on the other hand provides high fault coverage in principle, and can also detect anomalies in operating mode, provided it is carried out with the corresponding dynamic. However, the test patterns used also exert a very strong influence on the outcome, as faults must be stimulated in order to be detected. The test can also detect structural faults if they effect the function, but the fault diagnoses are very unclear. If structural faults are not stimulated by functions, this generally leads to fault slippage with potentially serious consequences at a later stage. This also affects parametric faults on individual components, open pins with floating signal level, missing pull resistors or incorrectly mounted decoupling capacitors, to list but a few of the problems. For this reason, functional tests in production are particularly suitable for providing basic proof that the selected operation modes are fulfilled, such as those carried out in the end-of-line (EoL) test. However, they are by no means a replacement for the structure test.

A representation of the trends of the basic factors, as shown in Figure 1, provides a tangible display of the strengths and weaknesses of both

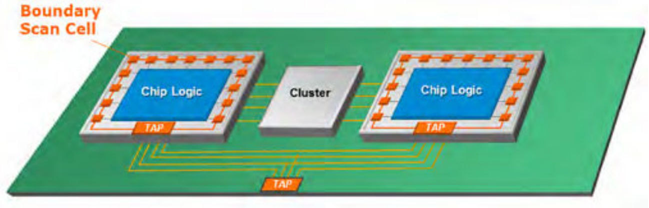


Figure 2: Functional cluster test per boundary scan.

strategies. It clearly demonstrates that there is an excellent synergy between the structure test and the functional test, and they should never be considered as alternatives. Instead, the right way to unlock the full potential of this duo lies in combining them.

Standardized Variety

Although JTAG boundary scan has now been in existence for over 25 years as the IEEE1149.1 standard[1], cyclical extensions such as IEEE1149.6[2] and new releases[3] have continuously maintained it at the level of technological requirements, keeping it up-to-date. In the context of the topic under discussion, particular attention should, however, be paid to some of the properties:

- The standard was designed as a successor of the digital, static in-circuit tests, but it is difficult or impossible to use it to cover areas that go beyond this
- JTAG boundary scan only defines digital test points inside chips, which can be used both for structure tests and static functional tests
- Because the inner circuit core is quasi-isolated, the basic separation between function and structure is achieved in an ingenious way
- At the same time, the high quality of the diagnosis is also ensured, because the test vector generation can be highly automated. Here, the process demonstrates an almost unbeatable level of efficiency
- Fault coverage can be predicted in advance (i.e. designs can be optimized while they are still testable, before a physical prototype is built)

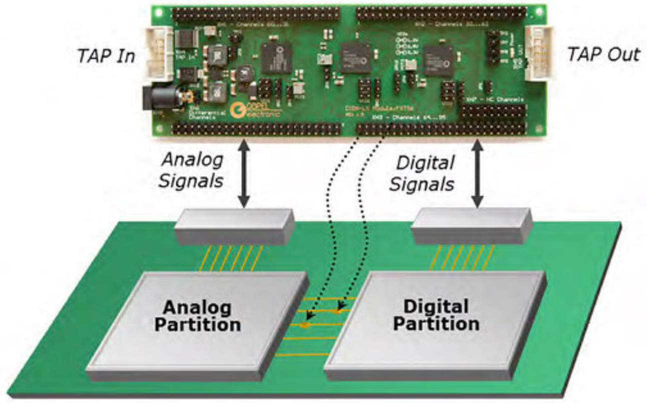


Figure 3: Functional test via external CION LX I/O module with mixed-signal channels.

- In the digital area, fault coverage is primarily restricted by the limited vector repetition rate. As a result, it cannot detect dynamic faults

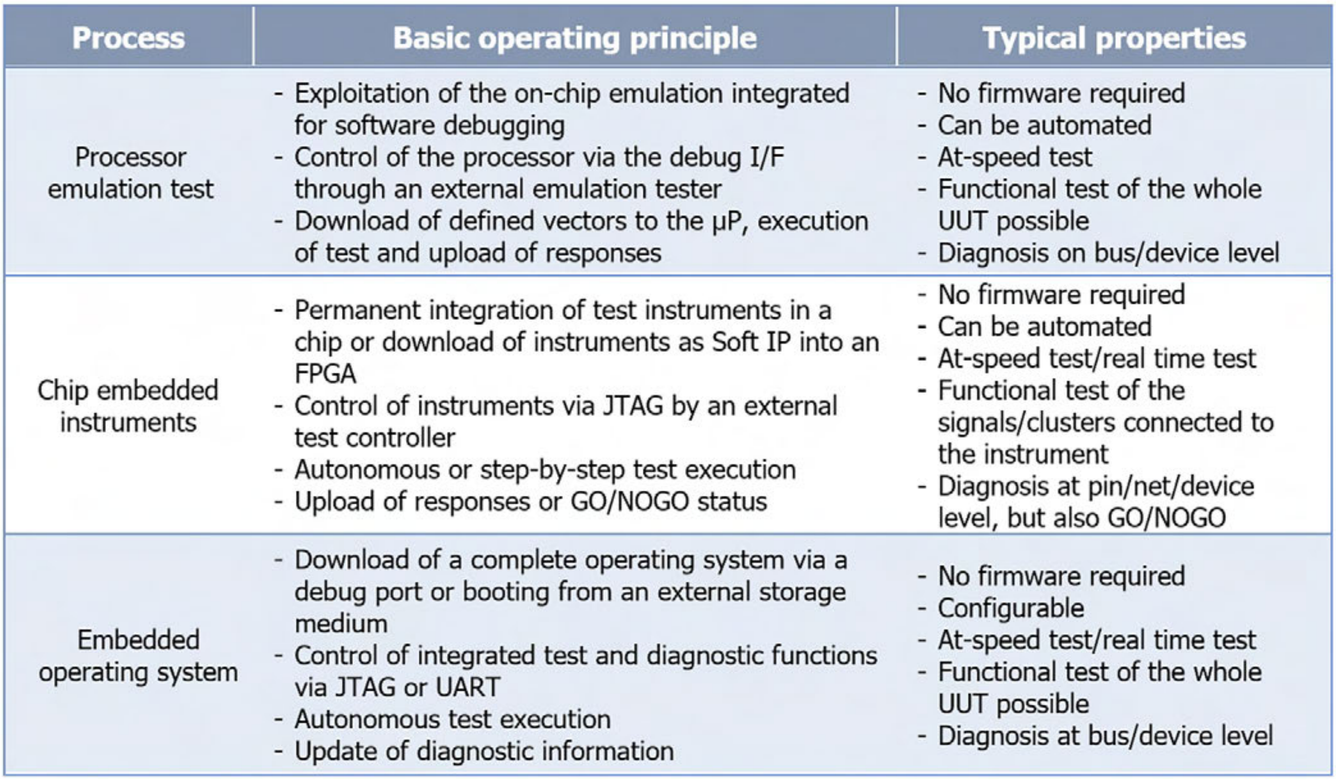
Boundary scan has established itself as a logical solution, primarily in complex chips such as processors, FPGA, DSP and ASIC. A singe boundary scan circuit can provide excellent services during testing[4] and is also a useful addition as a process sensor[5] in conjunction with inspection technologies.

The cluster test provides a method for using boundary scan as a functional test (Figure 2).

There are many varieties of cluster tests. For more details, please see the literature[4].

External I/O modules can also be used (Figure 3), besides such embedded applications. They can easily control the static functions of an entire circuit, using the native connectors or the test points on the UUT. If the board contains additional boundary scan circuits, it is often possible to carry out deep structural tests of connectors or other partitions that cannot be scanned. The boundary scan principle remains the same throughout, as the external modules are essentially added to the natural circuit.

Such a scenario can even be used to test analog functions, or clusters. However, this is contingent on the I/O modules being equipped with mixed-signal channels, as is the case, for example, with the CION-LX I/O module by Goepel electronic[6]. In summary, boundary scan innate-



Process	Basic operating principle	Typical properties
Processor emulation test	- Exploitation of the on-chip emulation integrated for software debugging - Control of the processor via the debug I/F through an external emulation tester - Download of defined vectors to the µP, execution of test and upload of responses	- No firmware required - Can be automated - At-speed test - Functional test of the whole UUT possible - Diagnosis on bus/device level
Chip embedded instruments	- Permanent integration of test instruments in a chip or download of instruments as Soft IP into an FPGA - Control of instruments via JTAG by an external test controller - Autonomous or step-by-step test execution - Upload of responses or GO/NOGO status	- No firmware required - Can be automated - At-speed test/real time test - Functional test of the signals/clusters connected to the instrument - Diagnosis at pin/net/device level, but also GO/NOGO
Embedded operating system	- Download of a complete operating system via a debug port or booting from an external storage medium - Control of integrated test and diagnostic functions via JTAG or UART - Autonomous test execution - Update of diagnostic information	- No firmware required - Configurable - At-speed test/real time test - Functional test of the whole UUT possible - Diagnosis at bus/device level

Table 2: Functional process for embedded text access.

ly offers several functional test options already, however, these are limited to the static level.

Turning the Functional Test Environment Upside Down

When the term functional test is used in production, it is nearly always first associated with the traditional version—external tester is connected to the UUT via the native connector, runs through its sequences and evaluates the results. But according to table 2, there are other methods that are of interest, which are specially focused on the embedded test and have many innovative features.

All these processes primarily have a single goal—to relieve the user of the need for coding their own test routines by providing preconfigured solutions, and to thereby ensure a much higher efficiency and predictability of the entire testing process. The actual test instruments are transferred to the inside of the UUT as part of this, and the term Embedded System Access is used. According to Figure 4, this has far-reaching consequences.

The most obvious change is that is the transformation of tester parts, which started with boundary scan, has increased further and now also includes the test executor. In other words, even more use is made of the elements defined by the design. This also results in a simultaneous reduction of external effort.

The emulation test uses the native on-board processor as a test executor and by doing so, can reach all the elements connected to the core. Typically, there is also a natural partitioning of the entire circuit through the system bus, which makes it possible to automate the generation process based on models.

This principle also facilitates the fast programming of flash modules. In many cases, this so-called core assisted programming offers much higher performance than boundary scan.

During an emulation test, the processor is generally supplied with vectors from an external source, applies them in a natural bus cycle, reads out data and transfers them back to the parent control unit for evaluation. For this reason, it is only possible to carry out an at-speed

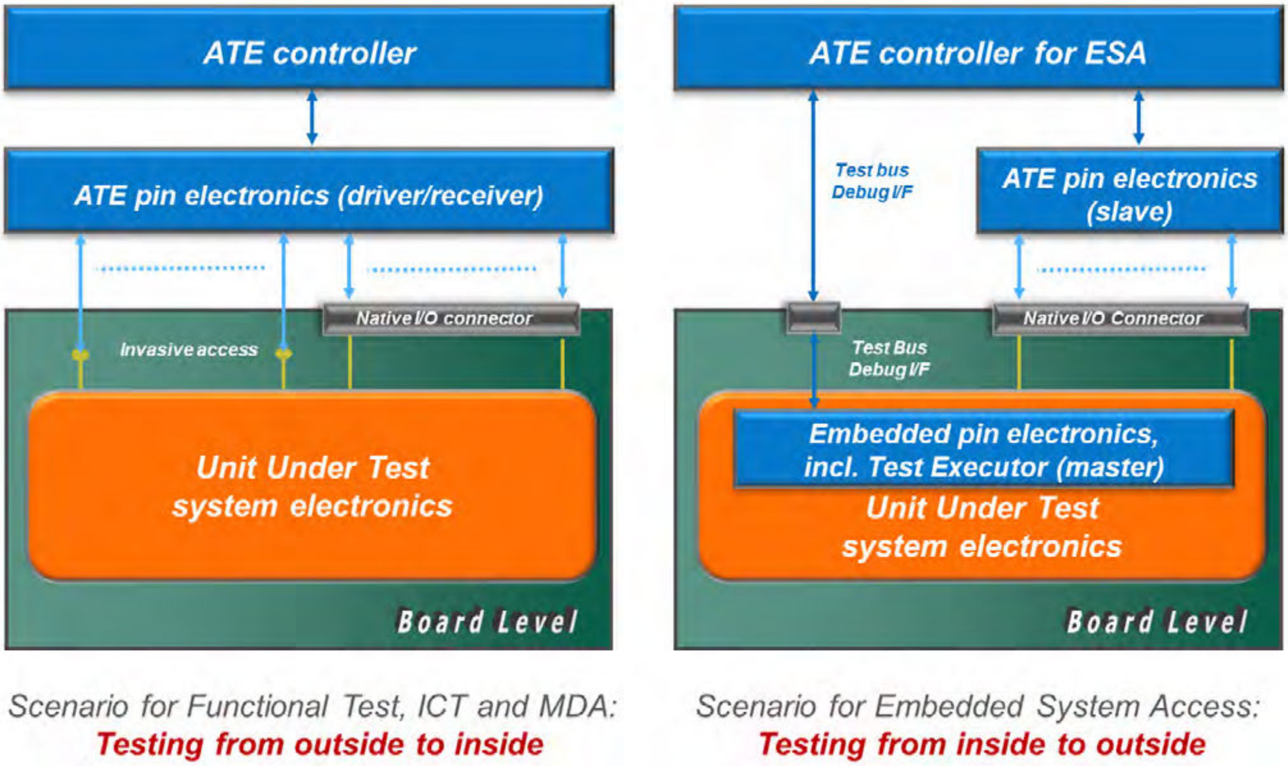

ATE controller
ATE pin electronics (driver/receiver)
Invasive access
Native I/O connector
Unit Under Test system electronics
Board Level
Scenario for Functional Test, ICT and MDA:
Testing from outside to inside
ATE controller for ESA
Test bus Debug I/F
ATE pin electronics (slave)
Native I/O Connector
Test Bus Debug I/F
Embedded pin electronics, incl. Test Executor (master)
Unit Under Test system electronics
Board Level
Scenario for Embedded System Access:
Testing from inside to outside

Figure 4: Paradigm change in testing through embedded system access.

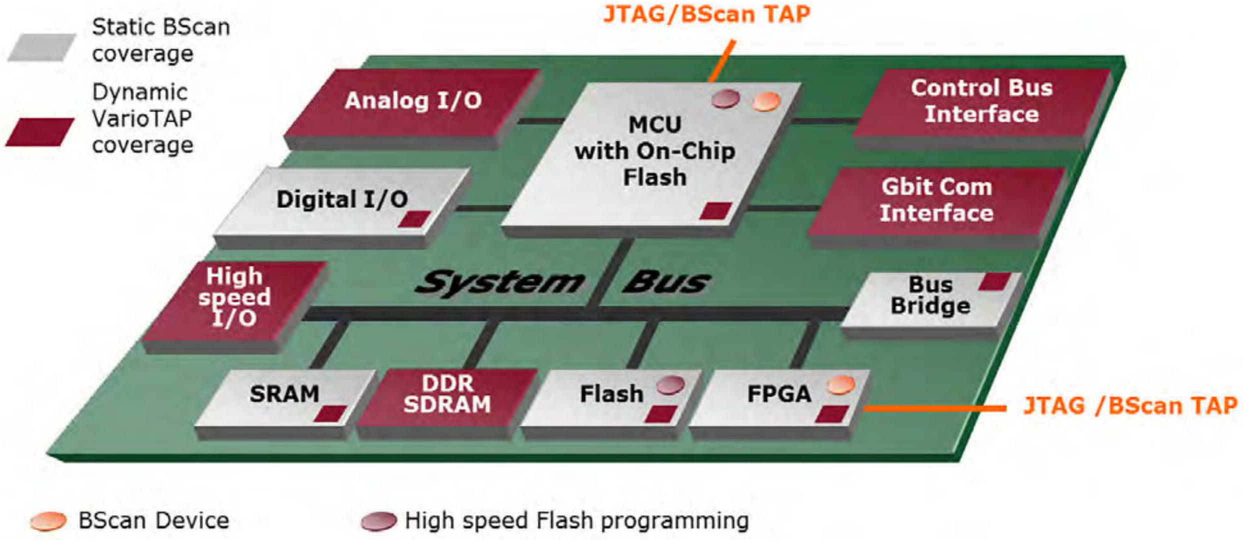

Static BScan coverage
Dynamic VarioTAP coverage
JTAG/BScan TAP
Analog I/O
MCU with On-Chip Flash
Control Bus Interface
Digital I/O
Gbit Com Interface
High speed I/O
System Bus
Bus Bridge
SRAM
DDR SDRAM
Flash
FPGA
JTAG /BScan TAP
BScan Device
High speed Flash programming

Figure 5: Partition-based test using processor emulation.

test. Recent developments, however, also facilitate real time processing of emulation scripts. An example is the VarioTAP technology[7] with RT extension, which was developed by Goepel electronic.

Chip embedded instruments have already been used successfully in the area of circuit testing for many years. Special IPs are integrated into the design as part of this. This infrastructure has now also been opened up for the func-

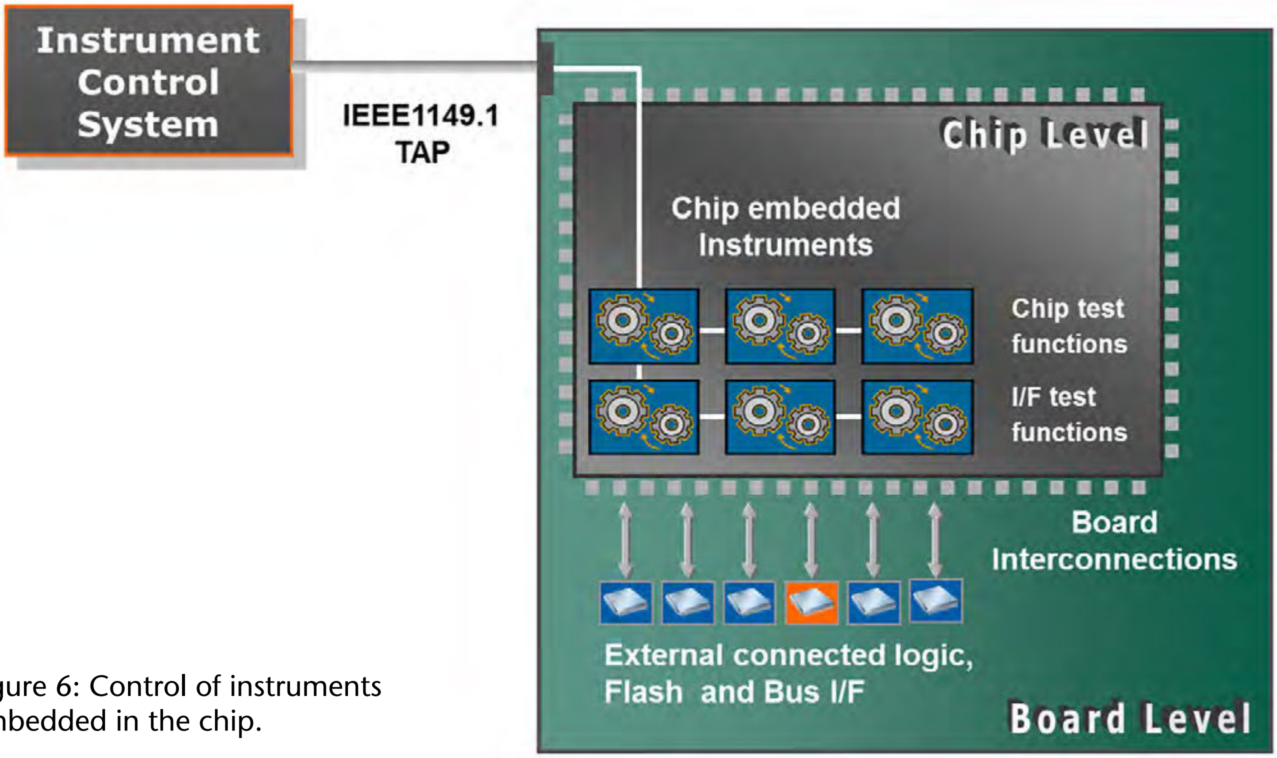
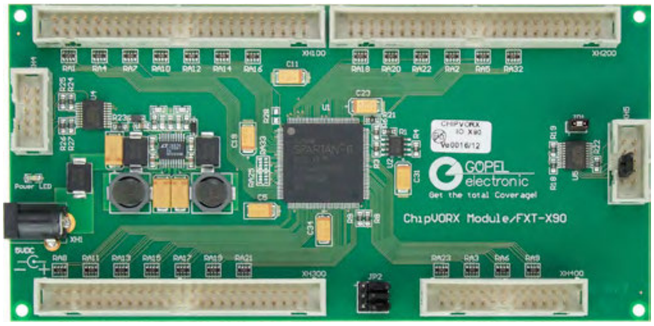

Instrument Control System
IEEE1149.1 TAP
Chip Level
Chip embedded Instruments
Chip test functions
I/F test functions
Board Interconnections
External connected logic, Flash and Bus I/F
Board Level

Figure 6: Control of instruments embedded in the chip.

tional board test by the latest standards, such as IEEE1687[8] and IEEE1149.1-2013[3]. The principle is actually quite easy to understand and is based on the use of JTAG as a transfer medium (Figure 6).

In practice, there are no limits to the variety of such instruments. The use of FPGA-based instruments is of particular interest in this context. They are temporarily loaded into the target as Soft IP and can be individually customized to the test task. Examples of such instruments include frequency meters, memory testers, bit error rate testers, LAN testers, flash programmers and logic analyzers, to name but a few. In the case of FPGAs, however, there is always the problem that the IP must be individually customized to the corresponding pins of the circuit to be tested. But recent developments such as the ChipVORX technology[9] developed by Goepel electronic even automate this IP to pin contact without requiring a recompilation of the design.

The use of external I/O modules with FPGA (Figure 7) is also of interest in this context. They directly expand the use of FPGA embedded instruments for the functional board test through access to the natural connectors.


GOPEL electronic
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ChipVORX Module/FXT-X90

Figure 7: ChipVORX I/O module by Goepel electronic with on-board FPGA.

The third process previously listed in Table 2 is the embedded operating system for testing and diagnosis. Here too, the processor is used as a test executor, however this time it is controlled by a complete test and diagnostic software, such as JEDOS (Figure 8).

The software also includes already preconfigured test vectors, and diagnostic algorithms, which are basically executed in real time. The vector download is completely eliminated. This is the final step towards a fully integrated ATE for functional testing.

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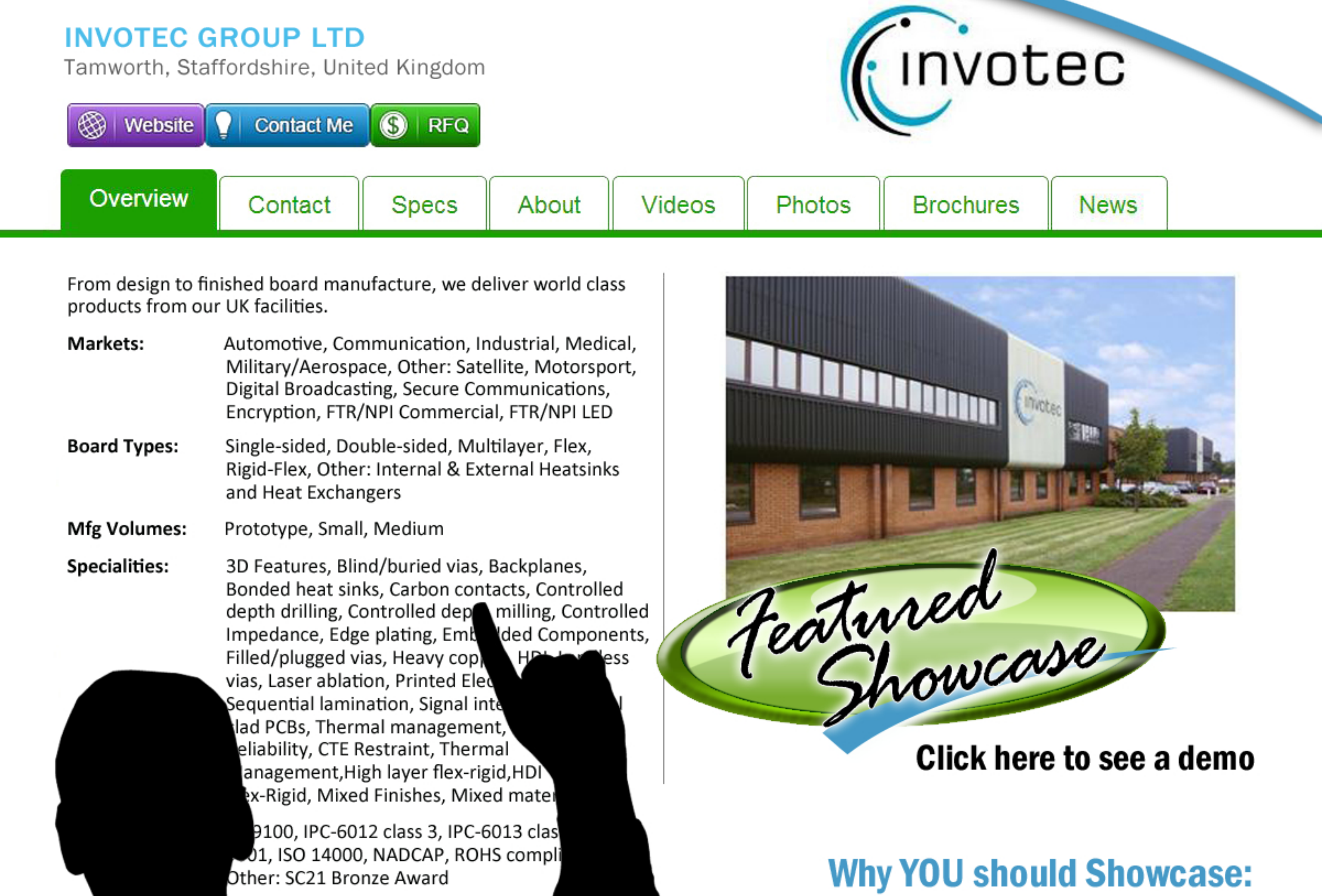

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vias, Laser ablation, Printed Ele
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eliability, CTE Restraint, Thermal
anagement,High layer flex-rigid,HDI
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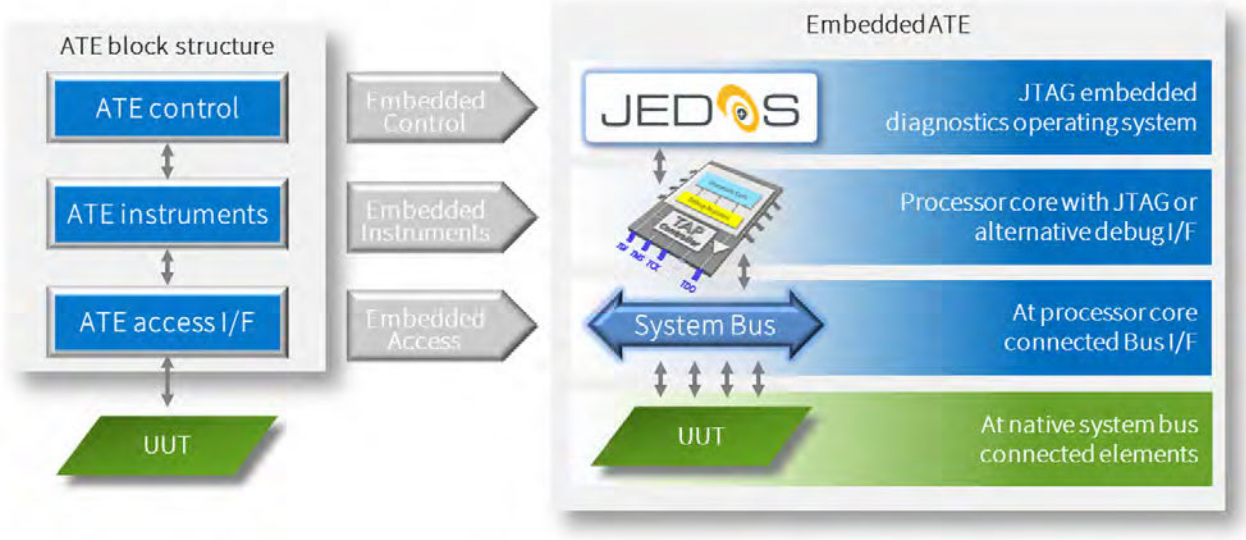
ATE block structure
ATE control
ATE instruments
ATE access I/F
UUT
Embedded Control
Embedded Instruments
Embedded Access
Embedded ATE
JEDOS
JTAG embedded diagnostics operating system
Processor core with JTAG or alternative debug I/F
TAP Controller
System Bus
At processor core connected Bus I/F
UUT
At native system bus connected elements

Figure 8: Embedding of a complete ATE through a test and diagnostic system.

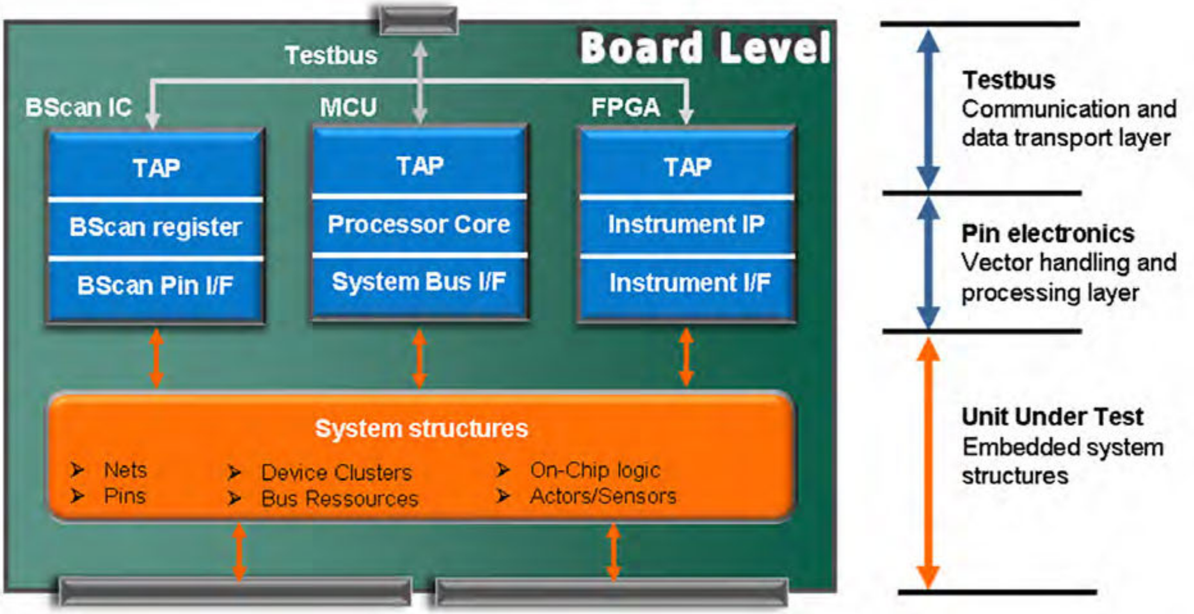
Board Level
Testbus
BScan IC
MCU
FPGA
TAP
BScan register
BScan Pin I/F
TAP
Processor Core
System Bus I/F
TAP
Instrument IP
Instrument I/F
System structures
Nets
Pins
Device Clusters
Bus Ressources
On-Chip logic
Actors/Sensors
Testbus
Communication and data transport layer
Pin electronics
Vector handling and processing layer
Unit Under Test
Embedded system structures

Figure 9: Uniform JTAG control of boundary scan, FPGA embedded control instruments and processor emulation.

Work Separately, but Test Together

Even though the above-mentioned functional test processes already offer many new possibilities in themselves, the full potential is only unlocked when they are combined in a meaningful way. The JTAG processes have the advantage that they all use the same infrastructure (Figure 9). It is easy to create an interactive mix of structure and functional tests based on corresponding multifunctional system solutions.

Complete desktop JTAG testers, such as the JULIET system [10], are also available for production requirements (Figure 10). With integrated I/O modules with a wide range of functional test instruments and pin adaptation, the

JULIET Series2

Figure 10: Combination tester for the synchronized use of external tools and all embedded system access technologies on one platform.

Figure 11: PXI/PXIe based combination tester, incl. MDA instrumentation.

device offers excellent flexibility for comprehensive testing of prototypes, for low to mid-range production volumes, as well as for repairs.

In addition, there are also very powerful platforms for open, modular instrumentation of traditional functional testers, which can be very well configured towards structure testing with the corresponding components. One of the leading integration platforms in this respect is PXI, or PXI Express (Figure 11).

The advantage of such architectures is the availability of a very high number of multi-vendor modules for almost all application and service areas. It is possible to implement flexible system concepts based on open software packages such as LabVIEW or TestStand. The JTAG components are integrated on corresponding hardware/software plug-ins. There are also software solutions, which make it possible for the functional tester to have full control of the JTAG hardware and provide an interactive vector interface. This transparent slave mode also makes it possible, for example, to implement cluster tests. A whole series of JTAG boundary scan controllers are available for the integration of embedded system access technologies, all in the natural PXI/PXIe format and implemented as a single slot instrument.

The same principle of plug-in JTAG boundary scan components is also used for the combination with invasive testers such as ICT, FPT and MDA components. Here too, it is possible and useful to use interactive procedures to increase fault coverage.

Summary and Conclusions

The ever-decreasing test access is forcing a rethink of the test philosophy for modern designs. Embedded structural tests, such as JTAG boundary scan in combination with innovative, embedded functional test methods offer new approaches in this regard, up to and including embedded ATE. The focus is on improving efficiency in test generation, while increasing test speed at the same time. This also makes it possible to maximize test coverage, as well as diagnostic quality. The use of external I/O modules with FPGA offers additional options to easily improve test quality.

Mature and powerful platforms are available for the mix of various strategies. This also applies to the combination with traditional, external test instruments.

Users now have access to an extensive range of technical solutions. But the right decision must be made individually, based on an exact analysis of the product properties, process parameters, and last but not least, of the cost conditions. **SMT**

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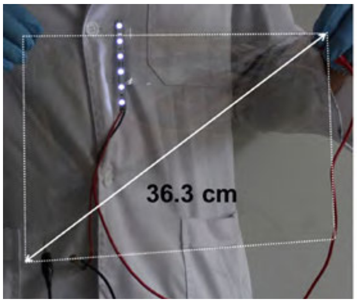
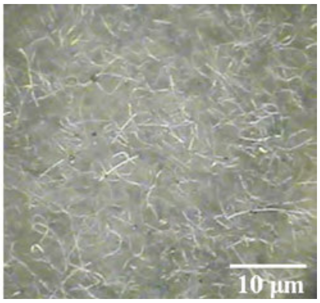
Thomas Wenzel is vice president at Goepel electronic and responsible for the Boundary Scan division.

Enrico Zimmermann is general sales manager for JTAG/boundary scan and inspection solutions at Goepel electronic.

Supersonic Spray Yields New Nanomaterial for Bendable, Wearable Electronics





A new, ultrathin film that is both transparent and highly conductive to electric current has been produced by a cheap and simple method devised by an international team of nanomaterials researchers from the University of Illinois at Chicago and Korea University.

The film is bendable and stretchable, offering potential applications in roll-up touchscreen displays, wearable electronics, and flexible solar cells. The results are reported in Advanced Functional Materials.

The new film is made of fused silver nanowires, and is produced by spraying the nanowire particles through a tiny jet nozzle at supersonic speed. The result is a film with nearly the electrical conductivity of silver-plate—and the transparency of glass, says senior author Alexander Yarin, UIC Distinguished Professor of Mechanical Engineering.

The researchers suspended the nanowire particles in water and propelled them by air through a de Laval nozzle, which has the same geometry as a jet engine, but is only a few millimeters in diameter. When the nanowires strike the surface they are being applied to at supersonic speed, they fuse together, as their kinetic energy is converted to heat.

The researchers applied the nanowires to flexible plastic films and to three-dimensional objects. The transparent flexible film can be bent repeatedly and stretched to seven times its original length and still work, said Sam Yoon, the corresponding author of the study and a professor of mechanical engineering at Korea University.

Earlier this year, Yarin and Yoon and their colleagues produced a transparent conducting film by electroplating a mat of tangled nanofiber with copper. Compared to that film, the self-fused silver nanowire film offers better scalability and production rate.

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THE TIME HAS COME FOR JET PRINTING

by Stephen Las Marias
I-CONNECT007

At the recent NEPCON South China trade show in Shenzhen, I spoke with Thomas Bredin, area sales manager at Mycronic, about the latest developments in jet printing technology, and their recent acquisition of Shenzhen Axxon Automation Co. Ltd—one of the leading providers of dispensing equipment for the electronics manufacturing and SMT industry in China.

***Stephen Las Marias:** So far, Thomas, how has business been for Mycronic this year?*

Thomas Bredin: From a global perspective, it's been up to our expectations. Here in China, we have seen a better performance than last year, but of course, expectation was also higher. Even here, we are on track with our forecast and we see a lot of interest with the jet printers. Hopefully we should be able to over-shoot expectations this year.

***Las Marias:** What are the challenges you're seeing?*

Bredin: Of course, not being one of the big players, it's still a matter of awareness. Get our technology well understood, especially with the jet printer. Pick-and-place is fairly easy, but the jet printer part, we still have a lot of marketing and transferring of the machine's capabilities to make sure that everyone knows what the machine can do and really understands the differences between this touchless printing technology compared to traditional screen printing or dispensing.

Also now we have this dispenser add-on to the MY600 open up to even more opportunities, and that, of course, for us is also a challenge to also to reach out with this message, that the jet printer is not only a solder-based printer but also a jet dispenser. That's why we're adding the second head.

***Las Marias:** Are you seeing a higher level of interest for this technology?*

Bredin: Absolutely. It can be utilized in so many different ways. If, for technology reasons, there are volume variances needs within the board, then it is an obvious choice, but we see more and more interest in the add-on area, where stencils have to become thinner and thinner, but there is still a corner on the board where you need more volume than what you get from the thin sensors. Actually, during these first two days of exhibition, we have had a lot of interest and a lot of requests. Because it seems like people or potential customers are becoming

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aware of this possibility to do the second-phase process step to make sure that they get lots of speed, but with adding on the jet printer, you also will get the ease and the quality of the board.

Las Marias: ***Especially now that the trend is for smaller and smaller, more compact, high-density boards or devices, right?***

Thomas Bredin

Bredin: Absolutely. Also with the broadband of boards, so that there is the all-in-one. Even the small hand-held, let's say, cell phone boards, they need these RFCs. Even within those very dense boards and the small components, on a few of the parts you still need a lot more volume than what you can achieve, typically, with a screen printer, within the same print cycle. I would say we're fortunate in that. Also, some local big players in the smartphone segment are also investigating how they can utilize this jet printing technology.

Las Marias: ***That sounds good for the company.***

Bredin: Absolutely. We are excited to make sure that we can explore all opportunities.

Las Marias: ***How is the China market for Mycronic, in general?***

Bredin: It is the market where Mycronic is growing the most. We have been active in North America and Europe for a very long time, and those markets are a bit more stable. From our perspective, China is where we can really see a huge growth in the future with both our current portfolio machines, what we have, and what is also being developed, in order to meet the demands from the Chinese consumer electronics producers, where we historically have not been a big player. We have things in the roadmap that are trying to get that changed.

Las Marias: ***Recently, Mycronic acquired Shenzhen Axxon. What do you think is the rationale behind this acquisition?***

Bredin: The rationale is, of course, that it's a very good and a local dispensing company, which has a very interesting product portfolio that compliments what Mycronic already has. They also have a very strong presence in China, where we can also learn from each other and utilize the synergies between these two companies who have huge potential, both to help Axxon grow in their segment, but obviously also for Mycronic to have an even stronger local presence in China.

Las Marias: ***What trends are you seeing in the market?***

Bredin: One of the trends that's been going on for almost forever is that things are getting smaller and smaller, but also, as we discussed earlier, one trend is that everyone is concerned about or interested in is Industry 4.0, and the smart factory has become very obvious that everyone is trying to target that part of the customer's mind. Everyone would like the factory to run less dependent on people. I guess also that's been a trend that's been going on for a while with automation.

We hear a lot of our customers, and potential customers, talking about, "How can we help them to get the same number of boards or more being done, with less people involved?" Labor costs being one thing, but also the quality that comes with it. The risk of quality is that the more people you involve, the more added risk of something being done not according to procedure. I think that is also a trend that's been going for a while. You will also see in this exhibition a lot of small booths with robotic arms moving things back and forward, and not long ago, the obvious choice was to have people doing that.

Las Marias: ***Now there's like a proliferation of robotics in the industry. One of the equipment you are exhibiting here is the SMD Tower. Tell us more about that.***

Bredin: The tower is an automatic warehouse, you could say, with climate control inside so that humidity and temperature is under control, and every reel is stored in a random but known location. The owner can keep track of where they're stored, so you cannot misplace a reel and not find it again. It's also, again, the smart way for making sure that we use the oldest reel first, or that if there are multiple recent stock, that you get the reels out with the sufficient quantity to run the batch of boards that we have scheduled. Also it will automatic replenish while running, so that you get the components in time or before you need it, or just when you need it, so that you don't run the risk that your expensive assembly line is standing still, waiting for a single reel. In the worst case, it's the only one you have, and that one was misplaced by someone working in the stores late last night.

Las Marias:* *Earlier on, you discussed one of the new developments in your equipment, which reduces the change-over time while trying to maximize yield. Can elaborate that?

Bredin: It is a way to automatically start both the jet printer and the pick-and-place by externally reading the barcode of the board that's coming and translate this into the correct job for the program for the machines in order to avoid that you run, let's say, the wrong revision of the board. It's also a way to achieve high efficiency, even though there's a very high mix. You can actually run a batch size without any stoppages and without the risk of selecting the wrong program.

We see more and more interest that companies would like to have a huge feeding capacity to be able to do family kits or do a batch of jobs and load them in one setting in the pick-and-place part of the line, and then are able to achieve full extension with them. The jet printer is a really nice tool, where you don't need to change the stencil, and with this automatic start function, you won't even need to be at the line. The line will change jobs according to what board is coming, regardless of batch-size or sequence of boards, which also goes well in hand with this Industry 4.0 strength.

Las Marias:* *Is there anything else you would like to talk about?

Bredin: We haven't talked a lot about the jet dispensing capabilities in the MY600 platform. We recently released two new versions of the MY600; the jet dispenser JD and the JX, which is a machine where you can interchange between the dispensing head and the jet printing head, where we have a cooperation with that one jet, so we have integrated, where there's a possibility now to have a one jet head into the machine. One jet has several hundreds of fluids that it's been qualified to dispense.

We're in the beginning of this development, so to say, at the moment. The most common is to use SMA, the use of a glue, but it's also the possibilities for conducting glue or for residual epoxy and the underfill. The jet printing on the MY600 platform is becoming more versatile and there are more things you can do. Going back to the question you had earlier about Axxon, they also have their own dispenser heads and we might, if it makes sense, integrate some of their heads into the MY600 platform. The platform itself is really a state-of-the-art, in terms of speed, repeatability and accuracy.

Las Marias:* *Are there any other new technologies in the pipeline at Mycronic?

Bredin: There are no ground-breaking news that is supposed to be released, but of course, it's a constant development, and the communication between existing customers and hopefully future customers here at exhibitions will, of course, give me a lot of feedback that I can take back to headquarters and see whether we can implement some of these customer requirements. R&D is always busy. From time to time, we do release fantastic new machines and features, but the roadmap is also obviously changing for everyone. To be successful in this industry, you as a supplier need to be smart. You need to be able to listen to customers' needs and adapt to them with a reasonable response time, because the needs are changing, and clients, including myself, don't like delays or don't like not getting what you expected.

Las Marias:* *Thank you very much again for your time, Thomas.

Bredin: Thank you very much. **SMT**

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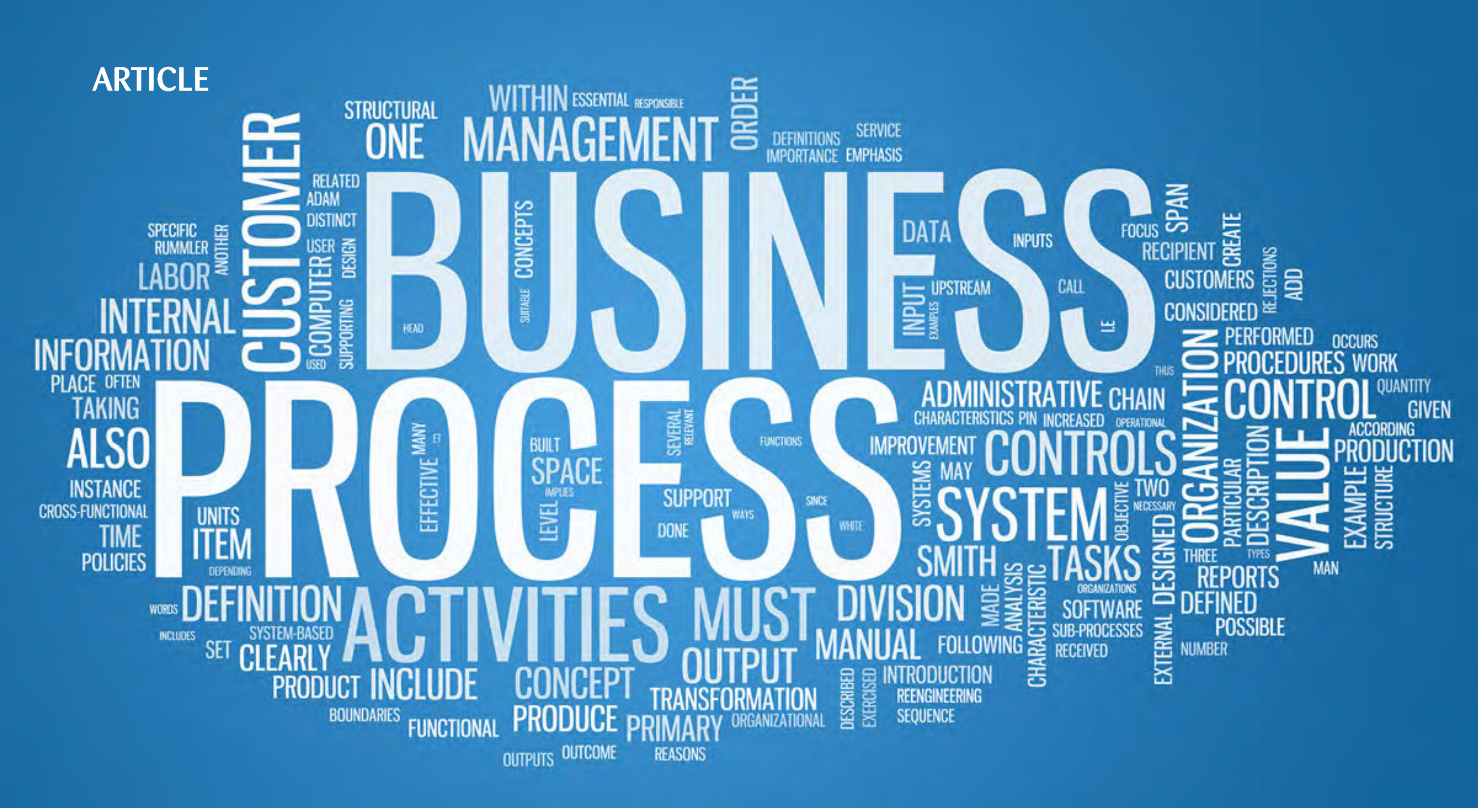
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The Business of Doing Good

by Frederick Blancas

INTEGRATED MICRO-ELECTRONICS INC.

This is the time of year when many people look back to what they have done so far to get a handle on goals for the coming year. Businesses also engage in the same year-end assessment, this time with greater focus on the things they have been doing right and how to improve on aspects that need more work.

For a growing number of businesses, the appraisal goes beyond financial and operational metrics, having gotten on board the sustainability agenda that is out to make the world a better and more equitable place. This 21st-Century ethos prioritizes 3Ps—profit (making money), people (generating employment and ensuring the welfare of workers and community), and the planet (ensuring responsible and sustainable products and operations).

As the United Nations Millennium Development Goals (MDGs), targeted for completion in 2015, gave way to the 17 Sustainable Development Goals (SDGs) in 2016, companies in many parts of the world have stepped up as game changers in the business and sustainability landscape, often with notable results.

They have also been proving to be the key to sustainability and its broader goals, given their products' attention to social and environmental issues that in many instances resolve sustainability challenges.

Filippo Veglio, a managing director of the World Business Council for Sustainable Development, said that while business may view the UN's SDG agenda as a cost rather than an economic opportunity, he noted that about 80% of CEOs believe that demonstrating a commitment to societal purpose is a business differentiator, while 87% of CEOs see that the SDGs provide an opportunity to rethink approaches to sustainable value creation.

Similarly, Richard Welford, chairman of CSR Asia, is convinced that the best way to achieve the SDGs "is through a model of shared value." This, he added, uses a virtuous cycle to maximize social and economic impact, unleashing greater innovation, value creation, and scale.

Samsung Electronics, a leading South Korean multinational electronics company, sets the bar for energy-efficient products and meets the high standards in energy regulations. Its products reduce power consumption and greenhouse gas (GHG) impacts generated in the use of these

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Mary (Missy) Cummings
Ph.D. in Systems Engineering,
Naval Officer, Military Pilot &
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products. The company's annual average power consumption improved by 47% from 2008 levels in eight major products: phones, notebook PCs, TVs, monitors, refrigerators, washing machines, air conditioners, and printers.

A recipient of Green Technology certification in Korea for products with high energy efficiency, Samsung has developed various energy-saving technologies, low-power SoC design LED TVs, software for the power-saving mode on PCs using a chipset motion mode control, and reduction of power consumption for the sleep mode on printers and multifunctional devices.

On the other hand, GE Healthcare, a subsidiary of General Electric (GE) that provides medical imaging and information technologies, medical diagnostics, patient monitoring systems, and other medical products and solutions, is well known for making available inexpensive medical devices for distribution in both emerging and developed communities.

Its Vivid T8 cardiovascular ultrasound device, for example, features quantitative features, stress echo and TEE capabilities in an affordable echo system. GE Healthcare has enhanced the reach of the Vivid T8 by combining the established cardiac imaging capabilities of GE Vivid systems with shared services performance of the company's Logiq systems. The Vivid T8 cardiovascular ultrasound system is rugged, reliable, robust and rich with features—and, more important, affordable and convenient.

GE Healthcare's Vscan, a handheld, pocket-size visualization tool powered by ultrasound technology, allows doctors a quick look inside their patients—immediately and non-invasively. By providing real-time black-and-white anatomic and color-coded blood-flow images at the touch of a button, Vscan is ideal for use in far-flung places with limited access to health care.

Integrated Micro-Electronics Inc. (IMI), a Filipino-owned global electronics manufacturing services (EMS) provider to key original equipment manufacturers (OEMs), has also been advocating shared value. IMI believes that maximizing the competitive value of solving social problems in new customers and markets, cost savings, talent retention, among others, will set it apart from the competition and redound to public good. Its work on car safety electronics, pollution reduction systems, home security devices, and medical diagnostic devices is part of the corporate vision to "be part of a global structure of products and services that will enhance and future-proof people's lives," according to IMI Chief Executive Officer Arthur Tan.

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Arthur Tan, CEO of IMI delivered a speech to the participants of Laguna Changemaker 2016.

Sustainability underpins IMI's innovation directions. At a recent innovation summit that brought together IMI and the United States Agency for International Development (USAID), through its Science, Technology, Research, and Innovation for Development (STRIDE) program, Tan said IMI cannot merely react to technological and market developments as they happen. "We have to be forward-looking and proactively innovate together with academe and other institutions to stay ahead of competition and find solutions to problems we all face."

The innovation summit promises to be the start of something big. Leveraging external funding and expertise, IMI can co-develop platforms that could improve the bottom line and rack up experience in technology development to accelerate capability build-up for its target markets.

IMI is getting behind value creation as well in its external CSR, which has gone beyond philanthropy and compliance. In early October, IMI, in cooperation with the British Council, Laguna Water Corp., Ayala Foundation, and Ayala Corp., ran "Laguna Changemaker 2016: Beyond CSR"—a social entrepreneurship boot camp for Laguna community-based enterprises. The five-day workshop was attended by 28 participants, consisting of a pair for each of the 14 participating social enterprises from the municipalities of Biñan, Alaminos, Bay, San Pablo, Santa Cruz, Kalayaan, and Majayjay.

Laguna Changemaker 2016 deployed the British Council's module based on its program "Active Citizens"—a social leadership training program that promotes multi-sectoral collaboration and community-led social development. The workshop brought together social entrepreneurs with different perspectives to learn from each other. Over the days they teased out their social mission—that is, to innovate, collaborate, and create shared value with a wide base of stakeholders.

For example, the pickle makers of Majayjay use organically grown vegetables in the preparation of healthy pickles as they provide livelihood and hope to poor women. The mushroom cultivators of Biñan deploy HIV patients to produce nutritious food for cancer and HIV patients as well as for the health-conscious. Bay's makers of processed fish products provide livelihood for families of overseas Filipino workers in hopes of eradicating a culture of dependence, while the garment manufacturers of Alaminos provide jobs and dignity to displaced and distressed overseas Filipino workers.

The Biñan garment subcontractors employ and empower members of the LGBT community and out-of-school youth. The bakers of Santa Cruz are persons with disabilities who make breads and pastries with nutritional benefits. The women of Pandin Lake in San Pablo protect and preserve the environment as they employ and empower women, allowing them to augment their family income.

To meet the ambitious UN SDGs, the world will need more market-led models that focus on the poorest on the planet, protect the environment, and ensure that the benefits of economic growth are more equitable. Thus, it is vital that the business community, with its power, assets, and economic heft, gets behind the SDGs.

Samsung, GE Healthcare, and IMI believe that making simple switches will not only help achieve the objectives of the goals around shared prosperity; these can also take the business to a new competitive edge.

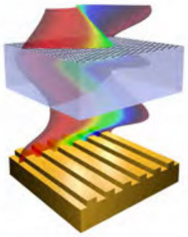
However, these multi-sectoral efforts play out, the goalposts set by the SDGs hope to leave the world a much better place in 2030. But as the real work begins, the world must remember to keep its eyes on the real prize: action. **SMT**

Frederick Blancas is the sustainability manager of Integrated Micro-Electronics Inc (IMI).

Designer Materials Create Miniature Computer Circuits

Scientists at The University of Manchester have discovered a new method of creating optoelectronic circuits using graphene and other 2D materials that are much smaller than their current counterparts.

Researchers led by Professor Sasha Grigorenko have shown it is possible to combine graphene, its sister material boron nitride and a nanoscale gold grating to create a new class of optical modulator. The proposed device can effectively process information using light much the same way as computers process information using electrons.



"This could pave the way for faster circuits, which is the main selling point of using light instead of electrical signals. But probably the bigger result from this work is that it could allow for a dramatic reduction in the size of these circuits," said Graphene NOWNANO PhD student Philip Thomas, who led the experimental work.

TOP TEN

Recent Highlights from SMT007

1 New Column: Millennials in Manufacturing

New columnist Davina McDonnell will be writing on the challenges millennials face in the workplace, and the unique dynamic between millennials and the industry veterans who manage them.

2 Mayim Bialik Chosen as Opening Keynote at IPC APEX EXPO 2017

Actress and neuroscientist Mayim Bialik has been selected through a vote of electronics industry professionals to present the opening keynote at IPC APEX EXPO on Tuesday, February 14, 2017 in San Diego.

3 Millennials in Manufacturing: A Long Term Career Prospect

The next millennial in this series is Alex Johnson, an associate engineer at Saline Lectronics and 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.

4 Is Your Manufacturing Facility Now the Weak Link?

If your manufacturing facility is the weakest link in your chain, all of the hard work put in beforehand—design, marketing, sales, purchasing—will have been wasted. This article looks at three signs your manufacturing facility could be dragging the rest of your company down, and highlights how outsourcing to an EMS provider can help.

5 MC Assembly Rolls Out Lean Workshops in its Three Facilities

Staff members of EMS firm MC Assembly recently underwent "Incito to Man" Lean Enterprise Simulation Workshops presented by the Incito Consulting Group.

6 Why Takt Time is Important, and How to Calculate It

A common misconception is that takt time relates to the overall build time, i.e., the number of man-hours put in to building a product. It doesn't; it relates to the time span required to build a product from start to finish to ensure the continual flow of finished products needed to satisfy customer demand.

7 Enics Expands Facility in Elva, Estonia

Enics' management has decided to carry out an expansion in the company's factory in Elva, Estonia. The expansion will enlarge the workspace by an additional 3,900 sqm. The total value of the investment during the upcoming years is planned to be over 5 million euros.

8 Kimball Electronics Reports 1Q FY2017 Net Sales of $226M

Kimball Electronics Inc. has announced net sales of $226.45 million for its first quarter ended September 30, 2016. Operating income was $12.8 million, and net income increased to $10.12 million.

9 Creation Technologies Launches FDA UDI Compliance Program

EMS firm Creation Technologies has announced its milestone achievement of the USA FDA Unique Device Identification (UDI) Compliance for Class I, Class II and Class III medical device labeling across its global operations.

10 Cemtrex Enters into Agreement to Acquire Electronics Manufacturer

Cemtrex Inc. has entered into an agreement to acquire a Silicon Valley-based EMS company focused on the semiconductor industry, as well as OEMs in the medical, industrial, telecommunications industries.

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SMT Magazine's full events calendar here.

ICT-UK Evening Seminar
December 1, 2016
Harrogate, North Yorkshire, UK

International Printed Circuit & Apex South China Fair (HKPCA)
December 7–9, 2016
Shenzhen, China

Rocky Mountain Expo & Tech Forum
January 19, 2017
Denver, Colorado, USA

DesignCon 2017
January 31–February 2, 2017
Santa Clara, California, USA

MD&M West
February 7–9, 2017
Anaheim, California, USA

IPC APEX EXPO 2017
February 14–15, 2017
San Diego, California, USA

China International PCB & Assembly Show (CPCA)
March 2017
Shanghai, China

The 14th Electronic Circuits World Convention
April 25–25, 2017
Goyang City, South Korea

IMPACT Washington D.C. 2017
May 1–3, 2017
Washington D.C., USA

Thailand PCB Expo 2017
May 11–13, 2017
Bangkok, Thailand

JPCA Show 2017
June 7–9, 2017
Tokyo, Japan

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Looking into the impact of plating and surface finishing in PCB assemblies

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