

SMT[®]

M A G A Z I N E

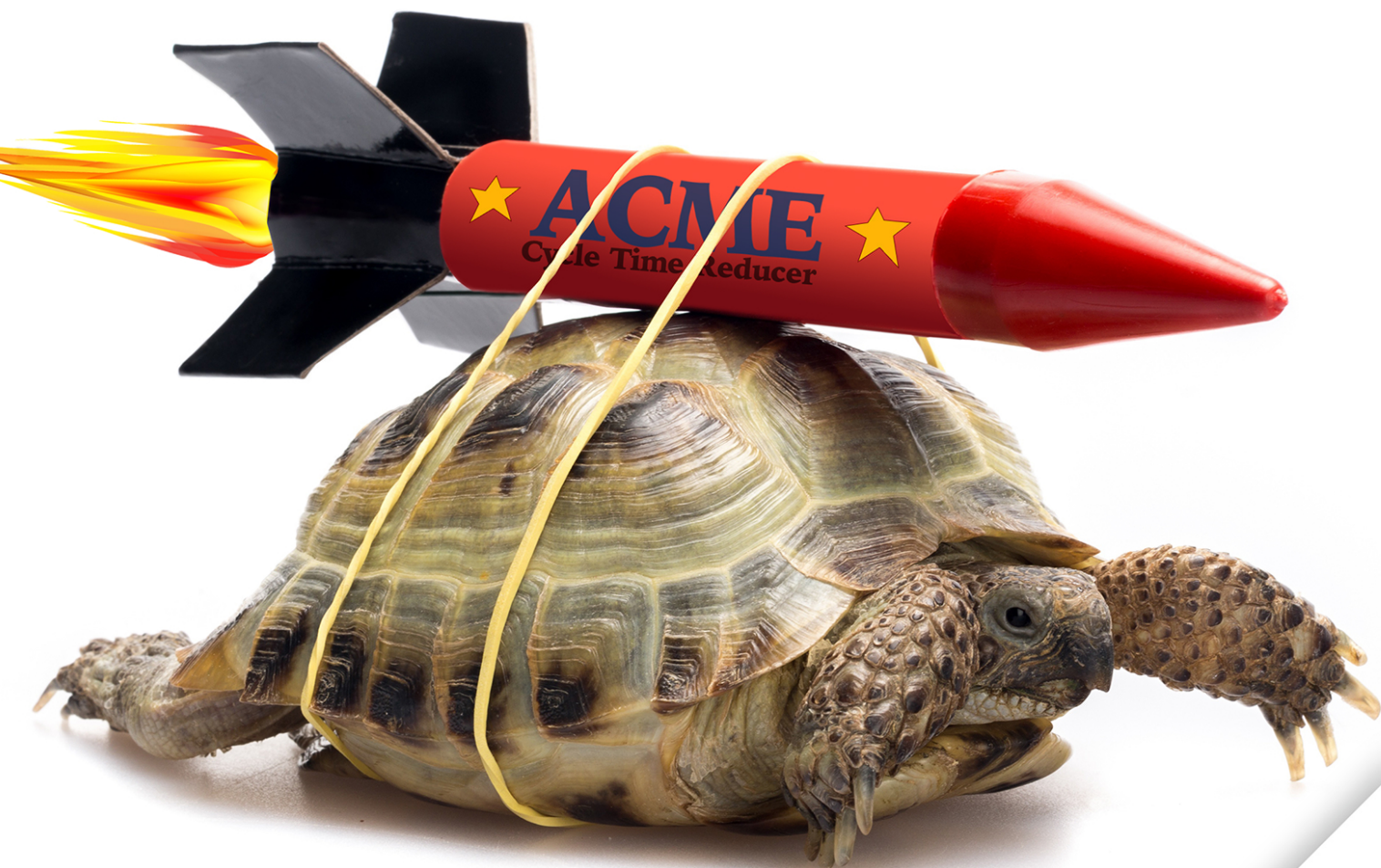
OCTOBER 2015

**Value Stream Mapping:
Operationalizing Lean
Manufacturing** p.12

**Choosing the Right
Component to Reduce
Cycle Times** p.20

**Cycle Time Reduction
in the Eye of AOI** p.30

And Much More!



Smarter Strategies for Reducing Cycle Time

thepcblist.com
thepcblist
THE Best Way to Find
a PCB Fabricator
...Anywhere.

PCB BUYERS - compare nearly 1900 manufacturers now at *The PCB List*.



Quick Search



Advanced Search



The best way to find a PCB fabricator, *anywhere*.

MERELY SURVIVE? OR DOMINATE.



IPC now delivers

online exams

through our global network of
licensed training centers.

Get improved accuracy,
increased security and
immediate results.

Evolve to New Standards Revisions with **IPC Certification Programs**

Success in the electronics industry happens when companies—and individuals—take every opportunity to push themselves to climb to a higher level of performance. Well, this is one of those opportunities. **IPC has updated our most popular standards to the latest industry requirements, including IPC J-STD-001F, *Requirements for Soldered Electrical and Electronic Assemblies* and IPC-A-610F, *Acceptability of Electronic Assemblies*.** The F revisions will help your company dominate through your commitment to outstanding quality assurance and rigorous performance standards. And, among the electronics supply chain, you will raise your profile while you improve communications with your partners.

Now is the time to evolve. Go to ipc.org/evolve to get your IPC specialists or non-certified operators certified on IPC's New Standards Revisions and find your closest IPC Licensed Training Center.



This Month's Feature Articles

CYCLE TIME REDUCTION

This month, *SMT Magazine* discusses strategies and technologies that will help electronics assemblers reduce cycle times in their processes to improve their efficiencies and increase their productivity.

- 12 Value Stream Mapping:
Operationalizing Lean
Manufacturing**
by Erwin Patrocinio



- 20 Choosing the Right
Component to
Reduce Cycle Times**
Interview with Edward Neff



- 30 Cycle Time Reduction
in the Eye of AOI**
Interview with Norihiko Koike



- 36 Reducing Cycle Times with
Innovative Bonding Solutions**
Interview with Gudrun Weigel

- 42 Technologies to Enable Quick-Turn
PCB Assemblies**
by Khurrum Dhanji

- 46 Process Improvements for
Cycle Time Reduction**
Interview with Randall Williams



- 58 Is Automation
the Answer to
Cycle Time
Reduction?**
Interview with George Liu



- 70 Inspection Innovations
to Reduce Cycle Time**
Interview with Guido Bornemann





“ We are delighted with the in-line automated system. It is everything that Manncorp said it would be. The reliability, speed and performance of the entire SMT line warrant an "A+". You have certainly delivered on your promise. **”**

Terry S.

Director of Manufacturing
NK Technologies, San Jose

SOLD



FREE \$20,000 Feeder Allowance!
[Click Here](#)

Valid through 10/31/15

Manncorp™
www.manncorp.com

TABLE OF CONTENTS

FEATURE COLUMNS

- 8 The Need for Speed**
by Stephen Las Marias



- 26 Reducing Print Cycle Times**
by Mitch Holtzer and Lourenco Nampo

- 52 Cycle Time Reduction with WORK, Part I**
by Steve Williams



COLUMNS

- 62 Gold Embrittlement Mitigation: Understanding the New J-STD-001 Requirements**
by Bob Wettermann



- 74 Selecting a Reflow Oven, Part 3**
by Robert Voigt

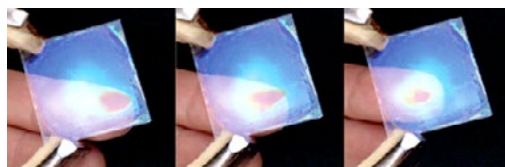
EXTRAS

- 80 Events Calendar**
81 Advertiser Index & Masthead

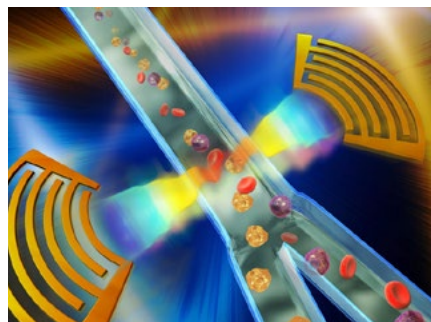
SHORTS

- 29 Darwin on a Chip**

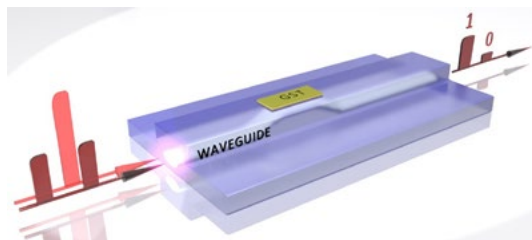
- 51 Nanostructures for Contactless Control**



- 67 A Fast Cell Sorter Shrinks to Cell Phone Size**



- 73 Permanent Data Storage with Light**



NEWS HIGHLIGHTS

- 34 Market**
56 MilAero
68 Supply Line
78 SMT007



LONG LEAD TIMES FOR PCB ASSEMBLY IS HISTORY!!!

R.P.A.S

Rapid Prototype Assembly Service

Is The FUTURE!

STENCIL-LESS JET PRINTING

Our Stencil-less jet printer eliminates the need for stencils. This allows us to turn your assemblies around in a day! No more waiting 1-3 days for stencils!

MULTI-HEAD SMT EQUIPMENT

State of the art equipment allows quick changeovers, eliminating downtime needed to swap parts for jobs in line.

QUOTING REVOLUTION

Our proprietary Quoting software gives full turnkey quotes (Boards, Components and Labor) online within minutes...not hours, not days.

Multiple day lead times are History! With our capabilities, we can turn around assemblies in 24 Hours*

PCBs

ADVERTISED SPECIALS

\$10

PER PIECE



**Try Imagineering's
Triple Play and
experience the Future!**

Industry leader in Printed Circuit Board Manufacturing and Assembly Services since 1985.

ASSEMBLY

\$250 UP TO
250 PLACEMENTS
PER ORDER

Maximum 10 pieces

**COMPONENTS
& PCBs**

FREE UP TO
\$500
VALUE



imagineering inc

☎ 847-806-0003



www.PCBnet.com

✉ sales@pcbnet.com

*Does not apply to this offer

EDITOR'S NOTE

The Need for Speed

by **Stephen Las Marias**

I-CONNECT007

I was recently invited to judge the editor's choice award at National Instrument's 2015 NI Engineering Impact Awards—ASEAN Regional Contest. This is my second time judging the annual technical applications contest. The awards aim to showcase the most innovative projects using NI hardware and software, and it's amazing to see the projects submitted by the academe and industry professionals that are designed for various industry applications—from autonomous vehicles to flexible control systems for car engines, to automatic generation control modules for microgrid applications and real-time localization systems. There were also projects on energy harvesting as well as reliability improvement for stamping machines. As NI provides test and measurement technologies and solutions, there were also a few tester submissions, such as a power supply sequencing tester, an EDA memory characterization tester, and a PCB connectivity tester.

There was one project that I found relevant to our topic for this month's issue of *SMT Magazine*, which is cycle time reduction. Developed


by Gatepacific Circuits Inc. (GCI) for a client, the project aimed to improve the process of dispensing paste compared to the manual process done by human operators, and increase the unit per hour (UPH) capability from 500 units to more than 1,000 units. The project incorporated pin location and visual inspection with motion and pneumatic controls to provide fast and accurate dispensing, effectively doubling the manufacturing yield of a human operator.

Project Specifics

Based in the Philippines, GCI provides quality products and professional services in electronic assemblies such as PCB design, fabrication and assembly, and in-systems engineering solutions including automated test systems and test development, control systems, and machine vision systems. Its clients include those in the semiconductor and electronics manufacturing industries.

For this particular project, GCI integrated the NI LabVIEW Vision Development Module and the CVS-145xRT with a slider electric actuator,





Polyurethane,
Silicone &
Epoxy Resins

Thermal
Management
Solutions

Contact
Lubricants

Water and Solvent
Based Cleaning

Conformal
Coatings

Maintenance
& Service Aids

Where experience and innovation come together

In the formulation, manufacture and global supply of conformal coatings, thermal pastes, encapsulants, cleaners and lubricants, we have the solutions of the future. Our ethos of collaboration and research, combined with a truly global presence and manufacturing capability has led to the development of ISO standard, environmentally friendly products for the world's leading industrial and domestic manufacturers.

Our unique provision of the complete solution, combined with the scale and scope of our capabilities ensures a reliable supply chain, and exemplary service.

Find out how you could become part of the solution. Simply call or visit our website



productronica

Come and visit us in Hall A4,
Stand No 466, Productronica,
10-13 November 2015



Tel: 888-501-9203
www.electrolube.com

ELECTROLUBE
THE SOLUTIONS PEOPLE

THE NEED FOR SPEED

two card motors, a gripper, and two air dispensers (EFD Ultimus), to develop an automated air dispensing system that inspects multiple pins in the target unit, applies paste accurately on these pins at a rapid rate, and performs vision inspection for uniform dispensing quality.

Overall, the machine tool increased the UPH as well as offered better quality of paste dispensing by transitioning from manual process to an automated process.

Reducing Cycle Time

While the project sounded simple, I think it provided an effective solution of reducing cycle time—and thus increasing the throughput—of the solder dispensing process for GCI's client.

And this brings me back to the topic of this month's issue of *SMT Magazine*. Basically, we did a reader survey to find out what their biggest bottlenecks are when it comes to reducing cycle times in electronics assembly processes. Some of our findings include the lack of automation, inspection and testing, and the equipment/machines. To help them answer some of their questions regarding cycle time reduction, including the best methods to use and the best practices that they can apply in their own processes, we talked to different companies to get their insights as well as learn from their experiences in tackling these issues.

Inside, you will find an article by Erwin Patrocinio of Integrated Micro-Electronics Inc., which describes value stream mapping (VSM), a lean manufacturing technique used to document, analyze and improve the flow of information or materials required to produce a product or service. Patrocinio also discusses a VSM project completed for one of their customers.

In "Reducing Print Cycle Time", Mitch Holtzer and Lourenco Nampo of Alpha address print cycle times, and illustrate two simple experiments that may lead to increased throughput and increased profitability.

Khurram Dhanji of Imagineering Inc., meanwhile, discusses technologies and new unique processes enabling quick-turn PCB assemblies in "Technologies to Enable Quick-Turn PCB Assemblies."

In an interview with Delo Industrial Adhesives, Gudrun Weigel looks at how bonding solu-

tions can help electronics manufacturers cut their cycle times. She also provides some best practices to help assemblers improve their processes, and increase the quality throughout the assembly line.

While I was at NEPCON South China in Shenzhen last month, I caught up with Norihiko Koike of Saki Corp. and Guido Bornemann of Viscom AG to get their perspectives on cycle time reduction, as well as new innovations happening in the AOI space that help customers address their inspection issues. You can find those interviews inside.

At the same event, I also talked to George Liu of Cencorp Automation, which provides router, depaneling, odd-form and through-hole component placement equipment for the backend of the PCBA line, about the impact of automation on manufacturing efficiencies.

For his part, Edward Neff of SMAC Moving Coil Actuators explains the strategies they implement in their production lines to reduce cycle times and go to market faster. He also discusses how manufacturers can ensure the uptime of their equipment and processes.

Moving on to our regular columns, Bob Wettermann of BEST Inc. explains the new J-STD-001 requirements regarding gold embrittlement mitigation, and highlights what the user community will have to do to comply with it.

Robert Voigt of DDM Novastar, meanwhile, contributed the last part of his article series on selecting a reflow oven, which discusses methods of control and profiling techniques.

I do hope you'll enjoy this month's issue of *SMT Magazine*. To know how the PCB design and fabrication industries are addressing cycle time reduction, check out this month's issue of *The PCB Magazine* and *The PCB Design Magazine*.

Next issue, we'll talk about how the gathering of correct and accurate real-time data will help electronics assemblers take their production processes to the next level. Stay tuned! **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.



PCB Fabrication & Assembly Services from *PCBCART*

More professional | More reliable | Short turnaround time | Less cost


Save **15%** Your First Order use code **PCBSMT007**

➞ www.pcbcarts.com

- ✓ PCB fabrication up to 32 layers
- ✓ Min. tracing/spacing to 3mil/3mil
- ✓ Min. microvias to 0.1mm
- ✓ Special PCBs-Aluminum, flex and HDI
- ✓ Prototype to mass production
- ✓ Full turnkey PCB assembly



✉ sales@pcbcarts.com



VALUE STREAM MAPPING: Operationalizing Lean Manufacturing

by Erwin Patrocinio

INTEGRATED MICRO-ELECTRONICS INC.

In the realm of electronics manufacturing services, EMS providers are continuously fraught with pressures from the original equipment manufacturers (OEMs) to lower the total cost of production.

One of the tools used by EMS companies to achieve this goal is value stream mapping (VSM).

VSM is a lean manufacturing technique used to document, analyze and improve the flow of information or materials required to produce a product or service. It provides optimum value to the customer through a complete value creation process with minimum waste in design (concept to customer), build (order to delivery), and maintenance (in-use through life cycle to service).

Through VSM, the EMS provider maximizes

the customer gains by adhering to a clear vision and implementing a clear plan connecting all improvement activities.

The VSM is a visualization tool that has its origin in the Toyota version of lean manufacturing (Toyota Production System). Through this tool, inherent wastes or losses within an operation are identified. The value stream maps reflect a broad view of the process, usually from external supplier to an external customer at a given facility.

Many of the problems that the VSM exposes reach across organizational lines of responsibility and expertise. The goal of the process is to identify, demonstrate and decrease those activities that do not add value to the production process.

By applying VSM, EMS providers can have a clearer picture of multiple processes involved

SUPER DRY[®]

Desiccant Dry Cabinets for
Moisture Sensitive Products



**THE WIDEST SELECTION OF SIZE AND
PERFORMANCE FOR ANY APPLICATION**



www.superdry-totech.com

VALUE STREAM MAPPING: OPERATIONALIZING LEAN MANUFACTURING

in a work flow, identify waste and its sources, identify where change is required, standardize the process, and identify potential problems that could be encountered in the future state. It can also be used as a tool for planning as well as for managing changes. The VSM process helps make organizations more efficient by improving their processes. Let's see how VSM is applied in an EMS environment.

The illustration below is an example of how a VSM project is done. The workshop typically runs for several days depending on the com-

plexity of a certain project under study, while project closure is targeted within six months. Pre-work is being done prior to the learning session and workshop. This includes gathering and analysis of business operations information, important production details and current performance. The line walk helps in gathering more information and shows the actual scenario of production where team members do line observation in each process and take notes. This forms part of the actual mapping process. And like any other improvement discipline, the

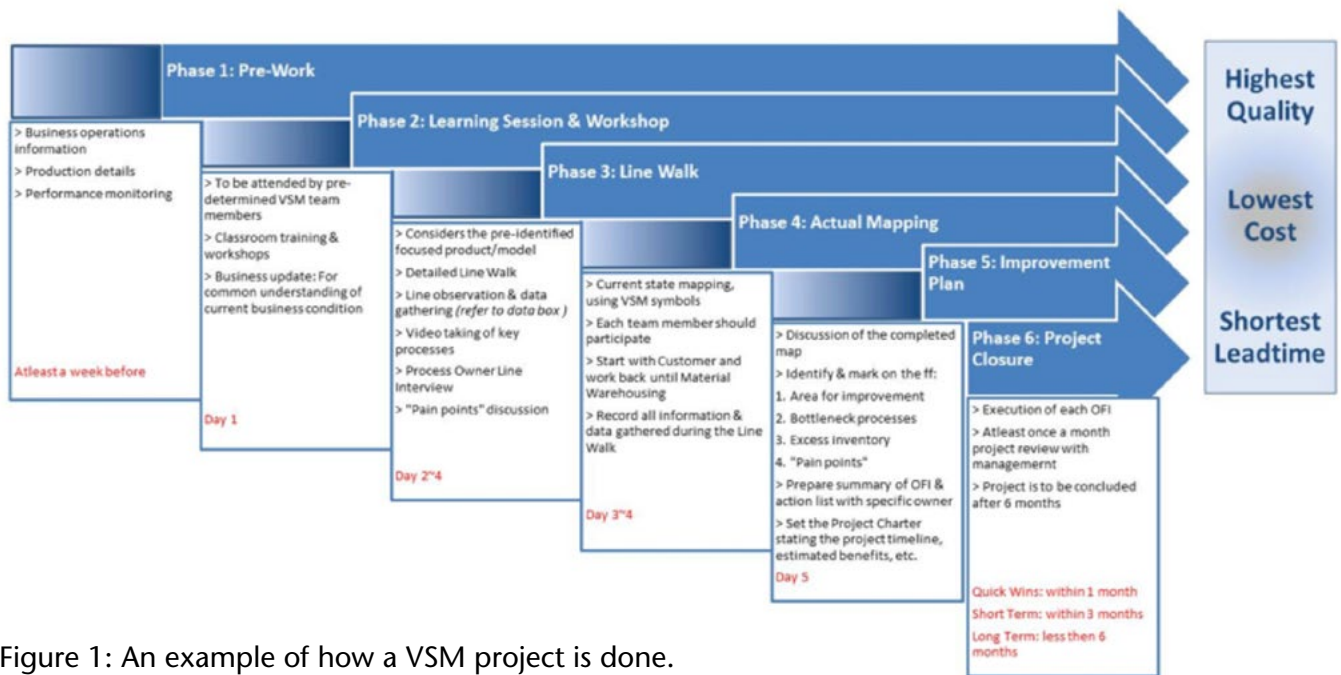


Figure 1: An example of how a VSM project is done.

Opportunities for Improvement		Category	Rank	Effort	Benefit
1	Improve flow of auto soldering station	Productivity	1	Low	High
2	Improve bent defect at FCT	Quality	9	High	High
3	Reduce downtime at FCT	Productivity	8	High	High
4	Balance UPH at SMT process	Productivity	4	Med	Med
5	Improve cycle time of auto soldering	Productivity	6	Med	Med
6	Solderability issue improvement at auto soldering	Quality	7	Med	Med
7	Lessen movement of SMT AOI-VI operator	Productivity	3	Low	Med
8	Lessen movement of screenprint operator	Productivity	5	Med	Med
9	Reduce WIP accumulation at OQA	Productivity	2	Low	High

Table 1.



BLACKFOX

Premier Training & Certification



Experience the Blackfox Difference!

Providing quality training systems and custom courses to the industry's cutting edge companies.

What makes Blackfox so unique?

- Our customer care is always our first priority
- Training is all we do and we are the best at what we do.
- We don't compete with our customers by offering production services.
- Our instructors truly care about the success of their students.
- We are dedicated to our veteran heroes, helping them prepare for long-term career paths.

We offer IPC certification as well as training for instructors, operators, conformal coating, lead free, high temp solder and more!

[CLICK FOR COURSE SCHEDULE](#)

For more information contact us at
888.837.9959 or sharonm@blackfox.com

www.blackfox.com



VALUE STREAM MAP: OPERATIONALIZING LEAN MANUFACTURING

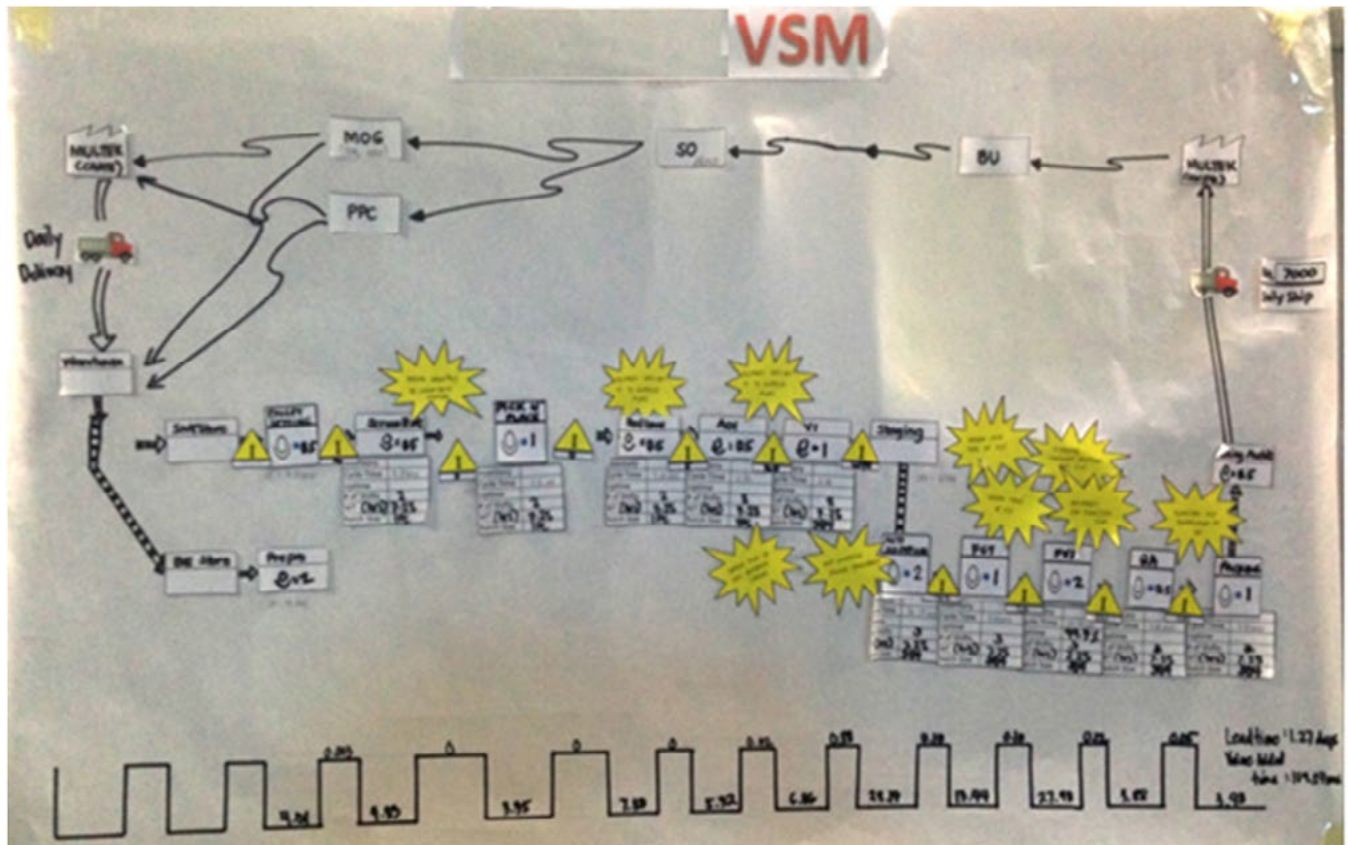
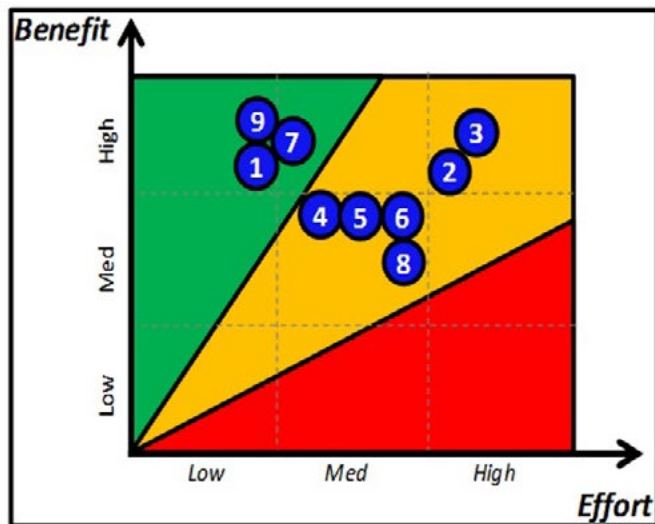


Figure 2: The bulletin board above shows how a VMS project was successfully completed.



Opportunities Prioritization Benefit Effort Matrix

Benefit includes:

- Strategic Fit
- Revenue Growth
- Cost Reduction
- Working Capital Reduction

Effort includes:

- Resources Required
- Project Duration
- Capital Investment
- Project Risk



Highly Desirable Opportunities

Projects in upper left are the most desirable projects.



Potentially Desirable Opportunities

Projects in the upper right are potentially desirable, but usually require more analysis to ensure good decision making. "The breaking" variables such as strategic fit, resource availability and project type may also be employed.



Least Desirable Opportunities

Projects in the lower right are the least desirable.

Figure 3: The prioritization matrix is also established to guide the team on which OFI to prioritize.

VSM project has its own project charter that states the project timeline, estimated benefits and other project information.

Figures 1 and 2 demonstrate how the team

improved the process for the manufacture of flexible circuit assembly for an OEM customer through the use of value stream mapping.

The project focused on high-volume and

INTRODUCING THE AKILA ALL-IN-ONE DOFFS UNIT For Use with MS2®



Why sell your dross to a recycler for a fraction of its true value? Ask us about the new compact Akila off-line solder recovery unit that, along with our MS2® Molten Solder Surfactant, takes the guesswork out of the solder recovery process.

- Easily convert dross into usable solder bars
- Fully enclosed machine
- Fume-free operation
- "Plug & Play" set up
- Small footprint



PK
M · E · T · A · L

Contact sales@pkaymetal.com for more information. (323) 585-5058 www.pkaymetal.com

VALUE STREAM MAPPING: OPERATIONALIZING LEAN MANUFACTURING

Opportunities for Improvement		Category
O1	Improve flow of Auto Soldering station	Productivity
O2	Reduce WIP accumulation at QA	Productivity
O3	Lessen movement of SMT AOI-VI operator	Productivity
O4	Balance UPH at SMT process	Productivity
O5	Lessen movement of screenprint operator	Productivity
O6	Improve Cycle time of Auto Soldering	Productivity
O7	Solderability Issue improvement at Auto Soldering	Quality
O8	Reduce downtime at FCT	Productivity
O9	Improve bent defect at FCT	Quality

Table 2.

high-value model that runs through the SMT line and complete backend processes. This improvement project was specifically initiated by the sponsor to achieve operational excellence targets and be more competitive.

During the VSM workshop, the team identified nine opportunities for improvement (OFI) and classified them according to productivity, quality and delivery aspect of operations (see Table 1).

Prioritization matrix is also established to guide the team on which OFI to prioritize.

The matrix provides a means for ranking projects based on criteria that are determined to be important. This enables the team to see clearly which projects are the most important to focus on first based on effort and benefit.

Among the improvement activities done during this VSM is the process improvement in the screen print process in SMT where cycle time was improved by 17% by changing the direction of auto stencil cleaning. This resulted in a 15% increase in SMT line capacity.

In the backend process, changing the solder wire type used in the auto soldering process resulted in an 86% quality improvement. Layout analysis in both SMT and the backend process helped reduce unnecessary travel and motion that resulted in an 18% improvement in travel distance.

Table 2 shows the improvement activities done based on the ranking.

In summary, through this VSM the team was able to successfully achieve 23% productivity

improvement, 18% process yield improvement and 14% improvement on the line balance index through cycle time and line balancing improvements. The change in layout reduced the total travel distance from 66 meters to 54 meters.

All of the activities and improvements caused significant impact financially both for the company and for the customer. More importantly, the customer appreciated the efforts and the impact of the project on the business.

Also known as an end-to-end system map, the VSM considers not only the activity of the product, but also the management and information systems that support the basic process.

Maps are important and indispensable tools for travelers, geographers or anyone embarking on a journey. Just like a map, the VSM is an indispensable tool and technique for both OEMs and EMS companies in achieving lean manufacturing. It gives the big picture point of view, exposes sources of wastes (not just the wastes), shows linkage between information flow and material flow, and forms the blueprint to identify areas of improvement. **SMT**



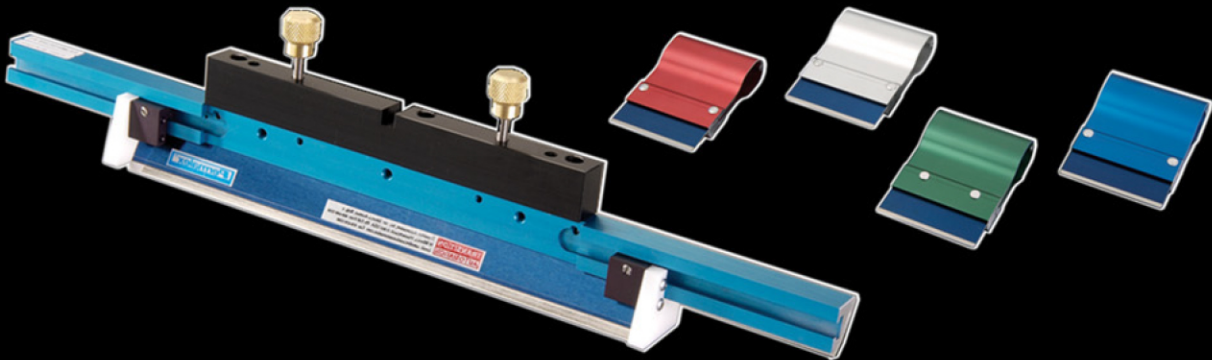
Erwin Patrocinio is the manufacturing engineering manager in charge of lean manufacturing implementation for Philippine operations of Integrated Micro-Electronics Inc. (IMI).

TRANSITION AUTOMATION

*Technology for Improving SMT Print Quality
and Production Yield*

Permalex®

Long Life Polymer Infused Metal Squeegees



PrinTEK

Ultra-Fine Pitch SMT Printers



Hall A3, Booth 112/2



productronica 2015
innovation all along the line

WWW.TRANSITIONAUTOMATION.COM



Choosing the Right Component to Reduce Cycle Times

by **Stephen Las Marias**
I-CONNECT007

SMAC Moving Coil Actuators is a leading manufacturer of precision programmable electric actuators based on moving coil technology. With its patented “Soft-Land” function, the company’s electric actuators perform at exceptionally high speeds or very low speeds with extremely accurate sensing of product location or dimensions—making them suitable for a wide range of high cycle positioning, measuring, inspection, and pick-and-place applications, particularly where 100% verification is required.

In an interview with *SMT Magazine*, SMAC president Edward Neff talks about the strategies they implement in their production lines to reduce cycle times and go to market faster. He also talks about how using proven components can help manufacturers ensure the uptime of their equipment and processes.

Stephen Las Marias: *What are the biggest bottlenecks in your process that contribute to longer cycle times?*

Edward Neff: Cycle time is the time required to perform a repetitive specific task. There are several factors that can slow cycle time. The fragility of the item being worked on can slow cycle time—for example, an electronic chip. The durability of the device doing the work is also a factor. For example, air cylinders are limited to 1,200 CPM. Both ball screw and air cylinders have cycle life in the 10–20M range. Linear motors are 10x that and are much faster.

The repeatability of the device doing the work in position and time can also affect cycle time. A $\pm 20\text{ms}$ time to reach a target means cycle time must increase. Other factors include the acceleration of the device doing the work, the mass of the object being worked on and the moving mass of the device doing the work.



TAKE A VIRTUAL TEST DRIVE AND THE VICTORY LAP IS YOURS

VALOR PCB MANUFACTURING SOFTWARE | Move into the fast lane with a free test drive of the latest manufacturing technology from Valor®. Get hands-on access to our lean NPI design verification, process preparation, and production planning tools from virtually anywhere. Complete your trial lap, and you'll be ready to cross the finish line with higher efficiency, performance, and productivity throughout your PCB manufacturing processes. Go ahead, take the wheel at www.mentor.com/drive

**Mentor
Graphics®**
THE EDA TECHNOLOGY LEADER



CHOOSING THE RIGHT COMPONENT TO REDUCE CYCLE TIMES



Edward Neff, SMAC president.

Las Marias: *How important is reducing cycle time, and how do you achieve this in your own processes?*

Neff: Cycle time reduction is a key target along with quality. It helps reduce the cost of operation, and increase capacity. Longer cycle times mean more capital equipment needed, increased overhead, more factory space required, and higher energy costs.

Cycle time reduction at SMAC is accomplished in a few different ways. We simplify design—because reducing complexity reduces cycle time. We do five at a time or 10, not one or two. We increase our output and improve quality by using mechatronic devices. SMAC moving coil actuators are low moving mass/high acceleration/precision positioning servo devices that can do the work and confirm its success at the same time.

Las Marias: *Can you please give some examples as to how you were able to reduce the cycle time of a particular process or project of yours or your customer?*

Neff: The answer to your question is going to be different for different industries. For example, in packaging, cycle rates for dispensing increases from 1,200 a minute to over 2,000. Here our moving coil actuator has much higher accelerations than air cylinders or moving magnet linear motors. Since the actuator is servo controlled, there is no slamming at the end of stroke so that cycle life is >10 times that of previously used devices. Similar results occur in eject/divert applications.

In addition, the ability to “Soft-Land” and push an object with a selectively programmable force allows the customer to adjust to a variety of work sets—full versus empty, large versus small. This means their system does not have to slow down in order to handle all the variation. Filling applications also speed up when repeatability in time to move improves. Air cylinders repeat with variation of $\pm 15\text{ms}$ or so. The operation must slow to ensure the minimum target amount is met. This also results in over filling. A moving coil actuator will repeat in the $\pm 1\text{ms}$ range so fill time speeds up and over-filling is greatly reduced. Therefore the costs go down and quality goes up.

In electronics assembly or chip assembly, low moving mass and thin linear rotary actuators developed by SMAC such as the LCR 13, combined with patented “Soft-Land” and “Programmable Force” technology, sped up the assembly of current generation small chips that must be assembled with an assembly impact limit of 1N. Additionally, the thin physical structure matches the pitch of feeders so that stack of actuators pick and place. So output increased since speed is faster due to lower moving mass and more parts are assembled at the same time, and quality improves with the Soft-Land technology.

In chip testing, the very-high acceleration (100G) LCA 32s reduce cycle time since moves of several mm can be made in milliseconds with end of stroke accuracy in microns. This, combined with proven cycle life of well over 100 million cycles, eliminates the use of cams, which damage current generation fragile parts. A new variation allows us to apply relatively high forces—30N to 50N—in very small package sizes. This includes applications where duty cycle is over 90%.

CHOOSING THE RIGHT COMPONENT TO REDUCE CYCLE TIMES

Las Marias: Please talk about best practices that will help assemblers/manufacturers reduce cycle times in their processes.

Neff: Some best practices include using closed loop servo devices that are repeatable and programmable; building in as much quality feedback as possible; and trying to use proven components—in-house solutions are often risky.

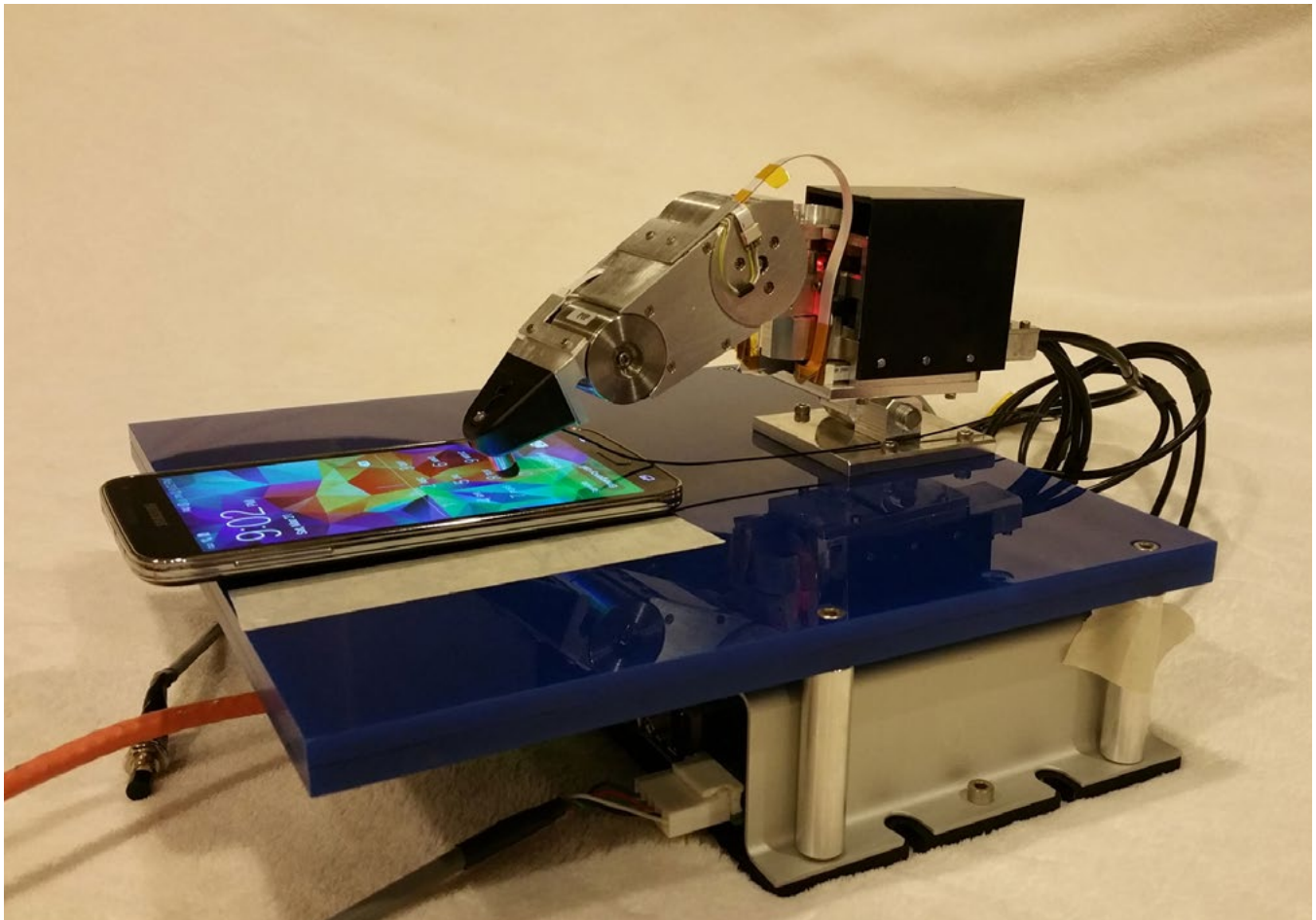
Las Marias: What about automation? How does automation help reduce cycle time in an assembly line?

Neff: Automation means processes are repeated exactly. It also means that a number of operations can be done simultaneously, such as feeding in parts, assembly and check, and sort

and unload. New generation mechatronic automation, such as SMAC moving coil actuators, are also flexible, so on-the-fly adjustment or changeover is possible as well as coincident assembly and quality check.

Las Marias: Some assemblers believe that SMT equipment such as pick-and-place machines are among the key issues when it comes to cycle time reduction. Please give your comments on this. How should manufacturers address this issue?

Neff: Electronics is key to many products today. The trend in electronics has always been towards smaller and smaller sizes, and with this comes increased fragility. Electronic assembly machines need to get smarter, faster, and more precise. Having the ability to determine assembly surface locations, which



Finger-hero.

CHOOSING THE RIGHT COMPONENT TO REDUCE CYCLE TIMES

sometimes vary on the fly, speeds up assembly. SMAC has a new on-board laser option that allows this.

Multi Z-axis machines can speed up output while actually running an individual axis slower, which helps reduce impact. Flexible circuit substrates are quite an interesting trend.

Las Marias: *What about equipment downtime? How does that contribute to cycle times, and should assemblers address that?*

Neff: Machine downtime comes from several causes. Failure of devices on the machine is one. That is normally an unplanned event and as such, is not good. That is more an expected output question as opposed to cycle time. In this case, components' expected lifetimes

.....

“Periodic review of new technology is also a good thing to do. Doing this systematically, with basic corporate goals such as yearly cost down % and sales/capacity %, get results.”

.....

must be at least equal to the expected life of the machine. Around three times the life is better. So instead of using components with known short life times, like ball screw drives or high current devices like moving magnet linear motors, use long life products.

Tied in with this is preventive maintenance (PM). Again, find the reasons then reduce their impact. For example, put a hole through the pick and place rotary motor and pull vacuum through it. It gets the dust out of the system. Keep improving and reduce the need for PM.

Another downtime comes from changeover. This can be for parts, such as changeover

of tips, for example. This has been addressed pretty well in current machines.

Las Marias: *Can you give some examples as to how manufacturers can address the impact of cycle time on costs?*

Neff: Manufacturers should first review their own products and simplify wherever possible. Reduce number of parts, limit the number of tool changes. Periodic review of new technology is also a good thing to do. Doing this systematically, with basic corporate goals such as yearly cost down % and sales/capacity %, get results. At SMAC, we do this through the operating budget plan.

Las Marias: *Finally, what about quality? How do you ensure that quality remains the same throughout the assembly line as you strive to reduce cycle times?*

Neff: Quality should always improve, not remain static. A good way to approach this is first to determine what is critical. Then build in 100% check of these items. As failures occur, immediately determine what caused these, and correct these issues so that they do not occur again. Also, tighten specifications and improve critical processes for those critical elements.

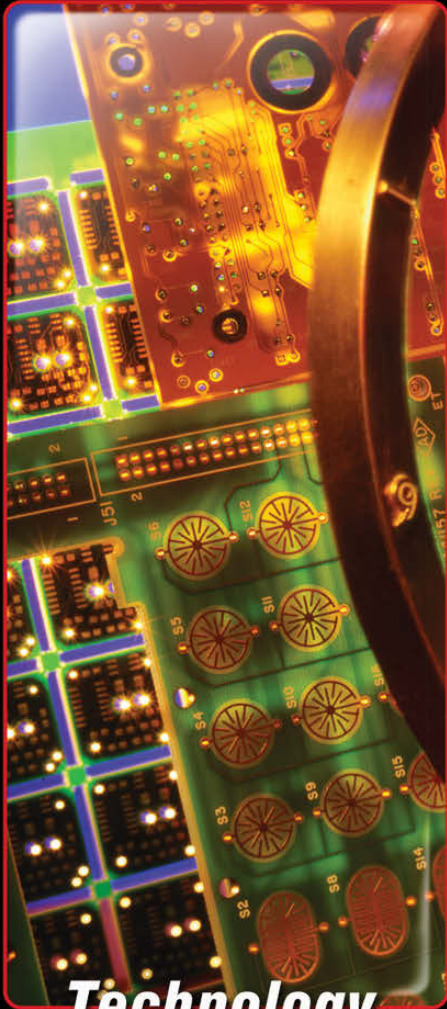
Mechatronic devices that perform work and verify the success of the work are an example of how to do this. For instance, a major auto maker tests switches using SMAC devices; they used to use air cylinders that simply confirmed the switch worked. The MCA does that but also shows where in the stroke the switch turned on and off, and what force was needed. It tells the customer about the quality of the switch. When parts are assembled, the MCA can do the work and also tell if the assembly was done correctly by feeding back information on end position of the assembly, how much force was required to make the assembly, etc.

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

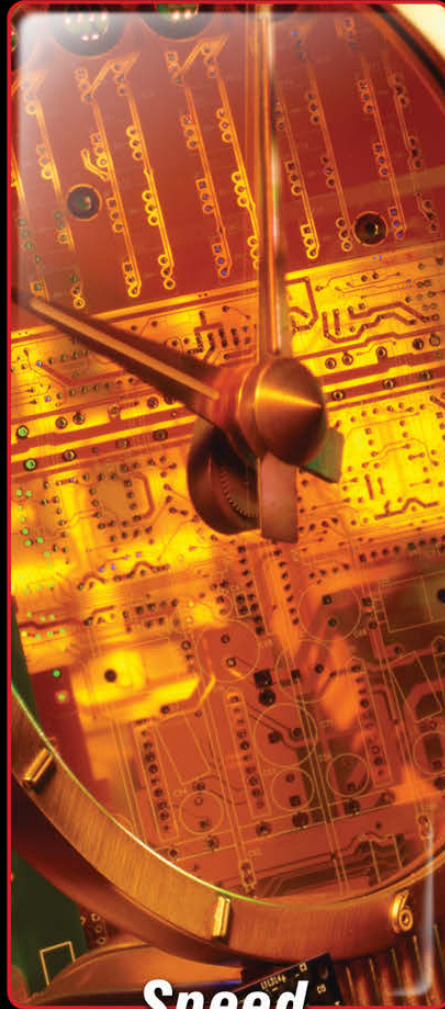
Neff: Thank you, Stephen. **SMT**

We Take the Time to do it Right

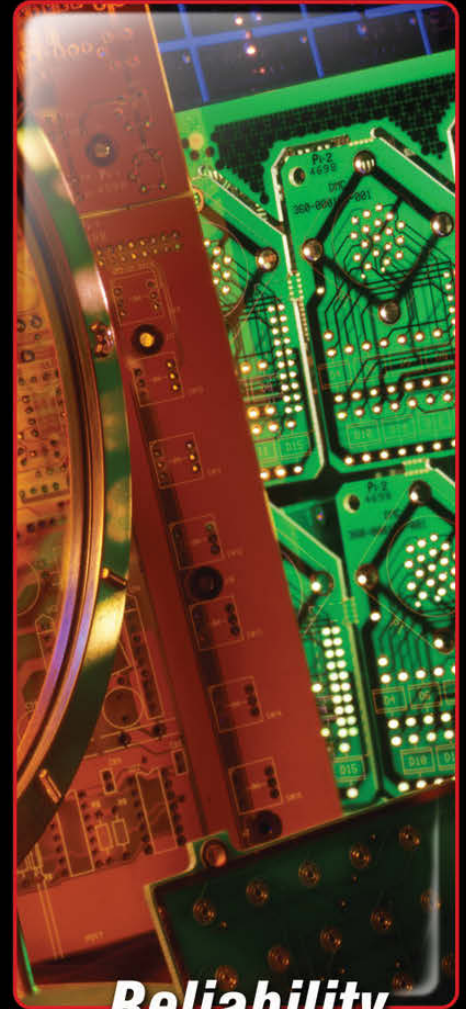
because you don't have the time to do it over.



Technology



Speed



Reliability



Prototron Circuits

High quality quick turn manufacturing, just another reason we are
America's Board Shop

Redmond Facility

15225 NE 95th Street, Redmond, WA 98052
Toll: 888.847.7686 Phone: 425.823.7000

Tucson Facility

3760 E. 43rd Place, Tucson, AZ 85713
Toll: 800.279.5572 Phone: 520.745.8515

Reducing Print Cycle Time

by Mitch Holtzer and Lourenco Nampo

ALPHA

Of the several steps in the SMT process, an effective method of increasing throughput is to reduce the cycle time of the rate-controlling process step. Depending on the type of assembly and equipment set used, the process step with the longest cycle time could potentially be printing, solder paste inspection (SPI), component placement or reflow oven conveyor speed. This article will discuss two simple experiments that may lead to increased throughput and increased profitability (assuming the selling price exceeds the marginal cost of each assembly).

Print cycle time can be the bottleneck if the electronic assembly has relatively few components or if the production line used has a well equipped set of placement devices. If this is the case, there are two simple experiments that can be carried out to evaluate if a reduction in print cycle time can increase production volumes without reducing quality. Producing bad boards

fast is much worse than producing good boards slowly. The first experiment is to increase the speed of the squeegee stroke. Figure 1 shows the relationship of the squeegee speed, stroke length and the time required for the solder paste to be printed.

If a slow squeegee speed is currently being used (<2 inches/second), there is a greater opportunity for increasing throughput. When running the experiment at increasing squeegee speeds, review the CpK recorded on your SPI equipment for a gain or reduction in process capability. Some solder pastes give better print volume reproducibility at higher speeds. This results in a win-win, higher production and improved process yields.

One important thing to look for when increasing the squeegee speed is paste left on the stencil (Figure 2). When a higher squeegee speed is used, it is usually necessary to increase

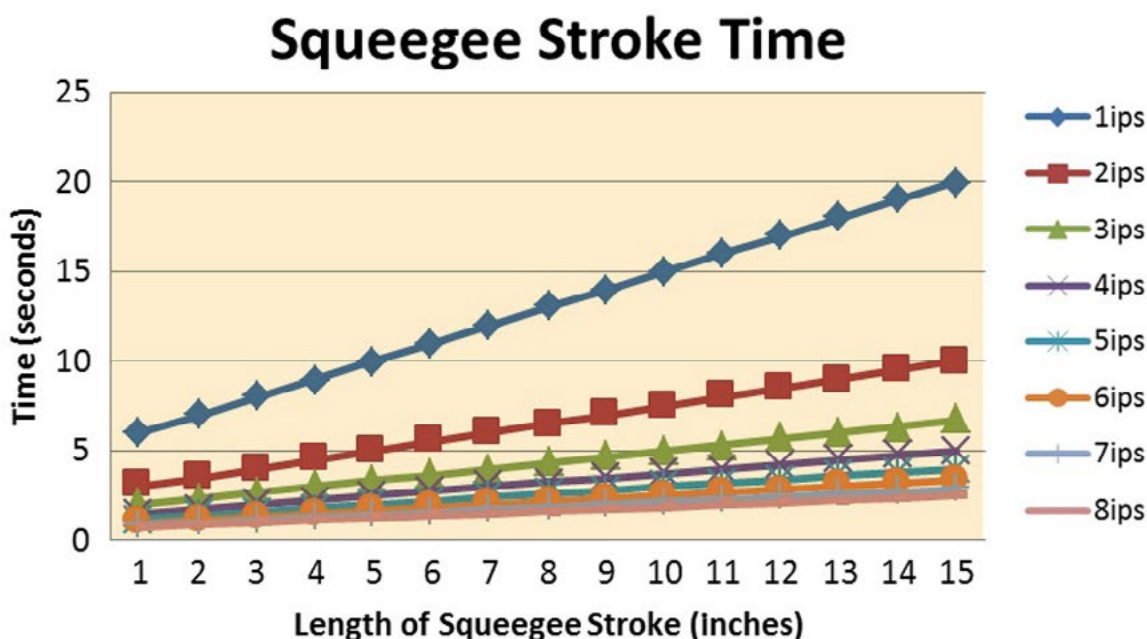


Figure 1: Stroke time versus speed (inches per second) and distance.

How can you find the best PCB Partner? We can tell you. We wrote the book on it.



Since 1985, U.S. Circuit has been a premier supplier of both commercial and military Printed Circuit Boards in the United States. We know what it takes to be a good PCB partner. And we want to share what we've learned with you.

Choosing a PCB partner isn't hard—if you know what to look for. We've broken it down into "The 5 Commandments" and you can download it for free.

We are proud to be the Circuit Board Manufacturer of more than 400 growing companies, and even prouder to be a good partner for all our customers!



Click to Download



U.S. Circuit, Incorporated
2071 Wineridge Place
Escondido, CA 92029
+1 (760) 489-1413
www.uscircuit.com



REDUCING PRINT CYCLE TIME

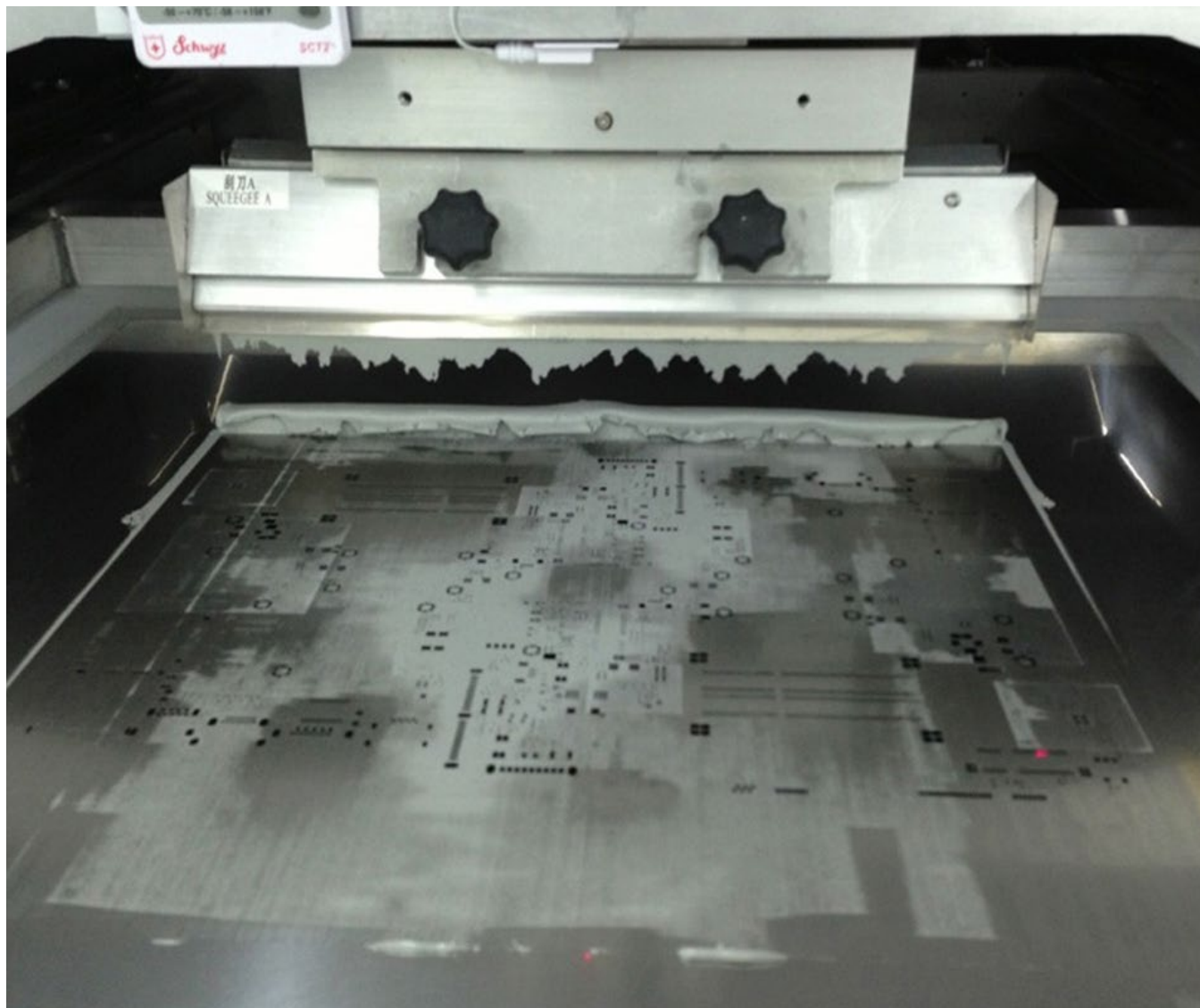


Figure 2: More pressure on the squeegee is required.

the pressure of the blade on the stencil until the residue disappears.

The second experiment to reduce print process cycle time is to examine how often you clean the bottom side of the stencil. This is commonly referred to as wipe frequency. Cleaning the stencil removes solder paste that may be building up in the apertures. It also removes any paste that may be trapped under the stencil, waiting to be transfer printed to an undesired place on the circuit card, later to be blamed as a spatter.

The cleaning sequence may take 15–30 or more seconds. Figure 3 shows how wipe fre-

quency can effect net print process cycle time. This example assumes a print cycle time of 20 seconds (with no stencil underwipe) and a 30 second cleaning step. It does not take into account the delays in replacing cleaning paper or chemicals. These replenishments take time, and are required at intervals proportional to the wipe frequency.

As Figure 3 shows, there is a significant opportunity to reduce print cycle time if the wipe frequency is below five prints per wipe. The marginal benefit declines exponentially as the number of prints per cleaning cycle are increased. The effect on first pass yield versus

REDUCING PRINT CYCLE TIME

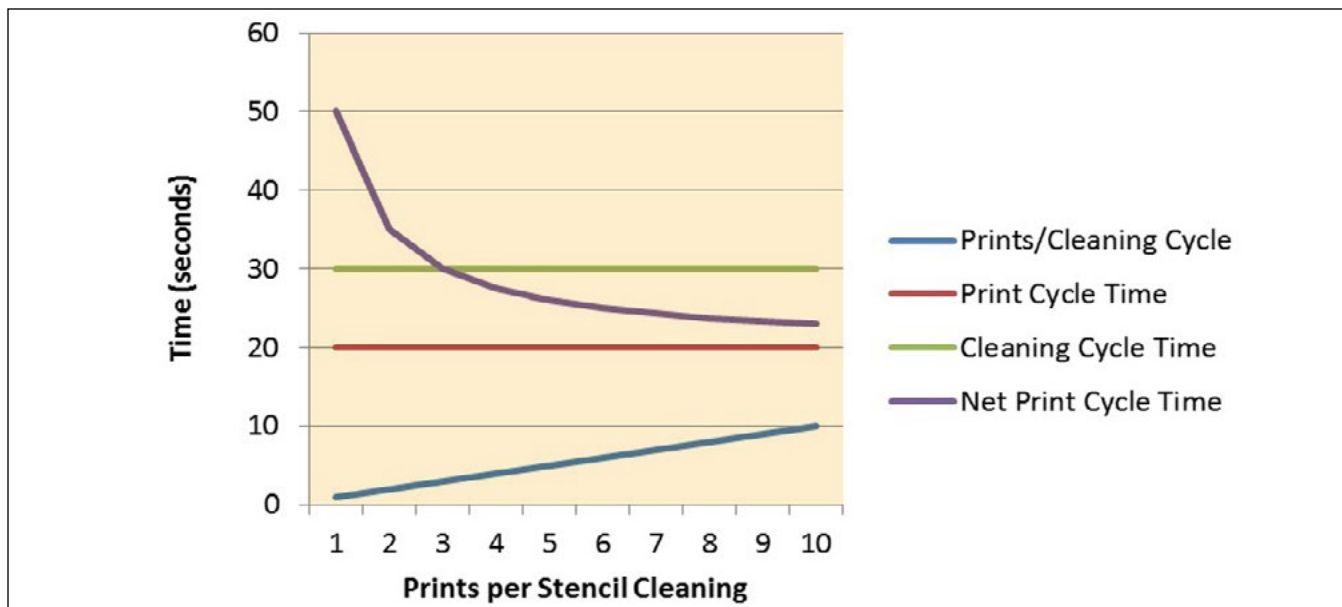


Figure 3: Wipe frequency versus cycle time.

throughput should be evaluated closely above 10 prints/wipe.

In conclusion, if the printing cycle time is the rate determining step in the SMT process, increasing the squeegee speed and pressure as well as reducing the frequency of stencil cleaning may be easily tested methods of increasing the number of quality circuits produced per unit time. **SMT**



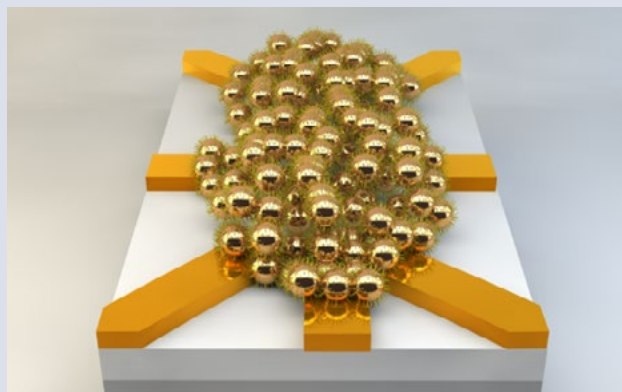
Mitch Holtzer is global director of customer technical service for Alpha. To contact Holtzer, [click here](#).



Lourenco Nampo is the South America Manager of Customer Technical Service (CTS) for Alpha, where he manages the CTS activities from Amazon to Tierra del Fuego. To contact Nampo, [click here](#).

Darwin on a Chip

Researchers of the MESA+ Institute for Nanotechnology and the CTIT Institute for ICT Research at the University of Twente in The Netherlands have demonstrated working electronic circuits that have been produced in a radically new way, using methods that resemble Darwinian evolution. The size of these circuits is comparable to the size of their conventional counterparts, but they are much closer to natural networks like the human brain. The findings promise a new generation of powerful, energy-



efficient electronics, and have been published in the leading British journal *Nature Nanotechnology*.



Cycle Time Reduction in the Eye of AOI

by **Stephen Las Marias**

I-CONNECT007

In our survey for this month's topic for *SMT Magazine*—cycle time reduction—inspection was identified as one of the key issues highlighted by respondents as a bottleneck in their manufacturing process when it comes to cycle times.

I spoke with Norihiko Koike, COO of Saki Co. Ltd, to get his insights on this, and how his company is helping their customers address the issue. He also talked about the future technology developments that we can expect in the AOI industry.

Las Marias: *From your perspective, Nori, what can you say about cycle time?*

Norihiko Koike: As a provider of 2D and 3D AOI, and AXI inspection machines, 2D AOI is the most traditional inspection machine that we have. When we talk about 3D AOI there's always not much issue about cycle time because ours is much faster than the cycle time of the production line; but when it comes to 3D AOI or AXI, cycle time is slower than the actual production time. So we need to start tightening up our technology so that it can meet the actual

cycle time. Right now, the trend is 3D AOI. A lot of our customers are chasing us to trim the cycle time of 3D AOI mainly. Our 3D AOI is in the range between 1.2x and 1.5x the cycle time of 2D AOI. So I think it's quite close, and I believe in the near future it will be within the requirement of our customers.

Las Marias: *Considering your customers, why do you think they have longer cycle times in their processes, and how do you think they can cut that down?*

Koike: The biggest issue from our customers' point of view will be the slowest machine in the line. In 2D AOI, it will never be the bottleneck, but it will be with 3D AOI. From the customer's point of view, the best solution is to have all equipment become faster and faster. So, it depends on what kind of line that our customer designs. If it is a very long line with mounters mounting many components, then often the bottleneck will be the mounters, not the AOI. But on the other hand, if the components are so tiny that they will need X-ray inspection, the problem is bottlenecking at X-ray inspection.

So it depends on the customer. But we do our best to talk with our customers and try to find a solution. If it is on our equipment, we

If you're using a major ERP solution, adding Portus will give you a competitive advantage, increase your productivity, and help you grow your business.

We combine decades of manufacturing expertise with advanced software development capabilities to produce game-changing business intelligence and workflow automation solutions for manufacturing companies.

Our solutions are revolutionary because we have fully automated the entire process of converting your transactional data into content rich, interactive web pages with continuous drill down. If you use a major ERP platform (like the ones below), we can offer you a turnkey solution with immediate time to value.

ORACLE®  **expandable**

 **MADE2MANAGE®**



"By adding Portus to our Made2Manage ERP, we no longer felt the need to undertake a costly transition to a new ERP solution – we now have a leading-edge business system on par with and beyond much more expensive options."



*-Joe O'Neil, President
Hunter Technology, Inc.*

See how Portus can be a game-changer for your business

Take our 30-day risk-free trial »

www.portusinc.com | 510.431.2318

CYCLE TIME REDUCTION IN THE EYE OF AOI

just keep on working with our customers so that our equipment will not be the bottleneck.

Las Marias: *What about cycle time's impact on cost, especially now with the increasing cost of testing or inspection?*

Koike: Of course, the faster the inspection time is, the lower the cost will be. But also this depends on what the customers are manufacturing. For example, satellite and aerospace industries—inspection is a must. And they need to see everything before they launch the rocket, for instance. But when it comes to mobile, it's the other way around. They can't see every single thing in their components. So in that case, we often offer 2D AOI, 3D AOI and if it's 3D AOI, and they only need 2D AOI, the cost will be substantially lower than X-ray inspection.

Las Marias: *Finally, Nori, they are saying that automation will improve the processes in the production line. And I think it will also be able to help manufacturers reduce their cycle times. Can you please give your comments on that?*

.....



Norihiko Koike, COO of Saki Co. Ltd

Koike: We keep on developing the latest technologies in inspection. But at the end, I think the inspection will be much closer to the measurement. The reason why I say this is because the equipment cost is directly related to the cost of our customers. That's not the only issue. If the equipment is in place, it reduces the cost of labor, then that will be another story.

Right now, the inspection needs a lot of programming and a lot of people surrounding the SMT to actually run the line. But if the measurement comes in, it will be much less effort to make the actual programming, and it will be a lot more effort to actually redo all the NG boards. So at the end, if we can start providing the latest technology, which will be the measurement, then this measurement technology will start contributing to a more efficient production, and it will be much more easier for our customers to shrink their cost.

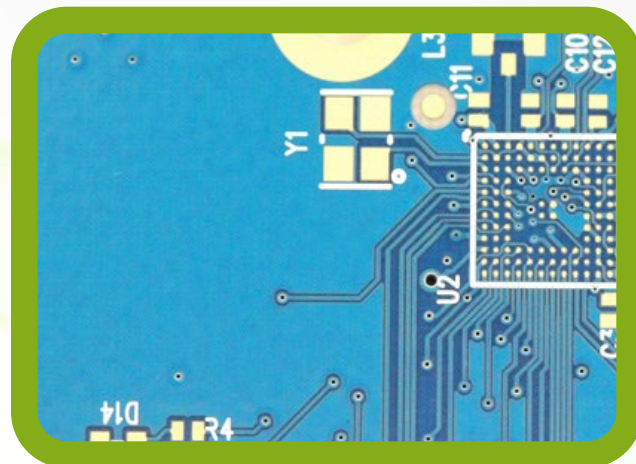
Las Marias: *What can you say about the future of the AOI industry?*

Koike: It is very much closely related to SMT and a part of the SMT industry. SMT is starting to go in the direction of a smart factory, with all of the equipment linked together. We will follow this trend, not only with one manufacturer, but a lot of manufacturers, so that it can be linked with any kind of machine. With AOI, it will be the same; AOI is the inspection machine, installed after the printer, after the mounter, after the reflow, so there's basically not only SMT, but the THT process, for a total of at least three, maybe five inspections during manufacturing. But the inspection equipment itself will inspect and that's all that one machine can provide. If you start linking all of these, and have some time for big data, we can analyze what is happening in the line and feedback much more useful information to the printers or mounting machines. So we, and a lot of AOI manufacturers, are starting to aim in that direction, to provide a much more efficient inspection result in the line.

Las Marias: *Thank you very much, Nori.*

Koike: Thank you, Stephen. **SMT**

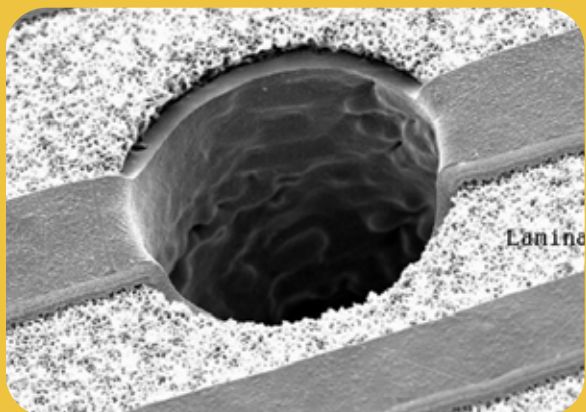
We deliver Advanced PCB Solutions!



Fine line PCB, 2 mil line /space

We have developed a unique set of processes based on electro-depositable liquid photoresist.

[CLICK TO LEARN MORE](#)

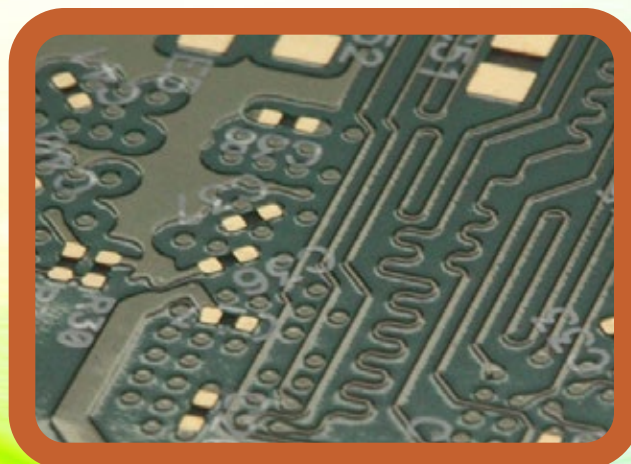


Landless Via Technology

We're the only manufacturer in the world to have perfected a liquid photo-imageable resist (PiP) in electrolytic form, used for all our production.

[CLICK TO LEARN MORE](#)

Our unique processes enable us to create and deliver Advanced PCB Solutions that meet the needs of the demanding market at competitive prices!



Impedance Tolerance <5%!

With our panel plating process combined with continuous foil lamination, our impedance tolerances are second to none!

[CLICK TO LEARN MORE](#)



CANDOR INDUSTRIES, INC.
ADVANCED PCB SOLUTIONS

www.candorind.com | sales@candorind.com | (416) 736-6306





Engineering And Providing Balanced Interconnect Solutions



Flexible Printed Circuits • Rigid Flex • Wire Harnesses • Complete Assemblies

Our products and services are specifically designed to empower our customers to produce a product with superior performance and quality, as well as lower design, assembly, and system installation costs.

Partnering With Your Engineering Team To Deliver The Best Solution

...connecting technology

**Miraco, Inc. • 102 Maple Street, Manchester, NH 03103 • miracoinc.com
603-665-9449 • Fax: 603-665-9459**



Reducing Cycle Times with Innovative Bonding Solutions

by **Stephen Las Marias**

I-CONNECT007

For more than 50 years, Delo Industrial Adhesives has developed tailor-made special adhesives and application technologies for the automotive, aviation, optoelectronics, as well as consumer and industrial electronics industries. The company also offers select equipment like a pneumatic microdispensing jet-valve or LED curing lamps that match its adhesives with its customers' processes.

Headquartered in Germany, Delo has subsidiaries in the United States, China and Singapore, and offices in several other countries. With 400 employees worldwide, Delo generated sales revenue of nearly \$93 million in fiscal year 2014–2015. Focused on innovation, Delo allots about 15% of its annual revenue—much higher than the industry average of 3 to 4%—for R&D. And so far, its biggest growth comes from innovative products developed within the last three years—accounting for 30% of its total sales revenue.

As a mid-sized company, Delo has strategically opted to concentrate on specific bonding applications with the highest challenges. These unique applications all meet a three-fold re-

quirement. Each needs a small amount of adhesive that must cure quickly, the capability to produce high-volume in fully automated production processes, as well as the ability to be exposed to harsh thermal, mechanical or chemical conditions.

In an interview with I-Connect007, Gudrun Weigel, head of engineering and a member of the board at Delo, talked about the importance of cycle time reduction, and how the company is helping its customers address this issue.

Stephen Las Marias: *How do you define cycle time?*

Gudrun Weigel: We see cycle time as a part of an overall process. When planning the production of parts or of assembly groups, it is important to first analyze the whole process, and then split it into different steps.

At the very minimum, when looking at the application of adhesives or encapsulants, process time is composed of the sum of dispensing the adhesive, joining the parts, and curing. In some cases other processes, such as surface pretreatment or subsequent tasks like demolding or in-process inspection, can be added. Depending on the industry and the application, cycle

STRIVING FOR EXCELLENCE IN EVERYTHING WE SAY AND DO.

- Prototype to Production
- Time Critical Production
- Commitment to Customer Service
- Best Quality & Delivery Performance
- Fair and Competitive Pricing/Costs
- Rapid Response to Quote Requests
- Flexibility Scheduling
- Stock/Consigned Inventory Programs

Tour our Facilities

View our Capabilities

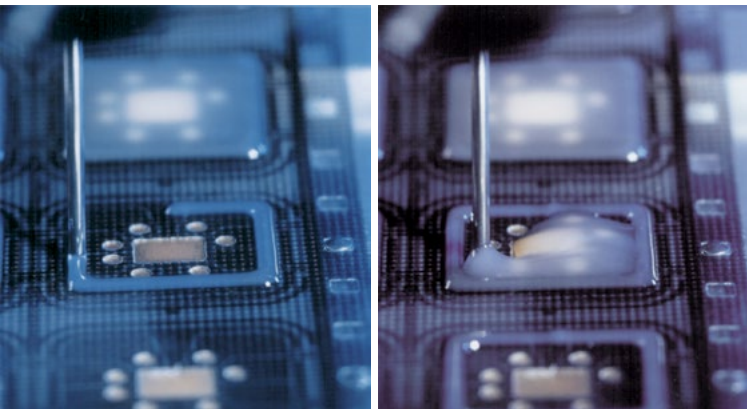


MANUFACTURERS OF QUALITY PRINTED CIRCUIT BOARDS

**The Absolute Best Value in
High Technology Circuit Boards**

847.891.5800 • www.eagle-elec.com

REDUCING CYCLE TIMES WITH INNOVATIVE BONDING SOLUTIONS



Dam and fill is a very precise encapsulation technique allowing for fine geometries. Cycle times can be reduced if the adhesive enables dispensing the fill in the not-yet cured dam, eliminating one process step.

.....

times of adhesive processes can start with less than a second or reach in excess of 20 minutes.

Las Marias: *How important is reducing cycle times and how do longer cycle times affect costs?*

Weigel: As the saying goes, 'time is money.' Slow output means less pieces sold, which equates to lower profits. So it should come as no surprise that high-volume production is definitely one of the key requirements of our customers.

However, from my personal perspective, cycle times should not be accelerated at the expense of quality because the majority of our products are used in high-performance applications and their properties ensure that the assembly group works correctly. No matter how quickly a product is being produced, if it isn't good quality, it isn't worth much, now is it?

But ultimately, it is up to the customer to decide.

Las Marias: *What are the biggest bottlenecks in your process that contribute to longer cycle times?*

Weigel: The curing of encapsulants or adhesives is often the defining step of the cycle time and can even become a bottleneck. That's why most of our customers are interested in fast-curing adhesive systems and their corresponding curing equipment. For some applications, we offer

light-curing products that cure within seconds as well as the corresponding LED curing lamps with the adjusted wavelength spectrum and intensities.

For high-temperature applications and harsh environmental conditions, where heat-curing epoxies are what work best, faster heat-curing products need to be developed in conjunction with the use of technologies that transport the heat to the adhesive as quickly as possible.

An example of this would be thermodes: An adhesive that cures in 20 minutes in a convection oven, only needs five seconds for curing in a thermode process due to the direct heat input. Other customers speed up the production of their assembly lines with induction systems that cure one- or two-component products.

We have also focused our efforts on very efficient, dual-curing adhesives, since we see them as one solution for the accelerating assembly processes of our customers. What we call 'DUALBOND' means that high-energy light fixes the parts in the cycle so that they can be handled and the assembly process can be continued. They reach their full strength, particularly in shadowed areas, with the help of a second curing mechanism. This can either be heat-curing, as it is often the case in semiconductor packaging, or humidity-curing, which allows the curing process to finish during storage.

Las Marias: *Please give some examples as to how you were able to reduce the cycle time of a particu-*

.....



PCB casting.

REDUCING CYCLE TIMES WITH INNOVATIVE BONDING SOLUTIONS

lar process or project of yours or your customer? What were the main challenges here?

Weigel: When using the chip on board technique, the chip is directly bonded on the PCB and then wire-bonded to apply electrical contact. The chip then gets encapsulated to protect tiny wires from damage.

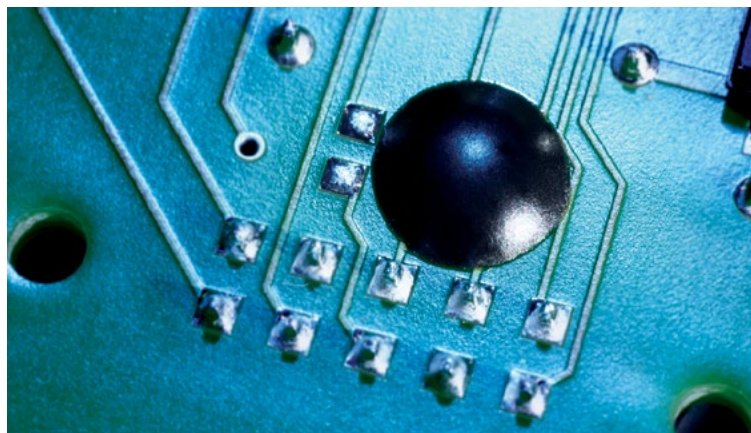
If a manufacturer uses the dam and fill method instead of a glob top to reach a lower height, more process steps will be required. First, a high-viscous dam needs to be dispensed around the chip. Afterwards, the space is filled with a low-viscous system. While some products on the market require intermediate curing steps, manufacturers with our adhesives can dispense what we call “wet in wet.” This means that neither the single dams nor the entire wall must be cured intermediately, and even the fill can be dispensed before any curing takes place. Curing the complete encapsulation in one step results in reduced cycle times and thus a great increase in productivity.

Las Marias: Please talk about best practices that will help assemblers and manufacturers reduce cycle times in their processes.

Weigel: The most important thing is to take a holistic approach. We always recommend that our customers consider adhesives in the early design phases. It's only then that you can leverage all benefits of bonding. Assigning the tasks of the assembly group, creating a specifications sheet for the adhesive, defining test methods and parameters and working out different bonding processes should all be done early on.

Las Marias: What does this mean in practice?

Weigel: In terms of design, you should make sure that it is adhesive-friendly. When looking at a component level, its material, its preparation and a potentially necessary pretreatment are all important. Considering the adhesive, you should also take its transport into account as well as its storage and handling. I would also think about the strain on the component and how to simulate this in the R&D phase. Lastly, I would take a look at the site of assembly, pro-



Chip encapsulation for automotive and industrial electronic products requires encapsulants with extremely good thermal and chemical resistance.

.....
duction facilities, suppliers, assembly parameters and the know-how of the employees.

Las Marias: Can you give some examples as to how manufacturers can address this issue?

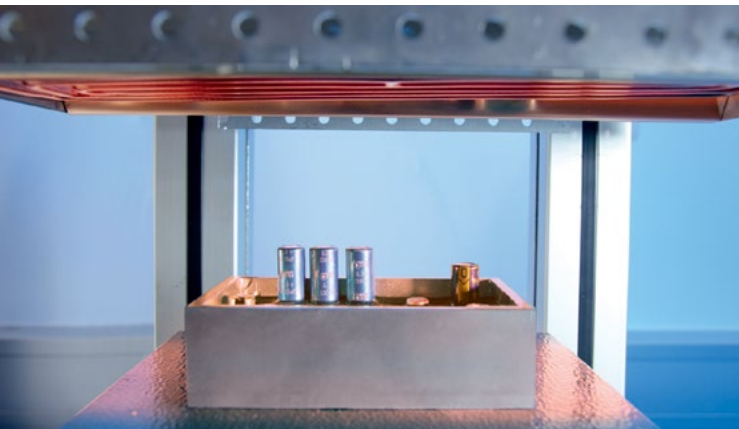
Weigel: With light-curing, dual-curing and quicker heat-curing, we have already discussed different technologies to accelerate cycle times from an adhesive and a curing equipment perspective. Other process components that can speed up production are using plasma if pretreatment is beneficial and jet valves or eccentric screw pumps for dispensing.

Las Marias: Some assemblers say SMT equipment such as pick-and-place machines are among the key issues when it comes to cycle time reduction. Please give your comments on this.

Weigel: Understanding high-volume production processes is essential for an adhesive manufacturer. We have a department that specializes in very specific applications. For example, one of our engineers may be well versed in all the fine details of chip encapsulation, while another may focus primarily on MEMS packaging processes.

Delo has very specific equipment and machines in its labs. For example, with our fully-automated die placer, we can re-produce customer processes under realistic circumstances

REDUCING CYCLE TIMES WITH INNOVATIVE BONDING SOLUTIONS



In this example, curing a casting compound by infrared radiation speeds up production when compared to conventional heat-curing.

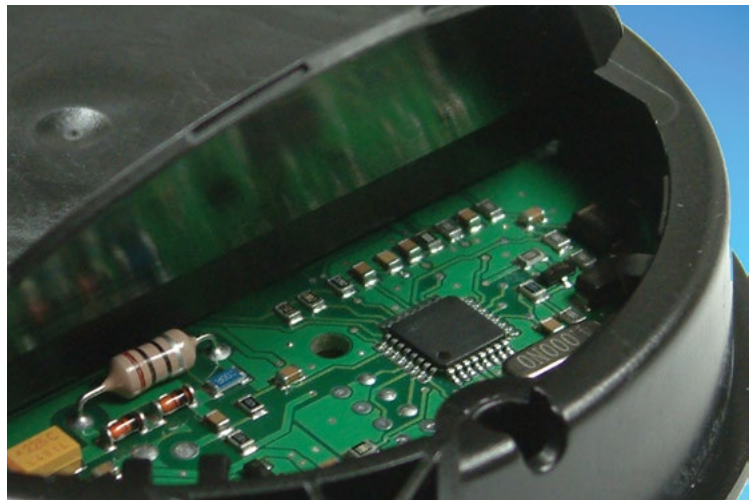
and suggest parameter sets for the integration of dispensing, joining and curing of the adhesive in an assembly line. This proposal normally leads to an optimal flow with reduced cycle times, enabling the customer to quickly evaluate and select the fastest, most secure process from its suppliers.

Las Marias: *What about equipment downtime? How does that contribute to cycle times, and how do you think should assemblers address that?*

Weigel: Obviously, the number of pieces produced shrinks if there is downtime. It is essential to closely evaluate the process before implementation. It is advantageous to work closely with the adhesive manufacturer because they are a wealth of knowledge on their products and how they will work with yours. From the assembler's perspective, it is a good idea to reserve process capacities so that adjustments can be made if necessary.

Dimensioning a machine correctly can largely avoid downtimes due to overload or functional deficits. A periodic maintenance and service are as indispensable as continuously checking the system components and their performance.

Las Marias: *What about quality? How do you ensure that quality remains the same throughout the assembly line as you strive to reduce cycle times?*



PCB housing.

Weigel: Our goal is to not only preserve, but also to help our customers to increase quality following best practices. Apart from reducing cycle time, quality and reliability are the main focuses of all of our activities.

As the mentioned earlier when we discussed the die placer, Delo has very well equipped labs in which we have plenty of opportunities to simulate dispensing and curing as it is done in the factories of our customers. We have also developed analytical methods and suitable test techniques to support customers in their adhesive selection.

Quality also depends on the educational level of the operators. That's why we have recently founded the Delo Academy that is supposed to train our customers in-house or at their facilities. It's no coincidence that one module covers short processes.

Not-qualified and decreased cycle times that do not match the chemical process of curing can lead to a loss in quality and reliability. That said, it makes much more sense for an assembler to connect with an adhesive manufacturer from the start.

Las Marias: *Gudrun, thank you for your time today.*

Weigel: Thank you, Stephen. **SMT**

Electronic Interconnect is
your best value for PCBs,
because we are...

THE PCB EXPERTS.

Electronic Interconnect is a reliable manufacturer of high-quality PCBs – up to Class 3 – with nearly 30 years of experience working with contract manufacturers and board assembly operations.

Our advanced capabilities include:

- Single, double sided, multi-layers or Rigid-flex
- Metal PCBs – up to 4 layers
- Material thickness from 0.005" to 0.250"
- Line width and space is 0.005"
- Panel layout assistance with Stencil files

...and that's only the beginning!
To learn more about our key
advantages for CM's, download our
brochure today!

Download our brochure:
**Best Value PCBs for Contract
Manufacturers and Assemblers**

CLICK HERE TO DOWNLOAD



NOW TS-16949 AND AS9100 CERTIFIED!



 **800.364.4844**  **sales@eiconnect.com**

Electronic Interconnect Corp. 2700 W. Touhy Avenue, Elk Grove Village, IL 60007



Technologies to Enable Quick-Turn PCB Assemblies

by **Khurrum Dhanji**
IMAGINEERING INC.

Many new and unique processes enable quick-turn assembly in 24 hours rather than days. Latest innovations include state-of-the-art machines, such as the stencil-less jet printer, and a proprietary PCB assembly turnkey quote system that gives customers a quote in minutes—not in days or weeks—and a fully assembled prototype PCB in 24 hours, after receipt of all materials.

Multi-day lead times for PCB assembly are a thing of the past as a few advanced thinking assemblers have worked hard to remove the time-related road blocks, enabling quick prototype assembly.

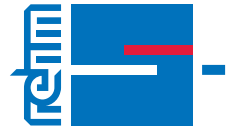
New software such as Instant PCBA Quotes Online allows you to receive a guaranteed quote in minutes. The second major time-related hurdle to be eliminated was the cost of buying and waiting for the solder paste stencil to be manufactured and delivered. A new disruptive technology, the advanced solder paste inkjet, is an in-line soldermask printer that allows instant changes between assembly jobs. Full and instant 3D printing of different thicknesses of solder paste, improved start-to-delivery time for prototype PCB assembly, and significantly improved soldering quality eliminates 90% percent of the rework time.

With reduced product development times, the electronic manufacturer's requirement for PCB assembly is 24 hours, enabling continued rapid development of a new product that will not stall at the final stage.

Stencil-less Jet Printing

For many years, stencil printing has been the standard and durable method of depositing solder paste on surface mount assembly PCBs, but difficulties often significantly slowed down a change from one product to another in the assembly operation, as well as added cost. A significant challenge in newer, smaller electronics assembly is the huge difference of size among components. Therefore, trying to apply the right amount of solder paste for each component with one stencil is difficult. The biggest problem is how to produce quick-turn prototypes without disrupting series production that is already running in the line. Product changeover requires time-consuming tweaks to the stencil printing process, while unnecessarily shutting down an expensive assembly line to change the product. The inability of the stencil's technology to vary solder paste volume by part, on the run, remains the biggest impact on the soldering quality.

Solder paste parameter optimizing after set up can take considerable time away from pro-



THERMAL SYSTEMS

Selective Conformal Coating -

Protective coating of electrical components



- › Greatest possible **process reliability**
- › Up to **4 heatable nozzles**
- › Highest coating **accuracy**
- › **All-in-one** lacquering

Jetting
Dispensing
Spraying



Protecto
Dispensing

For more information visit www.rehm-group.com
or call +1 770 442 8913

TECHNOLOGIES TO ENABLE QUICK-TURN PCB ASSEMBLIES

duction. Frequent changeovers create a bottleneck in assembly speed. Stencil manufacturing and lead time, as well as occasional replacement, add to the delays. Each PCB design and design change requires a new stencil. Thus, stencil costs and two- to three-day time delays can happen with multiple rev changes. Stencil-free jet printing technology has been developed to meet the demand for greater flexibility in modern electronics production, significantly improving the throughput speed. The CAD data (or Gerber data) for a particular PCB, compiled off-line, is sent to the ink jet printer for instant printing.

“The process is completely controlled by software. The solder paste volumes can be altered “on-demand.” The ink jet printing process allows control of solder paste deposits with precision, in 3D.”

High-speed solder paste depositing by jet printing is made possible by a unique ejection method. The technique ejects tiny droplets of solder paste from a cartridge through an ejector mechanism onto the PCB at the positions required by the Gerber file. The ejector system operates at speeds up to 500 droplets per second, which enables solder paste printing on the fly. The different types of solder paste used for jet printing are delivered in standard cartridges. The cartridge is swiftly snapped into the machine in seconds, so you can switch from tin/lead to lead-free solder paste in a matter of minutes. A barcode label on the solder paste cartridge and an identification chip in the cassette ensure that the wrong type of solder paste, or solder paste past its due date, is never loaded by mistake. The electronic identification barcode label and cassette memory make machine

settings automatic. Once the paste code type is entered, the printing can start.

Touchless jet printing technology applies no force to the PCB, hence no support pins are needed, further improving start-to-finish speed. In addition, the print program automatically aligns and adjusts to the PCB board stretch based on the fiducial marks. Accurate temperature control ensures that proper viscosity of the solder paste can be maintained at all times, which in turn leads to higher levels of application accuracy. The process is completely controlled by software. The solder paste volumes can be altered “on-demand.” The ink jet printing process allows control of solder paste deposits with precision, in 3D. It is possible to fine-tune the volume, area coverage, height and layers of solder paste that need to be applied for every individual pad, component and package. Ink jet can print pads for components with pitches as small as 0.4 mm (16 mil). With this level of control, you can print small deposits next to large ones (e.g., 0201s right next to connectors, something stencils have a hard time doing, resulting in time-consuming hand solder operations). For PCB assembly shops, the less on-line operator involvement needed, the faster it is to assemble a PCB while consistently maintaining higher levels of quality. To maintain a high degree of flexibility, printing programs can easily be adjusted on the fly if revisions are needed.

The absence of stencils ensures other time-reduction benefits, such as no need for special paper for underside wiping, no need for stencil cleaning machines, no need for clean up and storage of stencils, and no risk of damaging the stencils during handling (damaged stencils result in time delays to reorder, as well as faulty solder joints that need time to touch up). The lead time for the arrival of a new stencil delays production for several days, which results in delivery delays to the customer. **SMT**



Khurrum Dhanji is the CEO and managing partner at Imagineering Inc.



DON'T FEAR THE SHADOWS.

Conquer them with secondary curing – and protect the whole board.
Conformal Coatings from Dymax.

Give your PCB the ultimate protection with Dymax. In addition to secondary curing, Dymax offers:

- Faster, tack-free cure
- Ambient moisture cure in just 2-3 days
- Easy re-workability
- Solvent-free coatings

Let Dymax shed some light on your next project. Contact us today.



www.dymax.com/smtconformal • 877-396-2988

Process Improvements for Cycle Time Reduction



by **Stephen Las Marias**

I-CONNECT007

One of the issues highlighted in I-Connect007's Cycle Time Reduction survey for *SMT Magazine* this month was how automation can help reduce cycle times.

To help answer this, industry veteran Randall Williams, a mechanical automation engineer at B&P Automation Inc., explained the importance of reducing cycle time, key metrics to look for when planning for improvement processes in assembly lines, best practices to consider, and how automation can help electronics manufacturers improve their production.

Stephen Las Marias: *How do you define cycle time, and from your experience in the electronics assembly industry, what are the biggest bottlenecks in assembly lines that contribute to longer cycle times?*

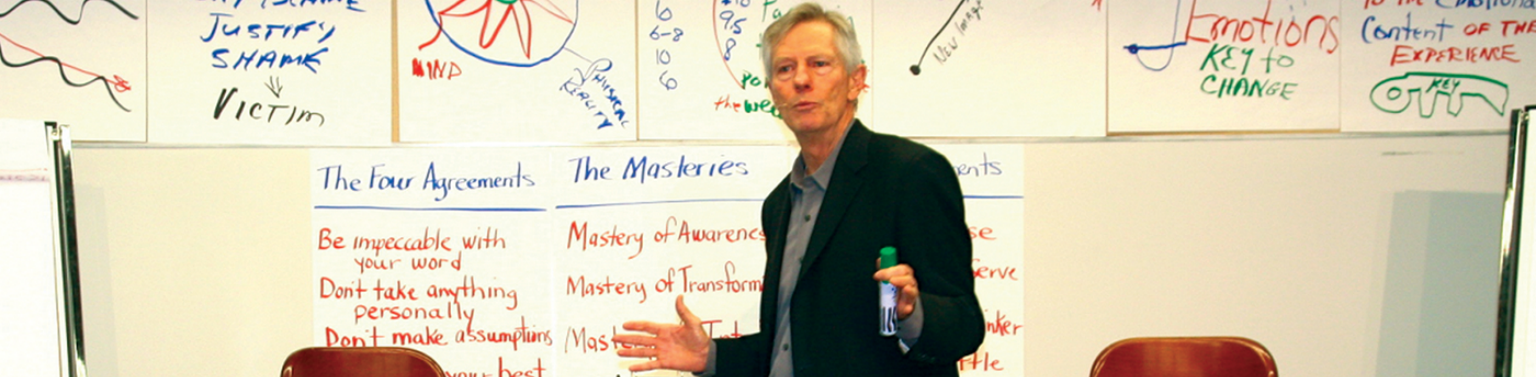
Randall Williams: Every company calculates cycle time differently. Ours is simple: value addition/time required to add that value. I do

not calculate visual inspection as part of that time because I normally work with automation that includes machine vision in milliseconds—not significant time added. Example: inserting chemicals into wells of the product/amount of time required to perform that function.

Bottlenecks fall into three categories: inattentive/inadequately trained operators; equipment requiring human interaction to keep it running or long time cycle programs; and incorrectly designed process sequencing. The latter is where most of my time is spent. I can usually re-order the process sequence to reduce bottlenecks. Part of that effort is typically spent in designing or locating different equipment to perform a function. Product burn-in or cure is a good example. Taking that step out of the process flow and making it a feeder line is sometimes the answer.

Las Marias: *How important is reducing cycle time?*

Williams: CT reduction is always a large benefit to a manufacturer. My experience has shown that reduction of in-process inventory has the greatest impact on the bottom line. The faster



It's not what you *DON'T* know that is hurting your business. It's what you "know" that ISN'T SO!

Are you curious about how this truth may be hurting your business? Do you want proven effective solutions to the problems keeping you up at night? Join us for fast-paced, experiential learning that will have you buzzing with new ideas and systems-based possibilities—a leader's or manager's best friend. Take your business to the next level with amazing new tools based on Nobel Prize winning science ... *Sign up today!*

CALLING ALL LEADERS & MANAGERS

Join us in Oceanside, CA for our amazing LIVE workshop.

**NOV
17**

The Four New Agreements for Leaders & Managers

Tuesday—8:30 AM to 5:00 PM (Pacific Time)

[more info](#)

Creating High-Performance, Systems-Based, Conscious Business Cultures
Fast - Simple - Sustainable - Proven Results


DIBBLE LEADERS
THE FOUR NEW AGREEMENTS FOR SUSTAINABLE SUCCESS
4newagreements4leaders.com



**FREE BOOK
DOWNLOAD**



For 25 years we have been doing Four New Agreements consulting and training, significantly improving businesses. This stuff really works!

—David Dibble



PROCESS IMPROVEMENTS FOR CYCLE TIME REDUCTION



Randall Williams, mechanical automation engineer, B&P Automation Inc.

.....

you can get product to the customer, the lower your cost per unit. With CT reduction, you can plan for larger start quantities in a given time frame, allowing better pricing on raw materials with those increased quantities.

Las Marias: *From your experience as a consultant to electronics assembly manufacturers, can you please give some examples as to how you were able to help reduce the cycle time of a particular process or project? What were the main challenges here, and what tools or strategies did you implement to help shorten the cycle times of these processes?*

Williams: I was working at a medical product manufacturer some years ago and part of a team that was tasked with this challenge. We determined that an automated single room production line, single unit lot, continuous flow with infrequent product changes was the answer. So that was what we worked on for about two years.

My portion was the material handling, robotics/machine vision and computer integration designs. Some of the process steps would benefit from existing equipment vendors, while others had to be designed as a unique item.

The latter was the challenge. Finding a vendor with the basic process capabilities and design strength to put those together took significant time on the front end of the project. Most of our manpower was directed in that effort for two equipment items.

The remaining designs were much more straightforward—taking off-the-shelf equipment items and placing them in combination—and performing the integration required much less effort. We were able to reduce the process time from three days to about six hours. Each step was reduced to less than 50% of the former CT. We were asked to duplicate this line in other parts of the world. Some of the ‘non-value adding’ steps performed previously were eliminated.

We were fortunate to have garnered management support before the project started, making approvals much easier. The other success factor that was significant was transparency. I see so many companies that encourage territorialism—secrecy between departments. We were able to get great ideas sharing design concepts in brainstorming sessions with other non-related departments.

Las Marias: *Please mention some best practices that will help assemblers and manufacturers reduce cycle times in their processes.*

Williams: Firstly, get some ‘outside eyes’ to review the process: a consultant, engineers from a completely different process department, even spouses of the engineers working on the process. Secondly, brainstorm to gather value-adding, quantified solutions. Thirdly, review the solution options with management and get a clear and fully supported direction. This is usually the most frustrating part of a project. Fourthly, determine the team skill set and members and then put together an excruciatingly detailed plan. Lastly, hold brief, frequent status meetings with supporting managers. Assess a value-add metric to each unique process step, and determine what combinations get the best value (add up to the lowest number).

Las Marias: *What about automation? How does automation help reduce cycle time in an assembly line?*



2015 Programs

October 13

IPC Conference on Government Regulation

Essen, Germany

Discussion with international experts on regulatory issues

October 13–15

IPC Europe Forum: Innovation for Reliability

Essen, Germany

Practical applications for meeting reliability challenges like tin whiskers, with special focus on military aerospace and automotive sectors

October 26–27

IPC Technical Education

Minneapolis, MN, USA

Professional development courses for engineering staff and managers:

- DFX-Design For Excellence (DFM, DFA, DFR and more)
- Best Practices in Assembly
- Advanced PCB Troubleshooting
- SMT Problem Solving

October 28–30

IPC Flexible Circuits-HDI Conference

Minneapolis, MN, USA

Presentations will address Flex and HDI challenges in methodology, materials, and technology.

November 2–6

IPC EMS Program Management Training and Certification

Chicago, IL, USA

November 4

PCB Carolina 2015

Raleigh, NC, USA

November 10–13

productronica

Munich, Germany

December 2–3

IPC Technical Education

Raleigh, NC, USA

Professional development courses for engineering staff and managers:

- DFX-Design For Excellence (DFM, DFA, DFR and more)
- Best Practices in Assembly
- Advanced PCB Troubleshooting
- SMT Problem Solving

December 2–4

International Printed Circuit and APEX South China Fair (HKPCA & IPC Show)

Shenzhen, China

December 7–11

IPC EMS Program Management Training & Certification

San Jose, CA, USA



IPC Flexible Circuits – HDI Forum

October 28–30, 2015 • Minneapolis, Minnesota

ADDRESS challenges associated with flexible circuits and HDI technology

To help you make optimal choices for meeting customer reliability requirements, IPC has gathered leading subject matter experts to share their knowledge and experiences with you in an exciting three-day forum.

- | | | | |
|------------|-----------------------|---------------------------|--------------------|
| • Battelle | • Flextronics | • Multek-Flextronics | • SAIC |
| • DuPont | • Insulectro | • Orbotech | • TTM Technologies |
| • eSurface | • Intrinsiq Materials | • RBP Chemical Technology | |

For more information, visit www.ipc.org/flex-hdi

QUESTIONS? Contact IPC Director of Education at AnneMarieMulvihill@ipc.org

Visit www.ipc.org/events for IPC Calendar

PROCESS IMPROVEMENTS FOR CYCLE TIME REDUCTION

Williams: Any automation design combines a group of process steps into a ‘cell’ that leverages existing technologies: robotics, machine vision, part conveyance, specialized processing equipment. All of these technologies will reduce ‘handling’ time for each part. The additive effect is always significant reduction in cycle time for those processes. Equipment is designed in close proximity so that material movements are predictable, brief, and very repetitive. The caveat is that fewer workers will be required—often only one—but that operator has to be a much higher caliber individual.

Las Marias: *Some assemblers say SMT equipment such as pick and place machines are among the key issues when it comes to cycle time reduction. Please give your comments on how manufacturers should address this.*

“Any automation design combines a group of process steps into a ‘cell’ that leverages existing technologies: robotics, machine vision, part conveyance, specialized processing equipment. All of these technologies will reduce ‘handling’ time for each part.”

Williams: I agree, but significant time and expertise are required to select the right equipment—from the multitudes offered—that meets all of the requirements. This implies that a very detailed requirements list has been generated. Engineers do not like doing this! Some key issues are: component feed reliability, speed against repeatability of the robotics, gripper change frequency, programming ease or user friendliness, computer/data integration adherence to stan-

dard protocols, upper level control capabilities, and part/lot/batch tracking resolution needs.

Las Marias: *What about equipment downtime? How does that contribute to cycle times, and how do you think assemblers should address that?*

Williams: High MTBF and MTTR metrics can quickly render CT numbers as useless. Companies should track these and recalculate at least weekly. This requires a good operator to report properly, or an automated system that records ‘out’ and ‘in’ times reliably. Frequent interaction between operators and maintenance people is essential.

Las Marias: *Can you give some examples as to how manufacturers can address this issue?*

Williams: Setting clear expectations with operators is necessary. The employee has to feel empowered—and non-threatened—to motivate them to do this. The one item that I find has been disjointed through the years is that a company will embark on a company culture path—JIT, lean, SPC/DOE, Kanban—and then abandon it after a few months, moving to something else. Operators can see through this! The message sent is that it not really important. Set the plan and stick with it for at least two years.

Las Marias: *What about quality? How do you ensure that quality remains the same throughout the assembly line as you strive to reduce cycle times?*

Williams: Training on ‘who is responsible’ for quality is important. That message is often not conveyed very well, especially if there is a large contingent of QA people around.

Las Marias: *Definitely, one of the things that are helping manufacturers cope with the high rate of change is by automating processes in their manufacturing lines. From your perspective, which processes in electronics assembly can easily be automated?*

Williams: On first pass, I look for people (production workers) who are yawning or often talking with fellow workers. That tells me which

PROCESS IMPROVEMENTS FOR CYCLE TIME REDUCTION

jobs are boring. Next is a safety issue—but that is usually brought up by the company bringing me into the plant. Processes that are boringly repetitive or have injury risk are on the top of the list. Last on the list are processes in which the operator has to use manual dexterity or judgement in determining a part status.

Las Marias: *What are the risks and challenges that need to be considered when a decision has been finalized to automate certain assembly processes?*

Williams: First is internal expertise available. Second is how committed is management. Automation is expensive on the front end—always two to three times more expensive than anticipated. The key is the incremental rate of return (IROR), and how well the manager understands this.

Las Marias: *From a production standpoint, how will automation benefit a company?*

Williams: I always steer them away from the ‘automation because I think we should’ viewpoint.

There has to be obvious, quantifiable practical value in CT reduction, quality improvement, and operator safety. My job is to assess and summarize those benefits.

Las Marias: *Do you think robotics will replace human workers in an assembly line?*

Williams: Never. There will always be situations that automation cannot address. For example, multistep automation cell has a gripper failure. An operator has to troubleshoot, fix, then recover all part states and tracking data.

Las Marias: *What can you say about the future of automation in the SMT industry?*

Williams: It will continue to grow. Technologies not yet invented will always involve some level of automation necessary to make it possible.

Las Marias: *Thank you very much, Randy.*

Williams: Thank you. **SMT**

Nanostructures for Contactless Control

LMU chemists have developed a photonic crystal from ultrathin nanosheets that changes color in response to moisture. The new material could form the basis for humidity-sensitive contactless control of interactive screens on digital devices.

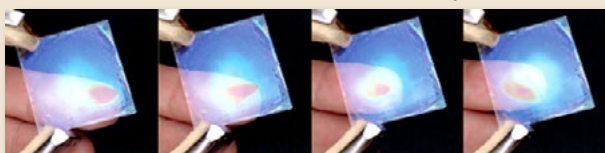
“These photonic nanostructures change color in response to variations in local humidity. This makes them ideal candidates for the development of novel user interfaces for touchless devices,” says Professor Bettina Lotsch of the Department of Chemistry at LMU and the Max Planck Institute for Solid State Research in Stuttgart. The new sensing platform is described in the journal *Advanced Materials*.

The photonic crystals are based on nanosheets of phosphatoantimonic acid. The new nanomaterial is extremely moisture

sensitive and at the same time chemically stable, transparent and easy to fabricate into nanosheets. In comparison with other vapor sensors based on nanosheets, the new photonic architecture displays markedly increased response times, higher sensitivity and long-term stability.

“This unique combination of properties enables it to track and color-code finger movements in real time,” says Pirmin Ganter, who also works in Bettina Lotsch’s group. In addition, the new system is stable on exposure to air, and therefore functions not just under controlled conditions in the laboratory but also in the constantly varying environment of the real world.

Lotsch and her collaborators have already applied for patent protection for the novel device and, together with the Fraunhofer EMFT in Munich, they are already working on a prototype screen which, in addition to providing for color-coding, will also be equipped with an electronic readout capability.



THE RIGHT APPROACH

Cycle Time Reduction with WORK, Part I

by Steve Williams

THE RIGHT APPROACH CONSULTING LLC

Summary

Lean, theory of constraints (ToC), quick response manufacturing (QRM), cross training, and SPC are powerful, tried and true methodologies for process improvement. However, these tools are rooted in high-volume manufacturing environments and don't always play nice in a high-mix, low-volume (HMLV) operation. The new WORK manufacturing strategy was specifically developed to overcome these shortcomings while capitalizing on their strengths.

Limitations of the Current Toolset

Lean

Lean is a collection of tools and methods designed to eliminate waste, reduce delays, improve performance and reduce costs. Lean focuses on eliminating non-value-added activities, as opposed to more traditional improvement efforts, which focus on reducing the time in value-added steps. The *problem* with lean is that many of the tools work best in a high-volume process that has very little variation in product mix.

TOC

ToC is a methodology that focuses on removing bottlenecks from a process through a series of five steps:

1. Identify the constraint
2. Exploit (improve) the constraint
3. Subordinate (align all activities)
4. Elevate (additional actions)
5. Repeat

The *problem* with ToC is that, by definition, eliminating one bottleneck creates another, and in a high-mix process the bottlenecks can change with the mix.

Quick Response Manufacturing

Quick response manufacturing (QRM), a cell-based strategy closely related to focus factories that was developed specifically for HMLV, has been gaining popularity over the past few years. The *problem* with QRM is that it works best when equipment sets from a number of sequential departments can be physically organized into small cells. This becomes problem-



3D Circumference Inspection for Connector Insertion

Quality Control of Plug-in Contacts using 3D Measurement Method

free Webinar 27th October 2015

3:00pm London · 4:00pm Berlin · 11:00am New York

- Which requirements are requested for the quality of connectors, particularly plug-in contacts?
- Which technologies are necessary to measure plug-in contacts three-dimensionally?
- What are the advantages of combined inspection methods?
- Which CAD data format is needed for automatic program generation for positioning control of plug-in contacts?



CYCLE TIME REDUCTION WITH WORK, PART I

Office WORK Cell

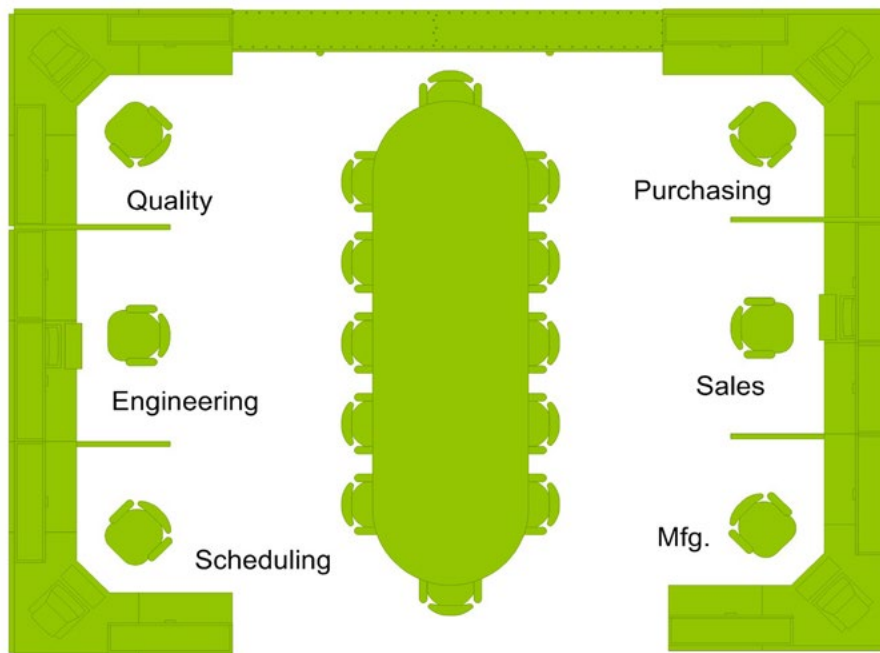


Figure 1.

atic in operations that have processes requiring capital intensive environments like plating, clean room imaging, etc., where setting up a single machine in a cell is prohibitive.

Cross Training

Cross training is critical to manufacturing continuity to overcome employee absences, specific department surges, and other unforeseen events that would compromise ongoing processes. The **problem** with cross training is that it is typically employed randomly, meaning that employees are cross trained based on their past experience or interest with no strategy to cross train across closely related tasks.

SPC

SPC uses statistical analysis to monitor and control processes. Once again, the **problem** with SPC is that it works best in a mature, high-volume process with a stable product mix. Companies tend to focus SPC on product specific attributes that change with each product, which creates challenges with processes that change part numbers multiple times daily like in printed circuit manufacturing.

Introducing WORK

Workflow optimized for rapid kinesis (WORK) adapts the most critical elements of the current toolset to the HMLV manufacturing environment. Developed over the past three decades in the trenches with manufacturing companies all over the world, this new manufacturing strategy is specifically aligned for high-mix, low-volume companies. WORK isn't just a production toolset; it applies to all processes from order entry through shipping. While the foundational tools and techniques are certainly not new or groundbreaking, the unique combination and adaption to HMLV manufacturing is. This first installment in a three-part series on WORK will focus on office operations, to be followed by production next month.

Cycle Time Reduction Starts in the Office

One of the biggest "A-ha" moments I've personally heard following a comprehensive assessment is just how much lead-time is consumed by office functions such as sales, order entry, engineering, and CAM. This is the fastest and easiest way to begin a WORK implementation with a payback that begins immediately. The follow-

CYCLE TIME REDUCTION WITH WORK, PART I

ing case study illustrates just how much cycle time can be regained with only a small process change and the reorganization of a few cubicles.

Company A

Company A is a \$24 million manufacturer of custom components serving the industrial, telecom and instrumentation market sectors. Company A reported a gradual loss of market share over the past two years along with increased customer pressure to reduce their standard 4–6 week lead-time to be more in line with their competitor's 3–4 weeks. TRA^c was contracted to perform a comprehensive “order entry to shipping” assessment and develop a cycle time reduction implementation plan.

Office Assessment

The assessment discovered that, on average, two-and-a-half weeks of Company A's lead-time was being consumed by office functions: sales, order entry, CAM, engineering and purchasing. A major collateral impact of this was that production was always put in the position of having to build product in a 3–4 week timeframe. Orders flow through the office functions in a linear fashion that tended to be batch processed. For example, each inside sales person would wait until they had a pile of orders before moving them to the order entry folks, which was repeated through the other functional groups. Sales booked an average of six quick-turn jobs per week, which became the top priority in each department, delaying every other standard production order in the queue regardless of due date. Another major cause of delay was technical questions from engineering that were filtered through sales back to the customer. Because of poor communication, it was frequently discovered that raw materials or components were not ordered in time to meet the delivery dates. Finally, every order went through the same path regardless of complexity.

The Office WORK Cell Solution

The first step was to analyze the type of orders coming into sales based on the production steps required to build them. The results showed that roughly 25% of all orders only went through about 55% of the process steps with the balance

requiring most of the steps. A designator was set up in the ERP system to differentiate between these two categories, using “L” for low complexity orders and “H” for high complexity.

The next step was to set up an Office WORK Cell (Figure 1), which physically located a person in the cell from sales, engineering/CAM, purchasing, scheduling, manufacturing, and quality. The key is to have these functions in an open, collaborative work cell where communication is instant, engineering can hear and participate with sales on technical discussions with customers, and drawings can be reviewed with all the major stakeholders at the same time.

The final step was to route all “L” jobs and “Q” (quick-turn) jobs through the office WORK Cell. It is critical that the type of jobs designed for the cell is of sufficient volume to sustain the cell; if not, the scope should be expanded. The key here is that the personnel in the cell are dedicated to only “L” and “Q” jobs with any downtime being spent cross training in the other cell functions to handle surges.

Results

The results were significant: Cycle times on “L” & “Q” jobs through the office WORK cell were reduced from 12.5 days to three days, giving production an extra 9.5 days to actually build the product! Because these orders were no longer running through the standard office path, a collateral cycle time reduction benefit was also realized on “H” jobs.

Next month, we will look at the second part of WORK implementation: setting up physical, virtual and hybrid WORK Cells in production to maximize the cycle time reduction benefits. **SMT**



Steve Williams is the president of The Right Approach Consulting LLC and the former strategic sourcing manager for Plexus Corp. He is the author of four books, including *Quality 101 Handbook* and *Survival Is Not Mandatory: 10 Things Every CEO Should Know about Lean*. To read past columns, or to contact Williams, [click here](#).

MilAero007

Highlights



Cirexx Sees Surge in Orders for ECLIPS Technology

Cirexx International has received over \$1 million in orders since launching its ECLIPS (Embedded Cooling Layer—Integrated Power System) technology for antenna and communications applications.

IEC Appoints Jens Hauvn as SVP of Operations

In his new position as Senior Vice President of Operations, Jens Hauvn will be responsible for IEC's manufacturing facilities throughout the United States and will report directly to President and CEO Jeffrey T. Schlarbaum.

Creation Technologies Welcomes Cong. Paul Ryan in Wisconsin Facility

Congressman Paul Ryan (R-WI-1), Chairman of the House of Representatives Committee on Ways and Means, recently met with executives and employees of IPC-member company Creation Technologies at the company's manufacturing facility in Oak Creek, Wisconsin.

Libra Industries Acquires ACD; Establishes New Facility in Richardson, Texas

Libra Industries' acquisition of ACD is a major step in the company's strategy to increase revenues and capture a larger share of the electronics contracting market.

Conflict Minerals Study: Only 25% of Filers Fully Met Dodd-Frank Section 1502 Requirements in 2014

A recent, independent evaluation of the public company "conflict mineral" filings submitted to the SEC for reporting year 2014 under Dodd-Frank Section 1502 found that of the 1,262 companies evaluated, 312 scored a perfect 100% and 245 scored below 75% in meeting the requirements of the SEC rule.

Sypris Reports \$40.8M Revenue for 2Q 2015

Sypris Solutions has reported revenues of \$40.8 million for the second quarter compared to \$93.1 million for the prior year period, reflecting the cessation of shipments to Dana Holding as of December 31, 2014.

LACROIX Electronics Named Polish Industry's Top Employer

Several well-known industrial groups with locations in Poland gathered to assist the ceremony award during which Polish Labour & Social Minister Władysław Kosiniak-Kamysz congratulated LACROIX Electronics for its job creation contribution and human resources policy.

FTG Cockpit Control Panels Receive Airworthiness Tags from CAAC

Firan Technology Group Corp.'s cockpit control panel assemblies being developed for Shanghai Avionics Corp. (SAVIC) as part of the Display System for the Chinese C919 aircraft have received airworthiness tags from the CAAC.

Sparton and L-3 Communications Reach Settlement Agreement

Sparton Corp. has signed a settlement agreement to pay L-3 Communications Corp. \$2.5 million on or before October 1, 2015, in consideration for dismissal of the complaint filed by L-3 Communications last September 2, 2013.

Digicom Electronics Expands Oakland, California EMS Facility

Digicom Electronics Inc. has expanded its facility in Oakland, California in the San Francisco Bay area. In addition to doubling in size, Digicom has added even more advanced manufacturing equipment and additional personnel to increase manufacturing capacity and capabilities.

INTEGRATED.
EXPERIENCED.
CERTIFIED.
EQUIPPED.



GET THE WHITE PAPER:
*Reliability Issues with RF Circuits
Influenced by Design and
Manufacturing Processes*

DOWNLOAD



Electronics Contract Manufacturing & Engineering Services

INTEGRATED

- Design
- Layout
- Engineering
- NPI
- Supply Chain
- Assembly
- Testing

EXPERIENCED

- Aerospace
- Military C4ISR
- Medical
- Cyber
- RF
- Space
- Unmanned Systems

CERTIFIED

- ITAR
- IPC Class 3 Trusted Source QML
- IPC J-STD-001 w / Space
- AS9100
- ISO-9001
- ISO 13485

EQUIPPED

- Established 1998
- Complex SMT Assembly
- Five (5) Processing Lines
- X-Ray, AOI, and SPI
- Box Build and Wire Harness
- Design and Test Engineering
- Purpose-Built CM Facility



Click to see video
of Zentech facilities



www.zentech.com • 443-348-4500 • sales@zentech.com

Accelerate Your Time-to-Market
Prototype and Rapid Order processing now available through our ZenPRO service

zenPRO

Is Automation the Answer to Cycle Time Reduction?

By Stephen Las Marias
I-CONNECT007

At the recent NEPCON South China event in Shenzhen, mainland China, George Liu, sales manager of Finland-based Cencorp Automation, sat for an interview to discuss the benefits of automating the backend process to the overall manufacturing line, and why manufacturers need automated solutions now more than ever.

Stephen Las Marias: *George, tell us more about Cencorp Automation.*

George Liu: Cencorp is an automation solutions company from Finland with more 30 years' in the industry. Our product focus is the backend of the electrical PCBA industry—routing, depaneling, odd-form and through-hole component placement, and test handling.

Las Marias: *What are some of the technologies you have on display?*

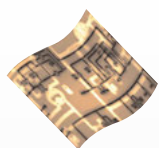
Liu: We are exhibiting our router and odd-form component placement machines. We provide a comprehensive solution for through-hole odd-form component placement. And because we are using a servo gripper—as opposed to pneumatic—you can easily program the equipment to handle different component sizes.

Las Marias: *What can you say about automation in the PCBA production line? Why does automation matter now more than ever?*



Liu: Number one, labor costs are rising, which everybody knows. Second, people are looking at quality control. Eventually, things made by machines will be better than those made by human hands. If you take a look at the past decade, SMT machines, AOI, SPI, printing, every process in the front-end is using automation. Now, the trend is moving toward the backend: the router, odd-form placement, and also the test handler, because for consumer or automotive electronics, auto components need to be tested—there's also a huge demand for automation. Basically, right now, a lot of people are using non-standard solutions. But we are providing a standard solution for test handling.

Las Marias: *You are exhibiting an automated pick-and-place machine, right? One of the surveys we*



Printed
Electronics
USA2015

November 18-19, 2015

Santa Clara, CA | USA

Conference | Exhibition | Masterclasses

WORLD'S LARGEST

CONFERENCE & EXHIBITION
ON PRINTED, ORGANIC &
FLEXIBLE ELECTRONICS

Meet customers. Do business

40%
ATTENDEE
DISCOUNT

Valid until November 14, 2015
Quote: I-CON007-40%



What to Expect:

Printed Electronics USA is the only event focused on the commercialization of printed, organic and flexible electronics.

- End-user focused - needs and experiences aired
- Latest technology developments and roadmaps
- Demonstrations, samples and much more

230 speakers
in 8 conference tracks

Over 3000 attendees
from 47 countries

200 exhibitors
in a co-located exhibition



Benefit from co-located events.

All the surrounding technologies under one roof.



IDTechEx Show!

Visit www.PrintedElectronicsUSA.com/Register

IS AUTOMATION THE ANSWER TO CYCLE TIME REDUCTION?



George Liu, Cencorp Automation

have recently conducted at I-Connect007 concerns cycle time reduction in the production line. Does automated equipment help reduce cycle times in the assembly process?

Liu: That will take time, because there's no 100% solution. You'll have to think about the capability or flexibility that you have to compromise to get something else. For instance, you can combine the speed and flexibility together, but the price will be very high. So we are looking at the middle point.

Las Marias: How does Cencorp Automation keep ahead of the competition?

Liu: We stay ahead through innovation. We're trying to make some interesting machines. That's what we believe in. We want to make a machine we are proud of.

Las Marias: Can you tell us about the future of your industry?

Liu: It's more automated. Eventually, there will only be a few people in the production line be-

cause SMT, printing and AOI, SPI and router, insertion, testing, laser, and dispensing will all be automated. You don't need people anymore. But the key point to finalizing that is software. We have a strong software team to combine all the processes together. Software is very important, such as the manufacturing execution system (MES) as well as traceability throughout the whole process.

Las Marias: Industry 4.0: What is your comment on it?

Liu: It is going to happen, and it's already happened for our customers.

One of our lines in Denmark is using the concept exactly. We have five odd-form (OF) machines. We are using the feeder, covering—all the components they need—and when the different boards come in, we just scan their barcode, and our production line will know what components need to be inserted into it right away. So, zero changeover time, no matter how many boards they want to make.

Las Marias: Finally, what are the benefits of having an automated production line for your customers?

Liu: They will no longer need to worry about labor cost overhead. Especially in China, they need to worry about how to recruit and manage skilled workers. Sometimes, if you have a rush order and workers are on leave for some reason, that's really a problem.

Las Marias: Thank you very much for your time, George.

Liu: Thank you. SMT

THE GREAT MINIATURIZATION: SYSTEMS AND PACKAGING

Technology Enabling Systems in your Pocket and Beyond

NOVEMBER 10 & 11, 2015 BILTMORE HOTEL, SANTA CLARA, CA

Diamond Sponsor



A JOINT MEPTEC AND SEMI TWO-DAY SYMPOSIUM

Symposium: November 10th & 11th, 8:00am to 5:00pm

Reception: November 10th, 5:00 to 6:30pm

Exhibits: November 10th Only, 10:00am to 6:30pm

Gold Sponsor



Gold Sponsor



Reception Sponsor



Association Sponsor



The first day of this two-day symposium will address the applications that drive the technology; the second day will cover emerging technologies and a wrap-up panel discussion with the experts. Each day will feature a leading industry keynote speaker.

SESSION TOPICS INCLUDE:

TUESDAY, NOVEMBER 10

- The Genius of Cars – and why Semiconductors Matter
- High Speed Components and Packaging
- Medical and Wearables for Human Health: Connecting the Dots from Silicon through Packaging
- Power Management and Energy Harvesting: Opposite sides of the Same Coin Battery?

WEDNESDAY, NOVEMBER 11

- Multi Die Integration
- On the Road to SiP and Modules
- Carrying the Standard(s) for Packaging
- IC-Package-System Co-Development in the New SIP Era

Register Online Now:

www.meptec.org

SPONSORSHIP AND EXHIBIT OPPORTUNITIES AVAILABLE

Contact Bette Cooper at bcooper@meptec.org or call 650-714-1570.

Media Sponsors

Gold Embrittlement Mitigation: Understanding the New J-STD-001 Requirements

by **Bob Wettermann**
BEST INC.

A significant change to the soldering assembly specifications is outlined in the recently released “F” version of the J-STD-001, *Requirements for Soldered Electrical and Electronic Assemblies* (July 2014) for gold-plated components. With the advent of more information from studies on the behavior of how much gold can impact the mechanical structure of the solder joint, the “washing away” of gold has become more important.

Gold is widely used in electronic package finish designs in order to enhance solderabil-

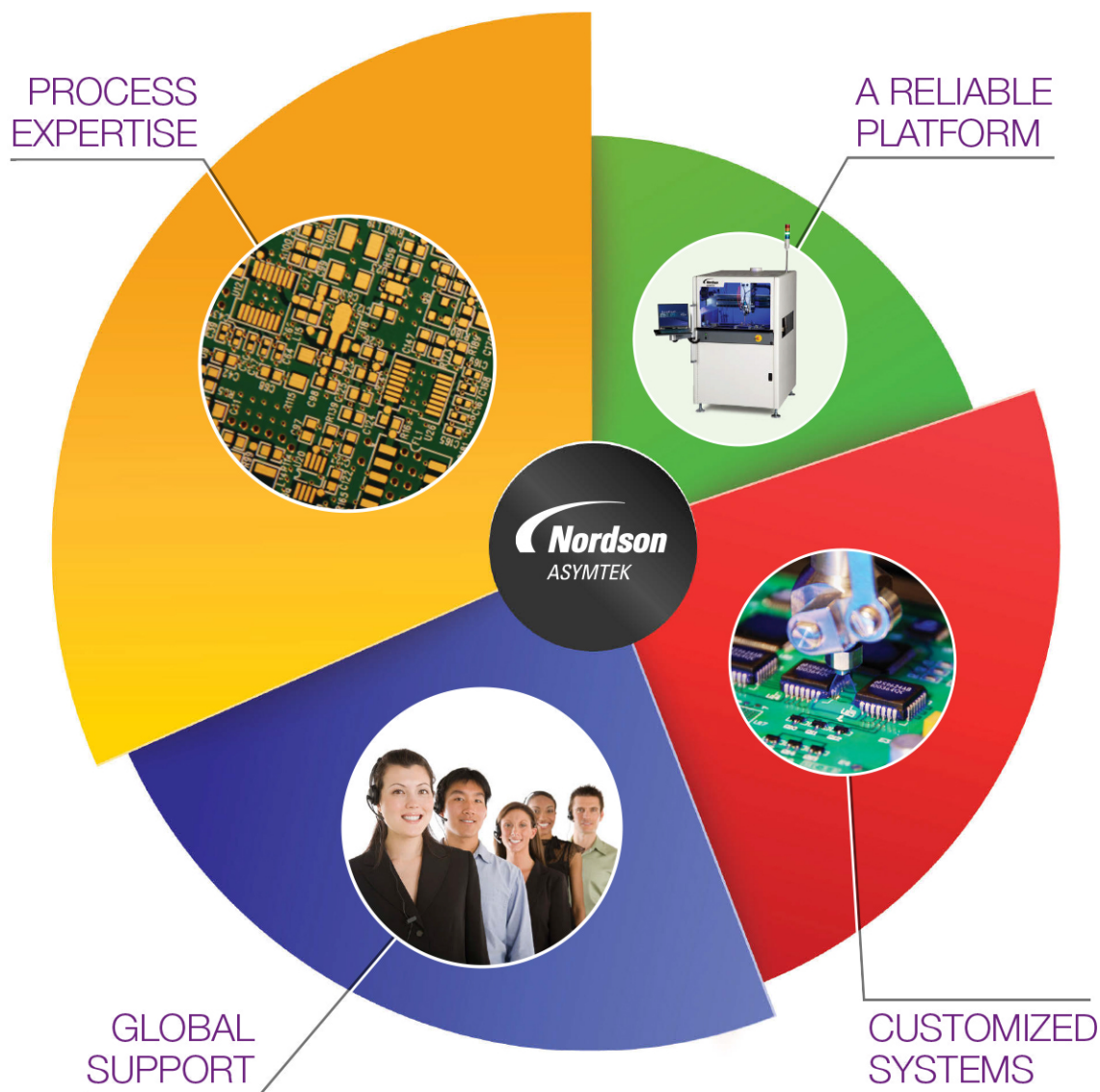
ity and wire bondability. A thick, pure gold finish (Figure 1) can be used to enhance wire bondability, but can be too thick for soldering, causing solder joint embrittlement. It does not oxidize very readily, melts at relatively low temperature, and dissolves rapidly in the soldering process. However, too much remnant gold in the solder joint can weaken the integrity of the interconnection.

If the gold dissolution is excessive during the solder alloy’s liquid phase formation, then the composition, mechanical properties and du-



Figure 1: Component tinning.

What's Important for Conformal Coating?



Have it all with Nordson ASYMTEK!

Nordson ASYMTEK brings them all together – conformal coating platforms, applicators, software, and accessories, plus our unparalleled global support that is backed by over 30 years of conformal coating expertise.

Please visit our website or contact us today.

nordsonasymtek.com/coating

info@nordsonasymtek.com

Select Coat
SL-940E



See
Nordson ASYMTEK
at Proelectronica, Stand A2.461

Nordson
ASYMTEK

GOLD EMBRITTLEMENT MITIGATION

rability of the resulting joint alloy can change, compared with the original solder alloy. As the finished electronic assemblies heat up and cool down, or when exposed to stresses, the gold in the solder joint can weaken or embrittle it and fail. Given the above understandings, solder joint embrittlement is defined as a change of solder joint durability due to dissolution and/or reaction with a finish such as gold and/or palladium.

The changes are expressed in tin-based solders by the appearance of AuSn₄ intermetallic compounds from gold finishes. The compounds can occur in the bulk of the solder joint, at the finish interface or in both locations. The compounds are brittle in comparison with the soft solder alloy. As a result, the ability of the joint to be robust when subjected to mechanical strains is reduced.

Limiting these localized weaknesses and maintaining a reliable solder joint is the reason, along with the corresponding testing to verify this, behind the J-STD specification change.

Changes in the J-STD-001 Specification

With the advent of the new version of IPC J-STD-001, the governing the assembly of printed circuit boards, changes to the procurement and preparation of gold plated parts for the military and aerospace markets has taken a new turn.

The following significant changes were made to the specification:

1. Gold embrittlement mitigation (gold washing), which when not done, was a process indicator for class 2 assemblies in "E" is now a defect if NOT done in "F"
2. All through-hole leads required to be hand-soldered regardless of gold thickness need to be "washed" (and hence are a reliability concern)
3. A new warning that gold embrittled solder terminations can be present when the solder volume is low (i.e., very small components) or when the dwell time is not sufficient in the soldering process

Impact on the User Community

The changes to the J-STD-001 specification will primarily impact the EMS and OEM build

communities performing class 2 assembly work where their customer base has specified and routinely uses gold-plated components, or for those building class 3 products who have hand-soldered components onto the PCB. This impact will be felt in terms of having to outsource these tinning operations or bring this capability in-house. In addition, the contract assemblers will have to educate their OEM partners on these changes and how that may impact lead time and costs of their finished assemblies.

“As the finished electronic assemblies heat up and cool down, or when exposed to stresses, the gold in the solder joint can weaken or embrittle it and fail.”

If this process were to be brought in-house or purchased from a service provider there are several key attributes to ensure successful, repeatable, and consistent tinning processes:

Flux choice must match the activity level needed to remove the old finish (as well as the end customer's specifications). It is prudent to test the various fluxes using a wetting balance test to determine the wettability of the solder prior to jumping into production mode. Also it is smart to make sure that the flux does not harm or impair the component body or seals. The right amount of flux volume is also key, as both the components and the fixtures need not get unnecessarily contaminated. After processing it is advantageous to have XRF analysis performed in order to confirm the elemental analysis of the re-tinned component leads.

Fixturing needs to be done very accurately and be flexible with the numerous variants of different lead and component styles. The fixture's job is to make sure the component bodies and leads are exposed to the solder and the flux



Chip Scale
Review

are proud to present the leading industry event for designers, users, and suppliers of 2.5D & 3D integration, flip chip, and wafer-level packaging equipment, materials, and services.



12th Annual International Wafer-Level Packaging Conference & Exhibition

October 13-15, 2015

DoubleTree Hotel, San Jose, CA USA

IWLPC Conference: October 13-14

IWLPC Exhibits: October 13-14

Tutorials: October 15

EVENT SCHEDULE

Tuesday, October 13 – Wednesday, October 14

Exhibition, Panel Discussion and Technical Presentations on 3D, WLP and MEMS

Thursday, October 15

Professional Tutorials

T1: Introduction to Fan-Out Wafer-Level Packaging

T2: 3D IC Integration and 3D IC Packaging

T3: Adhesion Science & Practice with an Emphasis on Temporary Bonding of Electronics (Wafers, Displays, Devices)

T4: Wafer-Level Packaging for MEMS and Microsystems Technologies for Size and Cost Reductions

CONFERENCE SPECIAL EVENTS

Tuesday, October 13



Keynote Breakfast Address
High Density Fan-Out: Evolution or Revolution

Rama Alapati, *GLOBALFOUNDRIES*



Panel Discussion
Fan-Out WLP Panel Processing: Will it happen and What will it be?

Moderator: Jan Vardaman, *TechSearch International*

Exhibitor Reception

Join us in the Bayshore Ballroom for the Exhibitor Reception where over 60 exhibitors will showcase the latest products and technologies offered by leading companies in the semiconductor packaging industry. This evening reception offers attendees numerous opportunities for networking and discussion with colleagues.

Wednesday, October 14



Keynote Address
2.5D/3D IC – Examining Low Cost Alternatives

Sitaram Arkalgud, Ph.D., *Invensas Corporation*



Panel Discussion
Interposers, 3D TSVs and Alternatives: What are the Options and Where do They Fit?

Moderator: Françoise von Trapp, *3DInCites*

THANK YOU TO OUR SUPPORTERS



2015 SPONSORS

PLATINUM SPONSORS



GOLD SPONSORS



SILVER SPONSORS



THERE'S STILL TIME TO EXHIBIT!

	Member	Non-Member
One Booth (8' x 10')	\$1,500	\$1,700
One Table (6')	\$1,100	\$1,300

A few sponsorships remain:

Reception, hotel key cards, lunches, refreshments, notepads/pens, and full-page B&W directory ads.

For more information about the conference, or exhibit and sponsorship opportunities, contact Tanya Martin at 952-920-7682 or tanya@smta.org. www.iwlpc.com

GOLD EMBRITTLEMENT MITIGATION



Figure 2: Hot solder dip.

.....

in a repeatable location. Fixtures also need to be simple to populate as there are some volume re-tinning requirements. The parts of the fixture which will be exposed to the solder need to be manufactured from titanium. There also needs to be drainage built in to the fixture for subsequent process steps including but not limited to cleaning and subsequent fluxing, soldering and cleaning processes.

Two solder pots—one for sacrificial alloy “scrubbing” and for non-porous plating—should be employed in the solder re-tinning process. The first pot should serve as the scrubbing or removal pot. The second one should contain the new alloy needed to coat the leads. Both should be flowing type pots, especially the scrubbing pot as the leads will have the solder removed in close proximity to this scrubbing action of the active flowing solder pot. It is important for this pot as the contamination should not be pulled back to and be re-deposited onto the component lead. Nitrogen purging of these pots is essential as the blanket promotes a lustrous finish while mitigating icicle, bridge and dross formation.

All process variables should be tightly controlled in order to be able to repeatedly re-tin the components in a production setting. Following the process guidelines laid out in the ANSI-GEIA-STD-0006 specification will allow for the repeatability that is required. This means process machinery should be able to control attributes such as angle of incidence for the com-

ponents into the wave, speed of insertion into and out of the wave, precise control of pre-heat temperatures and timing sequence and automated dross removal. In addition, it is critical that the entire processing environment be one in which a nitrogen blanket is present in order to maintain consistent wetting of all of the leads in a production environment.

Preheating for flux activation is critical to make sure that a non-porous continuous tinned lead is present. The preheating needs to take into consideration the thermal shock that can be withstood by the components, meaning in some cases sitting over the solder pot is sufficient while in others a forced hot-air knife may be required.

Summary

The changes to the latest J-STD-001-F are significant to a variety of users who are using gold plating as a finish on their component leads. These latest standards are imploring those with Class 2 and Class 3 assemblies to wash this gold off of the leads using re-tinning processes so as not to impact the reliability of the printed circuit board. This will add cost and lead time to the assembly but will ensure a more reliable solder interconnection. Be prepared for it. **SMT**

References

1. P. T. Vianco, “Lead-Free Surface Finishes: Compatibility with Assembly Processes and Interconnection Reliability” (Edina, MN: Surface Mount Technology Association, SMTA Webinar, January, 2007), pp. 35–36.
2. M. Wolverton, “Quality, Reliability and Metallurgy of ENEPIG Board Finish and Tin-Lead Solder Joints,” of SnAgCuX Solder Joints,” JOM, 59 (7) (Warrendale, PA: TMS, July, 2007), pp. 38–43.
3. S. J. Krumbein, “Porosity Testing of Contact Platings: Part 1,” Connection Technology, (January, 1988), pp. 21–26.
4. W. G. Bader, “Temperature Dependence of the Dissolution Rates of Au, Ag, Pd, Cu, Pt and Ni in Molten 60-Tin-40-Lead Solder,” Welding Journal, Research Supplement, 48 (December, 1969), pp. 551S-557S.
5. M. H. Bester, “Metallurgical Aspects of Soldering Gold and Gold Plating,” Proceedings of

GOLD EMBRITTLEMENT MITIGATION

the Technical Programme, Inter/Nepcon (October, 1968), pp. 211–231.

6. J. Glazer, P. A. Kramer and J. W. Morris, Jr., “Effect of Au on the Reliability of Fine Pitch Surface Mount Solder Joints,” Proceedings of Surface Mount International (Edina, MN: Surface Mount International, SMTA, 1991), pp.629–639.

7. R. N. Wild, “Effects of Gold on the Properties of Solders” (Owego, NY: IBM Federal Systems Division, IBM No.:67-825-2157, January, 1968), 31 pages.

8. F. G. Foster, “Embrittlement of Solder by Gold from Plated Surfaces,” ASTM STP 319 (1963), pp. 13–19.

9. C. Hillman, N. Blattau, J. Arnold, T. Johnston, S. Gulbrandsen, J. Silk, A. Chiu and Y-H Chan, “Gold Embrittlement in Leadfree Sol-

der,” SMTA Journal, Vol. 26, Issue 4 (Edina, MN: SMTA, 2013), pp. 23–34.

10. J. Pan, J. Silk, M. Powers and P. Hyland, “Effect of Gold Content on the Reliability of SnAgCu Solder Joints,” IPC APEX EXPO 2011 (Bannockburn, IL: IPC, 2011).

11. IPC J-STD-001F, “Requirements for Soldered Electrical and Electronic Assemblies,” (Bannockburn, IL: IPC, 2014).



Bob Wettermann is the principal of BEST Inc., a contract rework and repair facility in Chicago. His column, *Knocking Down the Bone Pile*, will appear bi-monthly in *SMT Magazine*.

A Fast Cell Sorter Shrinks to Cell Phone Size

Over the past decade, microfluidic cell sorters have emerged as a promising new tool for single cell sequencing, rare cell isolation, and drug screening. However, many of these microfluidic devices operate at only a few hundred cells per second, far too slow to compete with commercial devices that operate on the order of tens of thousands of operations per second.

Now, a team of researchers at Penn State has developed a cell sorter based on acoustic waves that can compete with existing fluorescence-activated cell sorters and is an inexpensive lab on a chip. The system can sort about 3,000 cells per second, with the potential to sort more than 13,000 cells per second.

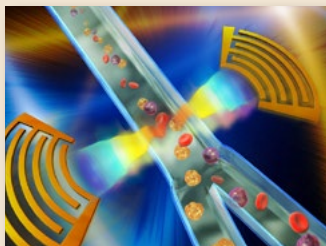
The researchers achieve the speed by using focused interdigital transducers to create standing surface acoustic waves. The narrow field allows the sorting to take place at high speed while gently manipulating individual cells.

“Our high-throughput acoustic cell sorter is expected to maintain cell integrity by preserving not only high viability, but also other cellular

features,” said Tony Jun Huang, Penn State professor of engineering science and mechanics. “The acoustic power intensity and frequency used in our device are in a similar range as those used in ultrasonic imaging, which has proven to be extremely safe for health monitoring, even during various stages of pregnancy. With the gentle nature of low-power acoustic waves, I believe that our device has the best chance of preserving cell integrity, even for fragile, sensitive cells.”

Because the device is built on a lab-on-a-chip system, it is both compact and inexpensive -- about the size and cost of a cell phone in its current configuration. With the addition of optics, the device would still be only as large as a book. The researchers fabricated the acoustic cell sorter in Penn State’s Nanofabrication Laboratory using standard lithography techniques.

The researchers, who are from Penn State, Ascent Bio-Nano Technologies and the National Heart, Lung and Blood Institute of the National Institutes of Health, published their work in a recent issue of *Lab on a Chip*. In future work, the researchers plan to integrate their acoustic cell-sorting unit with an optical cell-detecting unit with the goal of increasing throughput to 10,000 events per second.



WKK Discusses Trends and Opportunities in China's Electronics Assembly Industry

WKK's Hamed El-Abd talked to I-Connect007's Stephen Las Marias about his outlook for the electronics manufacturing assembly industry. He also provided his insights on the current business climate in China.

Faster, More Precise Jet Dispensing in Microsystems Technology

As miniaturization advances relentlessly, the components that need to be connected are becoming ever smaller and more delicate. At the same time, quality standards and the functionality of the materials are increasing. This development requires joining processes that can reliably fix the smallest of components.

ELEDLights.com: Manncorp's Bright Future

Ed Stone, sales manager at Manncorp Inc., speaks with I-Connect007's Stephen Las Marias about some of the trends he's seeing in the SMT equipment technology space that's driving demand for their ELEDLights.com business.

Nordson Expands Offering; Acquires MatriX Technologies

Nordson Corporation has acquired Munich, Germany-based MatriX Technologies GmbH, a leading manufacturer of automated X-ray inspection equipment used to ensure the quality of PCBs, critical electronic devices and fully assembled products in consumer, automotive and other industrial end markets worldwide.

OK International Appoints Allen Zou to Director of Sales for Asia

OK International has appointed Allen Zou as the new director of sales for Asia. He will assume this role as Ian Orpwood moves back to the OK International corporate office to assume the role of Director of Sales for the Americas in October.

AIM Solder Appoints Technical Support Engineer, Brazil

AIM Solder has appointed Anderson Albuquerque to the position of Technical Support Engineer, Brazil, wherein he will provide technical support for AIM's full line of solder assembly materials to the company's expanding customer base in Brazil.

Seika Machinery Debuts MALCOM VDM-2 Video Capture System

Used in conjunction with MALCOM Reflow Simulators, Seika Machinery Inc.'s recently launched MALCOM VDM-2 Video Capture System captures video of the simulated reflow process.

Mycronic Receives Order for Mask Writer Based on Replacement Strategy

Mycronic AB has received yet another order for a mask writer built on the Prexision platform, replacing an older system for manufacturing of display photomasks. The system is scheduled to be delivered during the second half of 2016.

Nihon Superior Discusses Solder System Innovations

Tetsuro Nishimura, president and CEO of Nihon Superior, talked to I-Connect007's Stephen Las Marias about the soldering industry landscape, some of the major industry changes he witnessed over the past decades, their Soft Solder technology, and why more and more manufacturers are now shifting to low-silver or no-silver solders.

ACE Production Technologies Opens New Demo Center in Mexico

ACE Production Technologies Inc., a leading supplier of selective soldering systems, is pleased to announce that due to continued international growth, the company is opening a new demonstration center in Mexico.



Solder plus Support

AT A GLANCE

- ▶ Halogen-free
- ▶ Low voiding on BGA and BTC components
- ▶ REACH and RoHS compliant
- ▶ For use with demanding, high density electronic assemblies
- ▶ High SIR/Electrically safe residue
- ▶ Formulated for use with T4 and finer powders
- ▶ Mitigates head-in-pillow

WWW.AIMSOLDER.COM

INFO@AIMSOLDER.COM



AIM, a leading global manufacturer of solder assembly materials for the electronics industry, introduces **M8 SOLDER PASTE**, a high reliability no clean paste for use with SAC305 and Sn/Pb alloys.

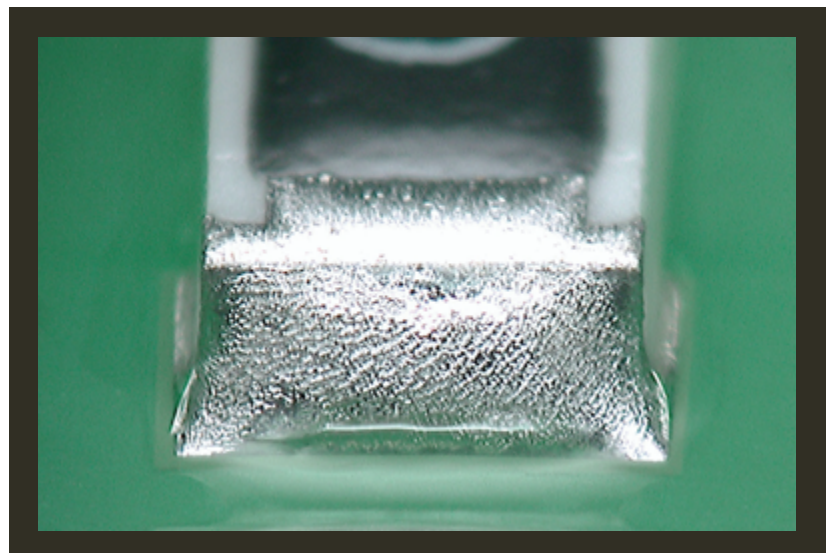
M8 NO CLEAN SOLDER PASTE is designed to provide stable transfer efficiencies required for today's challenging high density applications. A novel activator system provides powerful and durable wetting action, accommodating a wide range of profiling processes and techniques. M8 eliminates HiP defects on BGA and reduced voiding on QFN/BTC components while producing bright shiny solder joints. Developed with the input of coating and cleaning industry partners, residues can be directly coated or easily removed. M8 leaves minimal, high purity, residue, engineered to be safely left in place.

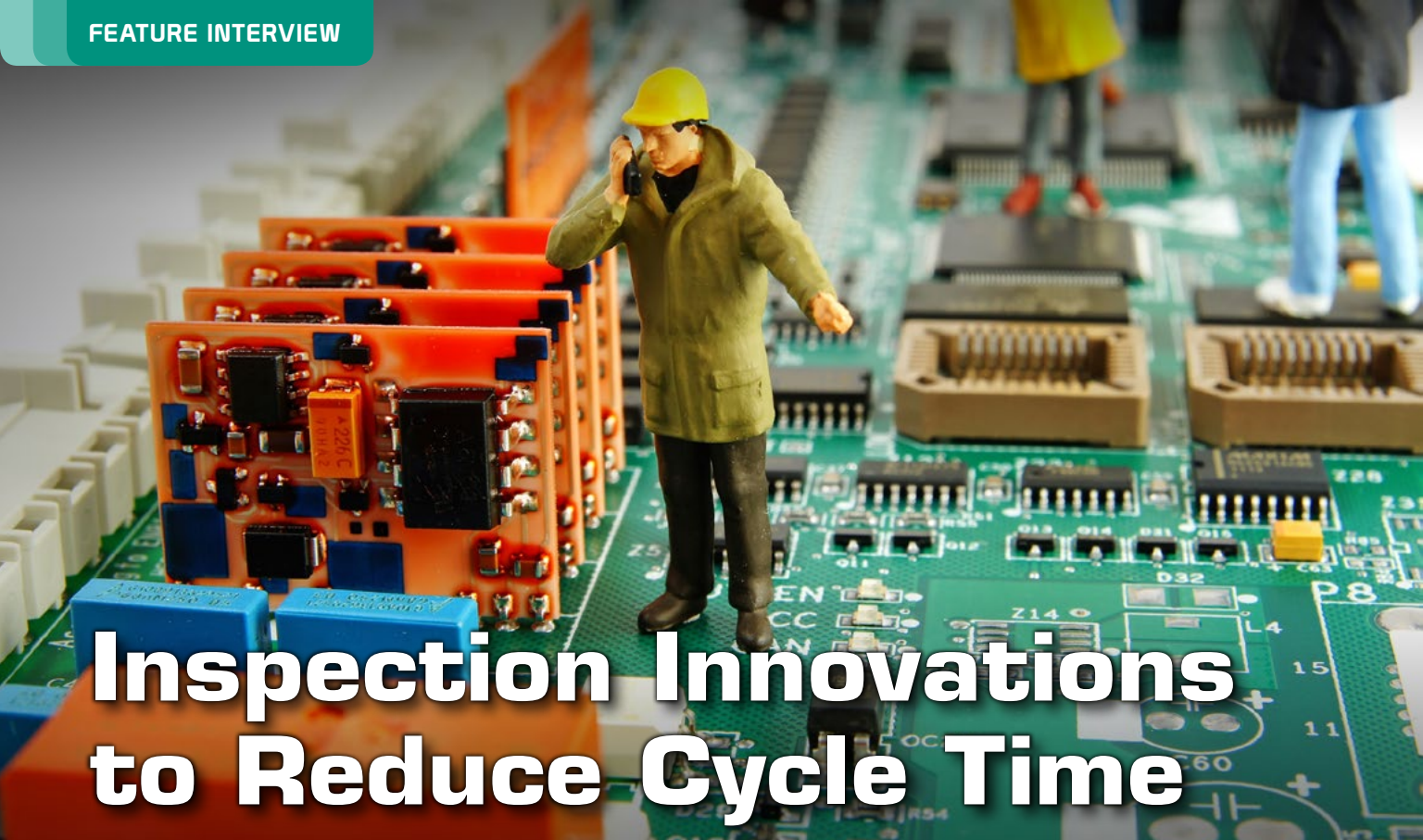


productronica 2015

MESSE MÜNCHEN | 10-13 NOVEMBER 2015

Visit **AIM** in Stand A4-531





Inspection Innovations to Reduce Cycle Time

by **Stephen Las Marias**
I-CONNECT007

Guido Bornemann, head of sales for Asia at Viscom AG, provided his insights regarding the impact of automated optical inspection (AOI) on cycle time. He also talked about the latest technologies in AOI—such as combining different types of inspection, as well as having integrated communications between different inspection points in a line—that can help customers reduce their inspection cycle time.

Stephen Las Marias: *From your perspective, how do you define cycle time?*

Guido Bornemann: In our perspective, cycle time is the time needed for inspection. Really, from the time the board goes into the machine, until the board goes out of the machine.

Las Marias: *How important is reducing cycle time?*

Bornemann: It is very important because this is defining the efficiency of the line. The more time you need, the less you can produce; in the end, it's a very important process. The thing is, Viscom, being a high-end supplier, cannot re-

duce cycle time based on sacrificing the quality of the process. We know some people are just looking for the throughput; but for us, the first priority is finding the defect and of course for the benefit of the customer, reducing cycle time to make the machines more efficient.

Las Marias: *Can you equate that to the cost of inspection?*

Bornemann: Cost is an important factor, and the thing is, usually our benchmark of the line is the slowest machine. Usually that's the pick-and-place machine; so what customers are giving us is the cycle time of the pick-and-place machine—and based on which we should not be slower. As long as we are not slower, then we can handle the board before they are piling up in front of the machine.

Las Marias: *What about in-circuit inspection; do you have some ballpark figure on the hours spent on a particular board?*

Bornemann: It really depends where you are coming from. In the automotive industry, the boards are a little bit smaller. When you go into telecommunications, IP networks, and server

LED A.R.T. Symposium

ASSEMBLY | RELIABILITY | TESTING

The bridge between research and development

SAVE THE DATE

November 17-19, 2015

Atlanta, GA

LED Assembly, Reliability & Testing Symposium

Light emitting diodes (LEDs) are increasingly the technology of choice in lighting and display applications. The main challenge to an even wider deployment platform for LEDs is the disconnect between the potential performance observed in laboratories and the real performance observed in the field. The LED Assembly, Reliability & Testing (A.R.T.) Symposium will provide attendees with information to bridge the gap between the semiconductor physics and the architectural design level issues in LED supply chain.

CALL FOR PRESENTATIONS - Abstracts due July 10th

The topics of interest are but not limited to:

- Semiconductor level: new materials and techniques used to make LEDs
- Luminaire level: assembly and inspection of LEDs mounted onto substrates
- User level: Policies and usage improvements/tradeoffs
- How LEDs degrade and fail - Failure modes and mechanisms
- Packaging materials – encapsulation, lenses
- LED Qualification
- Reliability assessment
- Assembly and packaging process
- Architecture: lighting designers
- Thermal management issues during integration
- Automotive applications
- LED testing and reliability standard

For more information on the conference, exhibition or sponsorship opportunities, please contact Amanda Dodson: **952-920-7682** or **amanda@smta.org**

www.smta.org/LED



calce

INSPECTION INNOVATIONS TO REDUCE CYCLE TIME

boards, they are really big boards, so usually the production process or pick-and-place processes are longer, and therefore the inspection process.

Las Marias: *Can you tell us about some of the advances in AOI technology that can help users reduce the cycle times in their processes?*

Bornemann: One of the important things we are doing is taking top-down testing and angular testing, which is really needed in the automotive industry to find every defect. Before, we had to do it one after the other. So we did a run for the top view, and we did a run for the angular view. The latest technology is the top view

.....



Guido Bornemann, head of sales for Asia, Viscom AG.

and angular view in one camera module, which means a savings of 50% of your cycle time, because at one shot you can take the top view and the angular pictures. And I think that's one of the biggest advantages. Nowadays, cameras are really fast, so the cycle-time-defining aspect is movement of the sensor. If you're inspecting 10 positions, for example, now you will need only five positions because the machine is twice as fast.

Las Marias: *You mentioned automotive, and that you cannot sacrifice the reliability of automotive electronics against throughput. Can you tell me more about that?*

Bornemann: That is always, from our point of view, the top priority. You can make fast machines, but if you only find 80% of the defects, it really doesn't help.

Las Marias: *Automating production lines, such as implementing automated testing, for instance, helps to significantly reducing cycle time. Please give your comments.*

Bornemann: There is no doubt about that. If you ever really automate your process, it's easier to calculate because the machine is always giving you the same cycle time. If you have manual inspection, it really depends on the operator. Automation definitely helps you to get a really stable cycle time, and therefore stable production planning.

Las Marias: *One of the trends right now is IoT/Smarter Factory. In an end-to-end line, is there a technology now that will help provide the data in these different inspection equipment/nodes that will provide operators actionable intelligence so that they know how to respond to any issue in the line?*

Bornemann: Indeed, that's one of the things we did in the last two years—communications along the process. If you have separate machines and you have all the information, but you don't connect it somewhere, the customer really doesn't benefit from it. But we are now connecting all the machines; we are working

INSPECTION INNOVATIONS TO REDUCE CYCLE TIME

with different pick-and-place suppliers and printer suppliers, to communicate, so that you know exactly when it reaches inspection. You have all the information available.

You need to find a way how to give this information to the customer, so that the customer can benefit from it.

Las Marias: *What are some best practices to help customers or manufacturers reduce their cycle times in the process?*

Bornemann: The best practice is working together. If we understand the customer requirements, we can work out solutions, and that's one of the things we want to do—provide solutions. We don't want to be a machine provider only; we want to be a solution provider. There are many different industries and every industry has a different requirement, therefore from my point, it's sitting together with the customer and using our knowledge, and our technology, to work out solutions.

Las Marias: *Can you give us some examples of how Viscom is giving value to customers who are still under pressure to cut expenses?*

Bornemann: In general, what we do is provide communications all along the line. So if you find defects, of course you want to know where they are coming from and how to avoid them. At AOI, you have all the information available. At the end of the line, you know basically what is happening in your processes. With our new TrueYield concept, and this communication along the line, we are providing this information to our customers as a way of helping them see where in their process the defect is happening, and avoiding this in the future—thereby cutting down their cost.

Las Marias: *Great, thank you very much for your time, Guido.*

Bornemann: You're welcome, and thank you as well. **SMT**

Permanent Data Storage with Light

The first all-optical permanent on-chip memory has been developed by scientists of Karlsruhe Institute of Technology (KIT) and the universities of Münster, Oxford, and Exeter. This is an important step on the way towards optical computers.

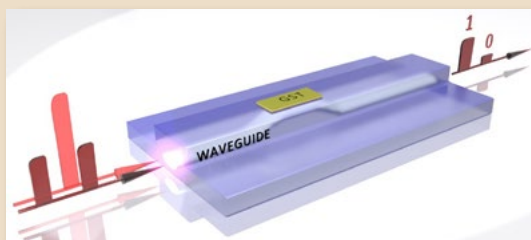
"Optical bits can be written at frequencies of up to a gigahertz. This allows for extremely quick data storage by our all-photonic memory," explains Professor Wolfram Pernice, who headed a working group of the KIT Institute of Nanotechnology (INT) and recently moved to the University of Münster.

"The memory is compatible not only with conventional optical fiber data transmission, but also with

latest processors," Professor Harish Bhaskaran of Oxford University adds.

The new memory can store data for decades even when the power is removed. It can also store many bits in a single cell of a billionth of a meter in size (multi-level memory). Instead of the usual information values of 0 and 1, several states can be stored in an element and even autonomous calculations can be made. This is due to so-called phase change materials, novel materials that change their optical properties depending on the arrangement of the atoms: Within shortest periods of time, they can change between crystalline (regular) and amorphous (irregular) states.

For the memory, the scientists used the phase change material Ge₂Sb₂Te₅ (GST). The change from crystalline to amorphous (storing data) and from amorphous to crystalline (erasing data) is initiated by ultrashort light pulses. For reading out the data, weak light pulses are used.



Selecting a Reflow Oven, Part 3

by Robert Voigt

DDM NOVASTAR

In this conclusion of a three-part series on selecting and evaluating a basic reflow oven configuration for a circuit board assembly environment, we'll address methods of control and profiling techniques.

Methods of Control

Any reflow oven, regardless of the type and number of heating zones, needs a method to control the temperature and recipe profile of the product being processed. These can either be built in to the oven (i.e., on-board) or PC-based and connected via a communications cable. As with everything else, there are advantages and disadvantages to each type.

On-board Control

On-board control means that the oven has a stand-alone controller built in to the system. It requires no PC or external source of information to create recipes to run the process. It can be controlled via a simple user interface displaying input prompts and readouts. In most cases, the interface is fairly basic and generally rather small.

Pros:

- Very good functional performance
- Generally more affordable than external PC-based system

Cons:

- Some restrictions in storage capacities for recipes
- Software updates can be more limiting due to the machine's limited hardware capacity
- User interface is typically minimal, displaying the bare essentials of inputs and outputs

PC-based Control

In this scenario, the oven plugs into a PC or laptop, which hosts the software via a communications cable. (It is not common to see wireless connections for this equipment; hard-wired connections are considered more stable.)

Pros:

- Software updates are more frequent, allowing on-going usability enhancements offered by the manufacturer

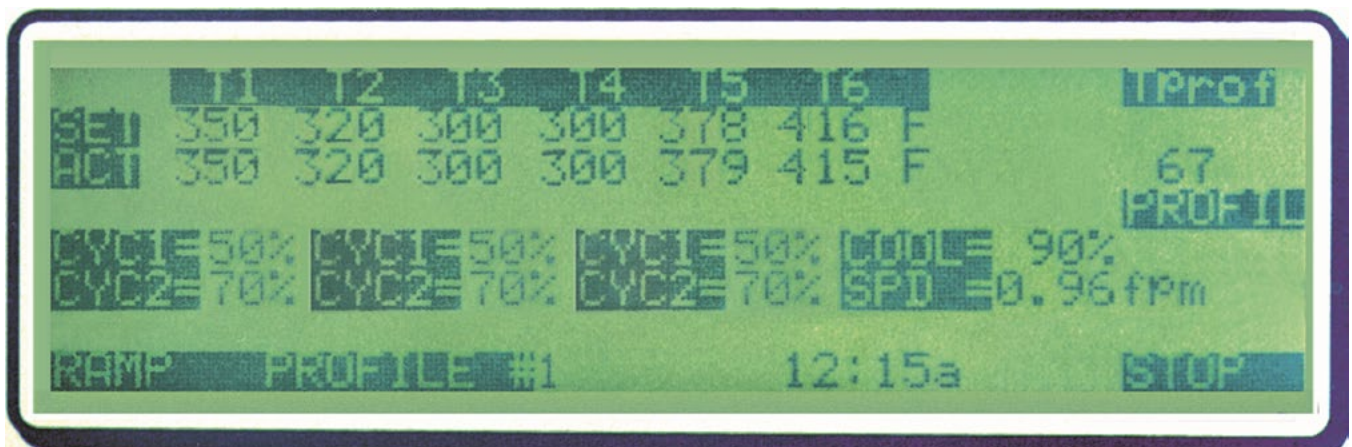


Figure 1: On-board control interface on a multi-zone oven.



THE best way to find a PCB fabricator, anywhere.

EAGLE CIRCUITS INC.

Dallas, Texas, U.S.A.



Overview

Contact

Specs

About

Videos

Photos

Brochures

News

Eagle Circuits has been in business for more than 25 years and is more than merely a transaction-based manufacturing machine. Instead, our professional expertise provides you with the intangibles of human intelligence and intuition. We offer an insightful consultative experience. Eagle Circuits with One Source Group offers parallel processing, as opposed to a traditional sequential system. It reduces total costs, and more importantly, saves you time

Markets: Automotive, Communication, Consumer, Industrial, Medical, Military/Aerospace

Board Types: Single-sided, Double-sided, Multilayer, Rigid-Flex

Mfg Volumes: Prototype, Small, Medium

Other Services: Assembly, CAD, PCB layout, Quick turn-around, Turn-key

Specialities: Blind/buried vias, Backplanes, Controlled depth drilling, Controlled Impedance, Microvias, Heavy copper, HDI, Printed Electronics, Thermal examination, Signal integrity, Silver

AS 9100, IPC-6012 class 3, ISO 9001, Registered, ROHS compliant, UL



Featured Showcase

Click here to see a demo

Why YOU should Showcase:

- Capabilities listing for advanced search functionality
- Specialties and certifications listing
- Ability to upload brochures and videos
 - News, web and contact links

Click to see a partial list of registered OEMs!

www.thepcblist.com

SELECTING A REFLOW OVEN, PART 3 *continues*

- A PC interface delivers a full-screen color graphical user interface for feature-rich visual presentation of data
- Users can see profile graphs not available on most on-board systems
- Users can purchase their own computers with all the capacity they may need now and in the future to accommodate a much greater number of recipes/profiles than would be available on an on-board system

Cons:

- Can add \$500 to \$1000 in cost versus an on-board control system.

Product Profiling

The product profiling process determines and/or validates the actual oven settings in the controller, regardless of whether it's on-board or PC-driven. Profiling kits are available from most manufacturers and include thermocouples, all accessories to attach the probes to the board for use during the process, and a how-to guide with instructions.

Profiling is done using one or more thermal probes (thermocouples) attached to the product and running it through the entire process to validate or modify a recipe based on the solder paste or product requirements. Multiple probes

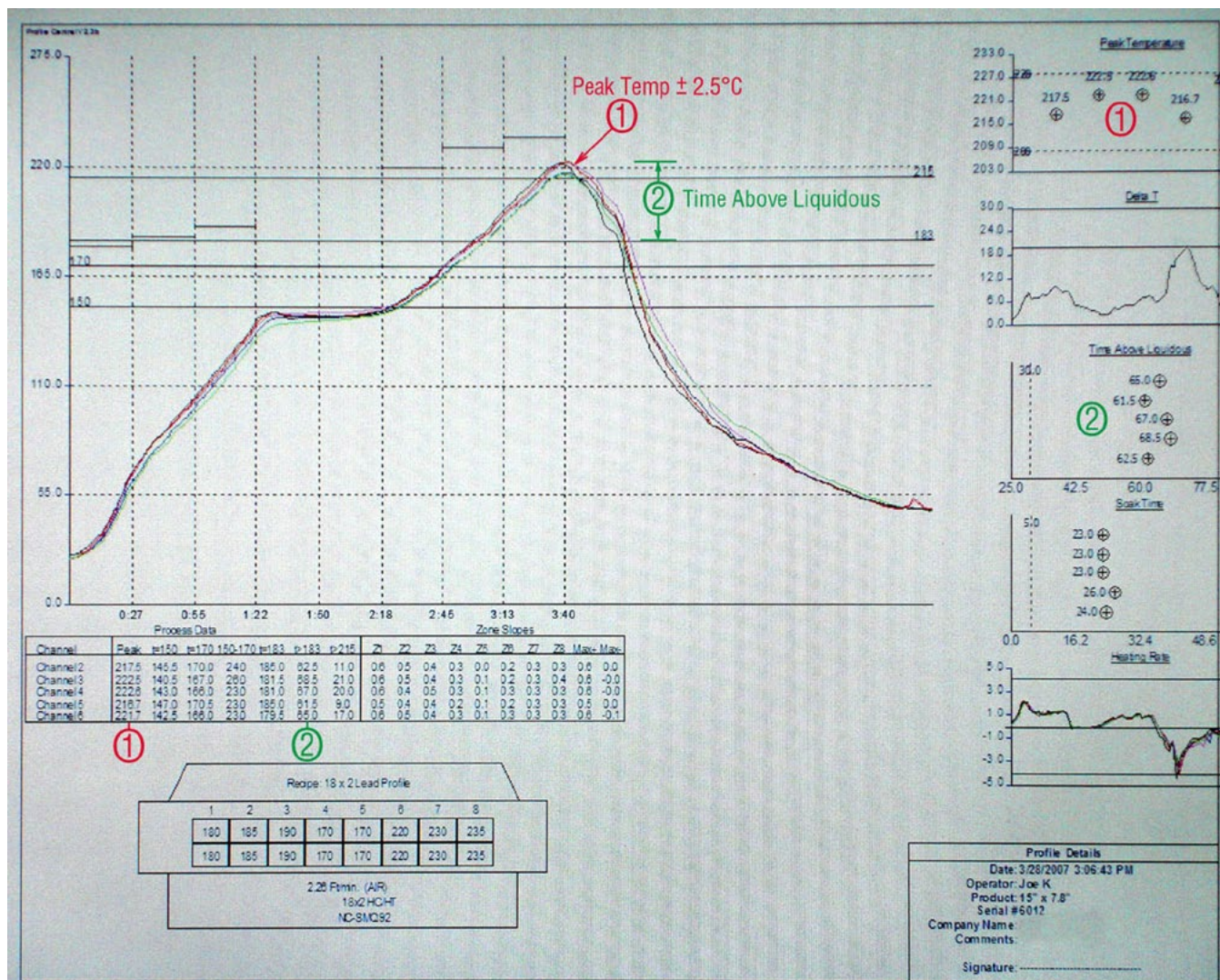


Figure 2: Sample of user interface in a PC-based control system.

SELECTING A REFLOW OVEN, PART 3 *continues*

are desirable for profiling to ensure that the board surface temperatures from one side to the other don't vary more than 2–4°C.

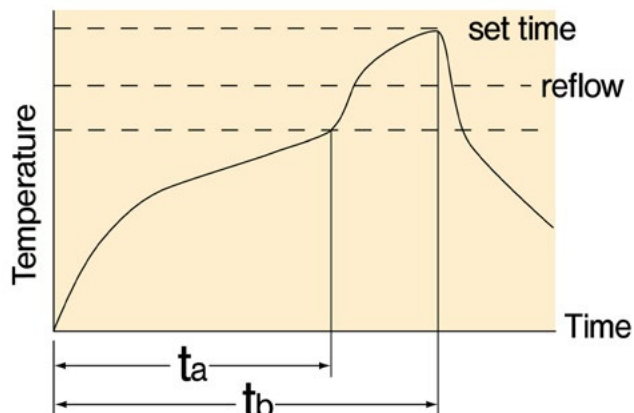
An optimal reflow profile is one of the most critical factors in achieving quality solder joints on a PCB assembly with surface mount components. A profile is a function of temperatures applied to the assembly over time. When graphed, a curve is formed that represents the temperature at a specific point on the PCB, at any given time, throughout the reflow process.

On-board Profiling

Profiling can be done with some on-board control systems; however, they are limited in visual representation by size and configuration of the display, and they usually don't have a utility to print or save and retrieve a file off-line, which is necessary for ISO 9000 and other quality assurance documentation. So if you are considering an on-board control, make sure it has the option available to export/output data for QA documentation if you think you will ever need it in the future.

PC-drive Profiling

A PC-driven profiler will provide a feature-rich user interface to enhance the operator's



t_a = preheat/activation time

t_b = total cycle time

Figure 4: An example of a theoretically ideal reflow profile made up of four parts or zones. The first three are heating and the last is cooling.

use. The Windows operating system is familiar to everyone and very intuitive for graphical presentations, with seamless printing and file saving functions to ensure proper record-keeping.

Third-party Profiling

A profiler purchased from a third-party provider typically combines more enhancements than either on-board or PC-driven systems have available. Profiler devices are offered by a number of manufacturers and can be found easily using a search for "reflow oven profile manufacturer."

In my next column, I will address selection of wave solder systems. **SMT**



Figure 3: Sample profiling kit including probes, accessories and user guide.



Robert Voigt is VP of global sales at DDM Novastar Inc. To reach Voigt, [click here](#).

TOP TEN



Recent Highlights from SMT007

1 **IPC Lauds Launch of Flexible Hybrid Electronics Institute**

Association Connecting Electronics Industries (IPC) applauds the launch of the new public-private institute on flexible hybrid electronics in Mountain View, California. This new facility, which will contribute to America's global competitiveness in manufacturing, is part of the new National Network for Manufacturing Innovation (NNMI), which IPC has strongly supported.

2 **Congressman Mike Honda Visits Juki Automation's California Plant**

Congressman Mike Honda (D-Silicon Valley) recently met with executives and employees of Juki Automation Systems at the company's facility in Fremont, California, as part of a nationwide effort to educate policymakers about legislative and regulatory issues that affect the electronics manufacturing industry.

3 **IPC Releases Annual Electronics Industry Quality Benchmark Study**

The survey-based study addresses five major groups of manufacturing and service measurements: production, quality control, customer satisfaction, supplier performance and certification status. The survey sample includes 65 OEMs and EMS companies from the Americas, Europe and Asia with annual sales ranging from under \$10 million to more than \$500 million.

4 **LACROIX Electronics Named Polish Industry's Top Employer**

Several well-known industrial groups with locations in Poland gathered to assist the ceremony award during which the Polish Labour & Social Minister, Mr. Władysław Kosiniak-Kamysz, congratulated LACROIX Electronics for its job creation contribution and human resources policy.

5 EMS Industry Forecast to Grow to \$621B in 2019

The Worldwide Electronics Manufacturing Services Market—2015 Edition is the most comprehensive market research report on the EMS industry. This analysis focuses on the leading players, growing market segments, total available market, and emerging manufacturing opportunities and technologies by numerous product and country.

6 Cima NanoTech Enters Joint Venture with Foxconn

Cima NanoTech, a developer and manufacturer of transparent conductive film solutions, has entered into a joint venture with Foxconn to deliver the industry's first cost-competitive, projected capacitive (pro-cap) solution for large format touch screens.

7 EC Electronics Successfully Completes ISO 9001 Re-certification

After six days of successful auditing with no non-compliances, EC Electronics' operational sites in the UK, Romania and Hong Kong have been re-certified to ISO9001.

8 Kitron Secures Contract to Manufacture Medical Equipment

Kitron AS, a subsidiary of Kitron ASA, has signed a contract with a leading supplier of medical equipment. The agreement specifies that Kitron for specific products will be the supplier for a period of approximately two years from 2016. In this period the expected turnover linked to the contract is between NOK 100 million and NOK 120 million. Production will take place at Kitron's plant in Arendal.

9 Valtronic Welcomes Rainer Platz as New CEO

Valtronic, contract manufacturer of miniaturized electronic products for trusted medical device partners, welcomes Rainer Platz as new chief executive officer beginning November 1, 2015.

10 ESCATEC Opens New Factory in Malaysia

ESCATEC has announced the opening today of its new factory in Johor Bahru, Malaysia. It has been designed to the British Retail Consortium (BRC) standard for manufacturing consumer food and drink preparation products. After three months of full operation, the facility will be independently audited for BRC compliance.

SMT007.com for the latest SMT news and information—anywhere, anytime.



EVENTS



For the IPC's Calendar of Events, click [here](#).

For the SMTA Calendar of Events, click [here](#).

For the iNEMI Calendar, click [here](#).

For a complete listing, check out *SMT Magazine's* full events calendar [here](#).

IPC Conference on Government Regulation

October 13, 2015
Essen, Germany

IPC Europe Forum: Innovation for Reliability

October 13–15, 2015
Essen, Germany

14th International Symposium on Microelectronics Packaging (ISMP 2015)

October 13–15, 2015
Seoul, South Korea

International Wafer-Level Packaging Conference

October 13–15, 2015
San Jose, California, USA

Long Island SMTA Expo and Technical Forum

October 14, 2015
Islandia, New York, USA

TPCA Show 2015

October 21–23, 2015
Taipei, Taiwan

LED Assembly, Reliability & Testing Symposium

November 17–19, 2015
Atlanta, Georgia, USA

Rapid Oven Setup & PCB Profiling—Seminar

November 24, 2015
Warwickshire, UK

2015 International Printed Circuit & APEX South China Fair

December 2–4, 2015
Shenzhen, China

IPC APEX EXPO Conference & Exhibition 2016

March 15–17, 2016
Las Vegas, Nevada, USA



PUBLISHER: **BARRY MATTIES**
barry@iconnect007.com

SALES MANAGER: **BARB HOCKADAY**
(916) 608-0660; barb@iconnect007.com

MARKETING SERVICES: **TOBEY MARSICOVETERE**
(916) 266-9160; tobey@iconnect007.com

EDITORIAL:
MANAGING EDITOR: **STEPHEN LAS MARIAS**
+63 906 479 5392; stephen@iconnect007.com

TECHNICAL EDITOR: **PETE STARKEY**
+44 (0) 1455 293333; pete@iconnect007.com

EDITORIAL ADVISORY BOARD:

BILL COLEMAN, PH.D., Photo Stencil
HAPPY HOLDEN, IPC and SMTA
CRAIG HUNTER, Vishay
DR. JENNIE S. HWANG, H-Technology Group
MICHAEL KONRAD, Aqueous Technologies
GRAHAM NAISBITT, Gen3 Systems & SMART Group
RAY PRASAD, Ray Prasad Consultancy Group
STEVE PUDLES, IPC
S. MANIAN RAMKUMAR, PH.D., Rochester Institute of Technology
ROBERT ROWLAND, RadiSys Corporation
DONGKAI SHANGGUAN, PH.D., National Center for Advanced Packaging, China
VERN SOLBERG, Independent Technical Consultant
GARY TANEL, Electronics Alliance
TODD SCHEERER, ZESTRON America

MAGAZINE PRODUCTION CREW:

PRODUCTION MANAGER: **SHELLY STEIN** shelly@iconnect007.com
MAGAZINE LAYOUT: **RON MEOGROSSI**
AD DESIGN: **SHELLY STEIN, MIKE RADOGNA**
INNOVATIVE TECHNOLOGY: **BRYSON MATTIES**
COVER: **SHELLY STEIN**

SMT

SMT® (Surface Mount Technology) is published by BR Publishing, Inc., PO Box 50, Seaside, OR 97138

©2015 BR Publishing, Inc. does not assume and hereby disclaims any liability to any person for loss or damage caused by errors or omissions in the material contained within this publication, regardless of whether such errors or omissions are caused accidentally, from negligence or any other cause.

October 2015, Volume 30, Number 10 • SMT® (Surface Mount Technology®) is published monthly, by BR Publishing, Inc.

ADVERTISER INDEX

AIM.....	69	Mentor.....	21
Blackfox.....	15	Meptec.....	61
Candor Industries.....	33	Miraco Inc.....	35
Dibble Leaders.....	47	Nordson ASYMTEK.....	63
Dymax.....	45	P Kay Metal.....	17
Eagle Electronics.....	37	Portus.....	31
Electrolube.....	9	Prototron.....	25
Electronic Interconnect... 41		Rehm.....	43
General Circuits.....	11	SMTA.....	65, 71
Goepel.....	53	Super Dry.....	13
I-Connect007.....	82	The PCB List.....	2, 75
ID Tech Ex.....	59	Transition Automation....	19
Imagineering.....	7	US Circuit.....	27
IPC.....	3, 49	Zentech.....	57
Manncorp.....	5		

**Coming Soon to
*SMT Magazine:***

**NOVEMBER:
The DATA
Factor(y):
Looking at
the Industrial
Internet**

**DECEMBER:
Associations
and 2016
Events**

I-Connect007

GOOD FOR THE INDUSTRY



FREE SUBSCRIPTION



subscribe.icconnect007.com

EDITORIAL CONTACT

Stephen Las Marias
stephen@icconnect007.com
 +63 906-479-5392 GMT+8



mediakit.icconnect007.com

SALES CONTACT

Barb Hockaday
barb@icconnect007.com
 +1 916 365-1727 GMT-7



www.icconnect007.com