

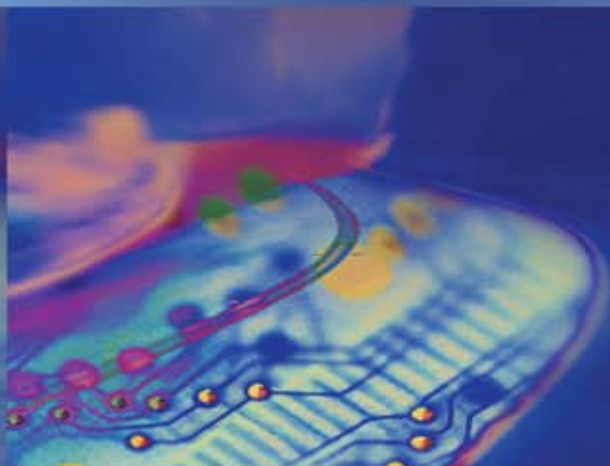
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"Woman Owned Small Business"

Volume 7, Issue 4

June 2008



inside this issue:

Dave's World: 2

Training Services: 3
2008 Schedule (July/August/Sept.)

Training Services: 3
BGA Courses

Engineering Services: 4-5
Analytical Methods for
BGA Evaluation

Sales & Distribution: 6
OKI's APR-5000 Rework Platform
& Easy Braid's VPI-1000
Optical Inspection System

Training Materials: 7
BGA Surface Finish

Jim's Corner: 8

I just returned from a great trip to St. Andrews, Scotland, the home of golf. Golf has been played there for several hundred years and it was almost like a religious experience for the group of friends that made the trip. I'm not going to bore you with details on all 54 holes (like I have everyone else) but just a few highlights: 1) Hitting my drive in the air and down the fairway off the first tee of the Old Course after not sleeping, eating, and barely breathing for the 24 hours leading up to the experience. All was fine after the first shot was struck; 2) Coming off the 8th green after 8 holes of really bad putting, my caddie was dead serious when he told me "Laddie, you have the touch of a blacksmith." (I parred the next 4 holes); 3) Getting up and down from the Road Hole Bunker (Pros have struggled with that one although most are good enough to not get in it to begin with.); 4) Walking with my caddie up the 11th hole at Carnoustie (arguably the hardest course in the world) where I was playing unusually well and him telling me "you need to make this par because it is the last one you are going to have a chance at today."



It's great to have a caddie!

I also was fortunate to have friends locally who served as excellent hosts and tour guides. Jim & Kath Henderson who own Solder School Technology in Glenthroes, Scotland devoted two full days to showing off Scotland and I was suitably impressed. We toured Edinburgh and the countryside and learned a lot about the history and culture of Scotland. Yes, we saw men in kilts but much to my wife's relief, I didn't try one (it was cold!) although I did have to explain the charge to my credit card for dining at a restaurant named The Flaming Kilt. We saw what seemed like millions of sheep. I also saw cattle in the field that didn't look like the cattle I know in Alabama. Upon closer inspection, it was because these were hairy cattle (Highland Cattle) which are native to Scotland. They looked like a cross between a cow and yak with long horns, long hair and bangs.



Back in the US, our new building continues to progress. It is fully framed from the outside now and it looks huge to us. Our plans are to be in it by the end of the year. Keep checking our website to view our progress.



I'm excited to welcome Dottie Grantham to STI. Dottie joins Sissie, Kelli, and Julia as our newest Customer Service Representative. She's unique in that she is our first CSR with prior experience in electronics manufacturing.

Our long awaited catalog should be available (or at least at the printer) by the time you read this. In an effort to save some trees, we will also have an electronic version we can mail to you and a PDF version which can be e-mailed. If you haven't received one yet, please let our sales office know which version you would prefer.

Business continues to be good and we really do appreciate your support. Please continue to let us know how we can better serve you.

David E. Raby

President/CEO
draby@stielectronicsinc.com

Training Services 2008: **Schedule**

Madison Alabama



July

- July 07-10 IPC-A-610 CIT Certification
- July 14-18 IPC J-STD-001 CIT Certification
- July 21-22 IPC Rework/Repair and Modification CIT Recertification
- July 23-24 IPC/WHMA-A-620 CIT Recertification
- July 28-30 IPC-A-610 CIS Certification

August

- August 04-05 IPC-A-610 CIT Recertification
- August 06-07 IPC J-STD-001 CIT Recertification
- August 08 IPC J-STD-001DS Update, Space Application Addendum to J-STD-001D
- August 11-15 IPC Rework/Repair and Modification CIT Certification

September

- Sept. 08-11 IPC-A-610 CIT Certification
- Sept. 08-12 IPC J-STD-001 Certified IPC Specialist CIS Certification
- Sept. 15-19 IPC J-STD-001 CIT Certification
- Sept. 15-19 MSFC/NASA-STD-8739.2/3 Solder Certification
- Sept. 22-23 IPC Rework/Repair and Modification CIT Recertification
- Sept. 22-24 IPC-A-610 CIS Certification
- Sept. 24-25 IPC/WHMA-A-620 CIT Recertification



Ann Duncan
Training Coordinator

To register for a course or for additional information go to www.stielectronicsinc.com or e-mail us at training@stielectronicsinc.com.

Training Services: **BGA Courses**

By: Dan Foster, Director of Training Services



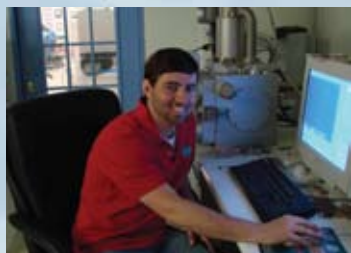
Dan Foster

Training Services has many courses to choose from both at your facility and ours. You may not know it but we offer BGA courses. These courses are customized to fit your needs. If you want training on your machine we can do that at your facility. At our facility we have an OKI APR 5000 XL. We can profile, reball, and align with the click of a button. We have a fine pitch board that we use for the course. The kit contains various BGA's and fine pitch components. Contact us today for details for your customized course.

If you have any questions please do not hesitate to e-mail me at dfoster@stielectronicsinc.com or call me at 256-705-5527.

Engineering Services: Analytical Methods for BGA Evaluation

By Aaron Olson, Senior Analytical Lab Technician



Aaron Olson

Ball Grid Arrays (BGA's) have become quite common on printed circuit board assemblies, which in turn opens up a new world of failure modes and analytical tools/methods required to properly evaluate these components. Traditional style SMT components

such as SOIC's or QFP's allow for inspection of the solder joints visually to look for anomalies but BGA's do not afford this opportunity since most of the solder joints are hidden underneath the components and are not visible to the eye. The following article will discuss some of the failure modes STI's lab has experienced and the tools and methods used to conduct the investigation.

Real-Time X-ray Inspection (RTX Analysis)

RTX inspection is often the first analytical tool used when evaluating a BGA with a potential failure or for general inspection after production. RTX inspection is a non-destructive form of analysis. RTX analysis allows for the evaluation and inspection of each individual solder joint underneath the component, that otherwise wouldn't be visible. Below are several characteristics that are evaluated during inspection with x-ray.

- 1) Bridging – an overall 2D image will be captured. This allows for inspection of bridging or shorting between individual solder joints. See Figure 1.
- 2) Proper pad alignment – an overall 2D image will be captured which allows for inspection of the overall alignment of the BGA solder joints with the corresponding PCB pads. Often times with tin/lead (Sn/Pb) solders if the BGA is misplaced slightly off of the pads, the BGA will self align during reflow. This is not the case when using some Pb-free alloys, particularly SAC305. If the BGA is not properly placed and centered on the pads, it will reflow where it sits and will not self align on the pads. This is often caught during general inspection after production. See Figure 2.
- 3) Voiding – voiding can be assessed by viewing an overall 2D image of the solder joints. Some voiding is expected but excessive voiding points to a process related issue. See Figure 3.

4) Adequate ball collapse – a 3D image of the solder joints can show proper reflow of the solder balls underneath the BGA. Proper ball collapse however is not an indicator of the degree of wetting to the PCB pad. See Figure 4.

5) Opens / Fractures – viewing the BGA solder joints in 3D can also show open connections if present and sometimes solder joint fractures, if the fracture is significant. Micro-fractures usually are not detectable with x-ray analysis. See Figure 5.

Dye and Pry Analysis

This analytical technique relies on the ability of a very low viscosity dye to penetrate fractures while under a high vacuum. Generally this is a vacuum applied for several hours, followed by a high temperature bake to cure the dye. Next, the BGA is mechanically removed and the interfaces inspected for any traces of the dye on the surface of the pads. If the bonds are intact, dye will not penetrate and stain the pads. However, if there is a complete or partial fracture, the dye will coat the fractured surface and subsequent inspection will identify the open solder joints. This analytical technique is destructive.

This method is used to determine if opens/fractures do exist and at what interface. It also shows if the opens/fractures are concentrated to a specific part of the BGA, like a certain quadrant or if it is a random problem. Many times dye and pry analysis will be performed prior to any micro-sections to determine where the micro-section needs to be taken in order to have the highest probability of capturing the failure in the micro-section. See Figure 6.

Micro-Sectional SEM/EDS Analysis

Micro-sectional analysis in conjunction with scanning electron microscope (SEM) imaging with EDS capability is a very informative method for gathering both mechanical and materials information from a solder joint. Micro-sectional SEM analysis can confirm proper ball collapse as evidenced through x-ray. It can also provide information as to the degree of wetting to the PCB and component pad and the amount of intermetallic (IMC) that was formed during reflow. Elemental data can also be obtained from the bulk solder to determine composition of the alloy. A chemical etchant can also be applied to the solder prior to imaging to show the grain structure of the solder. This allows for analysis of the solder itself to determine proper alloying of the metals in the solder, which relates to the amount of heat and dwell time during reflow. See Figure 7 & 8.

Continued on next page.

Engineering Services: Analytical Methods for BGA Evaluation

By Aaron Olson, Senior Analytical Lab Technician

All three of the methods described above are used during failure investigations and also as part of assembly construction analysis prior to full production of the assemblies. It is never a bad idea to sacrifice one or two assemblies up front for validation of the BGA attachment process prior to high volume production. While there is some cost involved with analysis, validating a process before production is always less costly than scrapping or reworking thousands of assemblies because a process issue was not found prior to production.

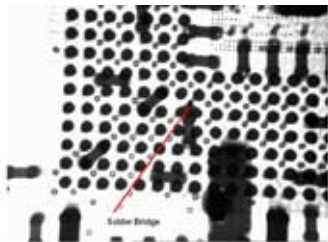


Figure 1. Solder Bridge

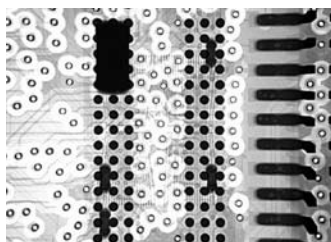


Figure 2. Proper Pad Alignment

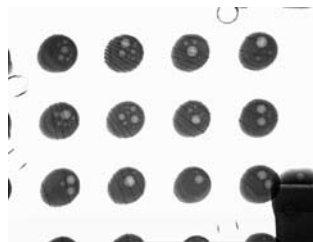


Figure 3. Voiding

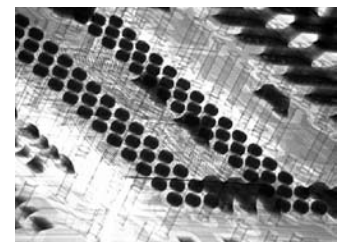


Figure 4. Adequate Ball Collapse

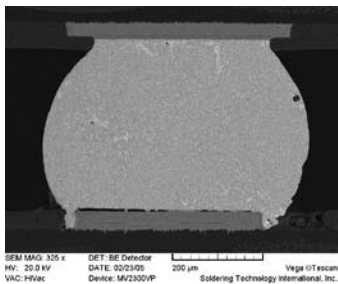


Figure 5. BGA Solder Fracture

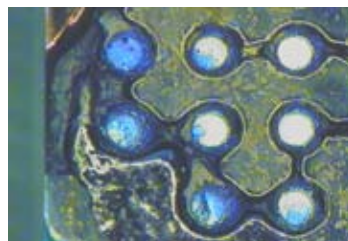


Figure 6. Open BGA Connections Found by Dye and Pry

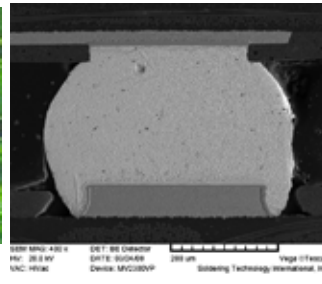


Figure 7. BGA Ball - Overall SEM Image

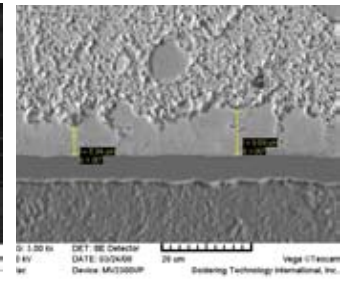


Figure 8. IMC Formation at Pad Interface

Josh, A.J., Mel, Randy, Angela,

On behalf of NG and the Northrop Grumman - Xetron Team, please accept our appreciation for ANOTHER job well done with your support in this BGA replacement on CCA's supporting one of our critical programs.

STI has always supported our quick turn efforts without imposing premium fees or added emotion.

Some suppliers utilize words like "Partnership" and "Win/Win". STI exemplifies this with their "actions"!!

This Memorial Day weekend we remember how important our "actions" are to the soldiers of today and yesterday who have died in our nation's service.

You have a GREAT team Dave !!

Pat Wallace
Subcontracts Adm.
NGES - Xetron
Cincinnati, Ohio

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To receive future issues of STI's newsletter electronically,
please go to www.stielectronicsinc.com.

Sales & Distribution: Features OKI's APR-5000 Rework Platform & Easy Braids VPI-1000 Optical Inspection System

By Sissie Eckstein, Sales Manager



Sissie Eckstein



APR-5000 Advanced Package Rework Platform

The APR-5000 Advanced Package Rework Platform is designed to facilitate rework of even the most challenging boards, including lead-free and multi-layer assemblies. These systems allow you to reflow packages without incurring excessive lid temperatures, re-melting soldered joints outside the rework area, warping of the PCB or distorting the plastic bodies of connectors. They provide the increased thermal transfer and stricter temperature control required for lead-free rework.

Consisting of two series, the APR-5000-XL and APR-5000-DZ Series, these systems have precision placement and powerful software that make the rework of complex array packages easy, fast and reliable.

The APR-5000 Series Advanced Package Rework Systems incorporate state-of-the-art vision, and closed-loop time, temperature and airflow control. Precision placement and powerful software make the rework of complex array packages easy, fast and reliable.

As the implementation of lead-free assemblies intensifies, the APR-5000 Series Advanced Package Rework Systems deliver best-in-class BGA/CSP functionality with professional performance at an affordable price. All machines incorporate the ideal combination of hardware features and automated software necessary for reworking today's array packages.

As the rework and repair processes have evolved, OK International has developed tools to keep up with increasingly sophisticated packages. The systems are designed by working closely with component suppliers and customers to develop powerful, user friendly systems and process solutions.



VPI-1000 Series Optical Inspection System

The VPI-1000 Series Optical Inspection Systems change the way technicians "see" array packages. For the first time, operators can check every solder ball, every joint and know the attachment has been performed to the original specification. The VPI-1000 Series Optical Inspection Systems get tighter, closer and lower than any other optical inspection system.

Software

Standard on the VPI-1000 Series Optical Inspection Systems is Easy Braid's pioneering software. Featuring precise measurement and analysis tools, multi-focusing and image enhancement capabilities, defect diagnostics, an exhaustive defects library, preset calibrations and an easy-to-use CD manual, operators have the data available to measure, record, annotate, analyze and communicate component information.

Setting the Standard

The VPI-1000 Series Optical Inspection Systems set the standard for post array package rework inspection. Using our patented MT1 90° mirrored tip, rework technicians are able to look under a BGA package and view interior rows of balls and top/bottom connections. Sleek and ergonomically designed, the compact nature of each separate feature ensures that a minimum of bench space is employed by the system as a whole.

For small to medium volume manufacturers, the VPI-1000 Optical Inspection System offers impressive functionality in an economical optical inspection system. High volume facilities can use the system to supplement X-ray inspection for optimum quality and improved process control. With on-screen magnification of 5X to 245X and focus distance of 0-3" (0-76mm), manufacturers can be assured that they are using a unique system capable of thoroughly examining even the most advanced array packages.



For more information on these or other products STI offers, contact one of our friendly CSRs at 1-800-858-0504 or sales@stielectronicsinc.com.

Training Materials: BGA Surface Finish

By Mel Parrish, Director of Training Materials

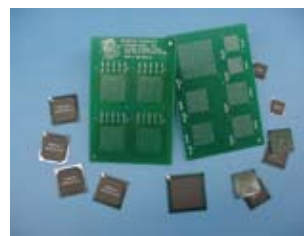


Mel Parrish

While surface finish of a printed circuit board (pcb) is commonly dictated by the design, the surface finish plays a major role in the success or lack thereof regarding BGA attachments. Initially, the unique properties of the BGA package must be considered. BGAs have no lead compliancy and therefore the flatness of the pcb and land/pad surface is a critical perspective for successful attachment (coplanarity). The finer the pitch or sphere to sphere spacing is and the smaller the sphere diameter is, the more critical this variable becomes. Coplanarity is improved with a plated surface finish when compared to others such as a Hot Air Solder Level (HASL) finish. When the solder is leveled it tends to build up or crest on the trailing edge of some pads and flatness or coplanarity suffers. This will typically not be an issue for common pitch dimensions around 1.27mm or 50 mil pitch. Electroless Nickel Immersion Gold (ENIG) allows a very flat finish and has the ability to be compatible with most Lead Free and Tin Lead BGA spheres. However, ENIG has been suspect for Black Pad

failures at the nickel interface. As a result, ENIG may not work with some designs when considering the design layout as a whole. Another common finish that has good coplanarity is Organic Solderability Preservative (OSP) since it is placed directly on the exposed copper surfaces. On the down side shelf life can be less than HASL or ENIG.

BGA soldering kits are available from STI with HASL finish for common pitch dimensions and ENIG for Finer Pitch. It is a cost effective way to evaluate BGA production capability without production material loss. Gerber data can be supplied to create stencils from your favorite source.



Looking for an IPC Specification on a specific topic? Just call our friendly Customer Service Representatives today for help at 1-800-858-0604. We have the ability to quickly search all currently available IPC documents using keywords or phrases to help determine which document/s best fit your need.

STI Electronics Awarded IPC Rework and Repair Training Development Contract

STI Electronics was awarded a contract by IPC, Association Connecting Electronic Industries, to develop the certification course for IPC based on the newly revised IPC-7711B/7721B, "Rework, Repair and Modification of Electronic Assemblies". STI has broad experience in developing and presenting electronics manufacturing training programs and previously developed four other IPC certification program courses. The elements of this rework and repair certification course were established by a committee of industry representatives. This two-tier "train the trainer" program includes certification and recertification elements for both Certified IPC Trainers (CIT) and Certified IPC Application Specialists (CIS). Beta testing of the CIT course was conducted at STI's facility in Madison, AL May 19-23. A CIS beta course is scheduled June 16-24 also at STI's Madison, AL facilities. IPC expects to release new course materials by August 2008 after approval by the industry technical training committee.

Surplus Inventory Sale

STI Electronics, as one of the largest distributors of electronic assembly and solder supplies, occasionally has overstock on some items. We have created a surplus inventory list with prices drastically reduced. The surplus inventory list is available at our website, www.stielectronicsinc.com, and is updated monthly. Please call (256) 705-5545 and ask for Sales or (800) 858-0604. Quantities are limited so don't delay.



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STI is a Resource for Training Services, Training Materials,
Engineering Services, and Product Distribution.
Visit www.stielectronicsinc.com

Jim's Corner

By: Jim D. Raby, PE, Technical Director



Two exciting things have happened since our last discussion. I have been looking forward to sharing them with you.

First, I just returned from a trip to China Lake, Ca where I was really surprised to see all the changes that have come to the Navy base as well as the outside community of Ridgecrest. It was amazing to see the growth of the town of Ridgecrest. Ridgecrest has several new hotels, restaurants, shopping centers and stop lights. Ridgecrest is very impressive and prosperous as well as progressive. It looked clean and well kept, much better than I remember from the 70's and early 80's.

Second, I had told you of a fishing dream I had to catch a brown trout. I learned that on the White River in Arkansas there are brown and rainbow trout. I made contact with a guide and on April 21st Ellen and I drove out to Lakeview, Ark which is next door to Flippin (home of Ranger boats). We rented a

cabin on the bank of the river at Gaston's White River Resort and on Tuesday morning the 22nd met the guide, Jon Miller. We started fishing and immediately began to catch rainbow and boated one Brown that morning. What a delight! The best brown of the day was on my line and kept taking line, would get near the boat and take line again, with drag set quite tight. After playing him and seeing him jump for about 30 minutes, he broke the line and kept going. The next day was again a great rainbow day with two big browns boated. It was a dream come true! My friend Doug Winther, owner of Technical Devices and his wife and son met us there and was a part of the experience. Doug and I both can say it was our very best fishing experience. We are off to Alaska next for a cruise and land tour then it will be time to go back to the White River, that was great.

If you have questions about fishing, feel free to contact me.

Jim Raby
jraby@stielectronicsinc.com