Minutes
PERM Meeting No. 2
September 9-11, 2009
Crane, IN

1 Attendees:

A list of the attendees is posted on the PERM Meeting pages of the AIA, Website.

2 Welcome and Introductions

Lloyd Condra, Transition Chair, welcomed the attendees to the second Pb-Free Electronics Risk Management Consortium meeting.

Appreciation was expressed to Naval Surface Warfare Center (NSWC) for hosting the group, Thanking Gary Latta and Mick Miller for their efforts to provide the meeting resources.

3 NSWC, Crane Welcome

Captain LaSota welcome the attendees to NSWC crane. He is very sensitive to the dependency on COTS and understanding mitigating associated risks. We need high reliability. With high reliability and lead-free, there are technical risks that need to be assessed. He is supportive of a technology roadmap to help identify the risks and how to overcome them. Need to highlight places where critical investments are needed.

Crane has a great opportunity. DoD has appointed Crane to be executive agent for printed circuit technology. Crane will determine what investments should be made in certain critical technologies. Crane will be in a senior leadership role. Captain LaSota wants our inputs on this.

4 PERM Status

Lloyd Condra provided status report on the PERM Activity. His presentation is available on the PERM Meeting Pages located on the AIA website (www.aia-aerspace.org).

It was noted that this is the second PERM Meeting. A summary of PERM formation was presented.

- PERM now sponsored by AIA, AIA Engineering Management committee (EMC) and Technical Operations Council (TOC).
- PERM is coordinating organization for all aerospace and defense lead-free activity.
- PERM includes representatives from “critical cousin” industry segments

EMC teleconference minutes of July 28, 2009 was shown to give the group an idea of kinds of information reported to the EMC. Lloyd mentioned (especially to PERM team leads) that they should each provide a high level action item to commit to the EMC.

5 Updated PERM Organization & Charter

Ed Morris gave an overview of the work that had been done by the transition team. This presentation is available on the PERM meeting pages. Morris highlighted that the PERM represented both the expertise of the Subject Matter Experts participating in the Lead-free Electronics Project WG (LEAP-WG) sponsored by TechAmerica, AIA and AMC and those who are driving policy through the Executive Lead-free Integrated Process team (ELF-IPT). The briefing included discussions on the:

Talked about the strategic needs which are how the task teams have been identified: Research, Supply Chain, Standards/Handbooks, Communications, Training, and Advocacy.

Side note: HR 2420 will probably "die a natural death".

See current Consortium Functional Framework slide for further details.

PERM consortium allows us to "turn up the gain" on lead-free risk mitigation activities.

Ed presented charter and scope/expected result for PERM and the task teams.

5.1 PERM Consortium MoC & SoP (Anderson)

Vance Anderson reviewed the Guidance documents (Memorandum of Collaboration, Standard Operating Procedures) which were e-mailed in advance of the meeting..

Memorandum of Collaboration (M of C): If one participates in PERM, then one agrees to scope and operation of PERM, i.e. working issues to lead-free in aerospace and defense. In other words, the signee agrees to the PERM organizational structure, objectives, and other items.

Explained that consensus vote means an approval based on the fact that the motion being voted does not violate ethical and legal rules. In a consensus vote, even though some do not agree with some technicalities, they would still support it.

5.2 Nomination and Election Process for Chair & Vice Chairs

Ed Morris reviewed the proposed process for nominating and election of leadership of the PERM. A slate of candidates will be provided to the members at large by 5 December. Nominees need to be present at the January PERM meeting.

See remaining slides for information on voting and election.

In accordance with the process. Nomination slate will be developed and proposed for an election during the January 2010 meeting.

6 Technical Presentation #1

LEAD-FREE MANUFACURING, Testing Reliability of several lead-free soldered systems presented by Matt Hamand of Rockwell Collins

- F-18 HUD was first studied per Navy's concern with lead-free reliability
  - Some concern/confusion on the laminate; typical glass transition temperature is 140C; a "better than" substitution. Temperature of decomposition was 30C higher at 170C.
  - SAC 305 used. Wave solder process temperature set at 260C. Board temperature was 198C vs. 178C for SnPb.
  - Board was essentially all through-hole.
    ESS: T/C was -55C to 125C; 10 minute hold at cold extreme, 30 minute hold at hot extreme for both SnPb and LF. Thermal shock was -55C to 125C, five minute dwell at each extreme, side to side chamber. Functional test was performed at room temperature.
    Test results: everything passed. Note: This was all through-hole technology, i.e. robust attachments.
  - These results will be presented at SMTA 2009.
  - Failure analysis: Shrinkage voids noted (from non-eutectic solder). Pad lift due to wetting of pad to laminate causing pad to pull up, did not cause stress in solder joint.
  - Conclusions: No failures with LF capable laminate through ESS. No failures with legacy laminate through manufacture. Tin whiskers investigation is on-going.

- Next study on a unit that mounts on a helicopter
  - Board: FR4 board, 135C Tg, immersion tin, blue solder mask
    Components: SMT, no array, some through-holes
    Solder was SAC 205, Type IV solder paste
  - Reflow 12 zone oven 235C, 30-60 seconds
  - Vibration: 4GMS for 10 minutes; once per day for 14 days
    Thermal excursions: See presentation.
  - Failure analysis: solder was under stress, some through-hole cracks noted, shrinkage voids, pad lifting
  - Should legacy designs be converted lead-free? Perhaps not.

- Lead-free Feasibility Program Avionics Data Unit

    - BT laminate, surface finish a mixture of immersion tin and HASL, miniwave used with CAST-IN
    - Signal processing card: some BGAs, some fine pitch parts
    - Same processes as the helicopter unit
    - ESS: HALT for 360 hours; Vibe 0 to 20 KHz, thermal ????
    - Results: No failures for tin-lead or LF.
    - Thermal cycle: After 500 hours, some issues found with LF BGA solder joint.

7 Technical Presentation #2

Tin Whiskers and the effect of Surface Contamination presented by Terry Munson from FORESITE

Metal Whiskers on a SAC 405 alloy and Tin plated leads of a MOSFET

Contamination levels ranging from 100 ppm to 500 ppm. Produced tin whiskers in a much shorter time (5 to 10 days vs. 42 + days) in lower cost/less complicated equipment than the current JEDEC test procedure. Surface contamination is a factor in whisker formation in an accelerated condition even with plating finishes that do not easily whisker.

8 Case study: Lead-free Fighter Electronics

(Humphrey and Burdick)

Pb-free Risk Management Contractual Flowdown presented by Dave Burdick of Boeing

Boeing has installed lead-free assemblies and sub-assemblies (COTS) on F-15, F/A-18EF, T-45. Integrators, OEMs' and others in the AHP electronics supply chain need help in managing the risks associated with this next giant step, which is the solder joint reliability aspect of Pb-free electronics. Thus, there is a great need to keep the GEIA standards/handbooks current and up-to-date.

Pb-free Cockpit Display Fighter Jet Application presented by Dave Humphrey of Honeywell

COTS assembly produced and sold by Chinese company
- approximately 300 active and passive components. Tightest pitch is 20 mils
- tin plated parts with small spacing, passives have nickel underplate

- SAC 305 solder paste, ENIG finish
- Standard urethane coating applied

Testing/experience: combined thermal and vibration testing (2G to 14G in 2G increments random while thermal cycling from -30 to 70C) fielded over two years ago; no field failures to date. NOTE: this product is in a benign environment (despite being in a fighter jet) but it does make the case that with proper risk mitigation and due diligence, lead-free can work.

Dave did mention that there is some interest in disposable electronics.

9 Government Briefings and Panel Discussion

(Kalt)

NSWC Crane Executive Agent Designation for Printed Circuit Board Technology presented by Gary Latta of NSWC

Today's warfighter tends to use equipment that is older than he/she.

1. PrCB Executive Agent (EA)

    - The EA activities will focus on providing critical solutions for all DoD/military technology users by leveraging collaborative participation across all components of the Government, Industry, and Academia.
    - PrCB industry, in the US, is slowly eroding away.
    - Intent of the EA is to anticipate issues and Identify broadly applicable solutions prior to suffering adverse consequences to critical system readiness, quality, and reliability.
    - Gary's concern: so much being made in China including our computers
    - National Academy of Sciences Identified four risk areas in their 2005 Linkages: Manufacturing Trends in Electronics Industry
    - Deputy Sec Navy identified NSWC-Crane as the PrCB executive agent. Crane awaiting formal direction.
    - Gary presented a notional structure and activities list of the PrCB
    - PrCB to focus on providing critical solutions; leverage collaborations across all components of government, industry, and academia.

DoD Lead-free Policy update

- Gary did show us a draft policy but it is yet unsigned.
- Estimate to sign-off: 3 months
- GEIA documents are listed as references

Defense Acquisition University Lead-Free Website presented by Andy Ganster of NSWC

- The LF website is a public access website
- http://www1.dau.mil/default.aspx See Andy's presentation for the successive steps to get to the actual lead-free website. (Need to go to aging systems and then sustainment to find it.)
- Users need to register to use the website.
- Tim Kalt and Andy are editors for the website.
- Tim and Andy are looking for input to the website.

Lloyd Condra has requested that DoD formally adopt the LEAP GEIA documents. Lloyd mentioned that the counterfeit document AS5553 was recently adopted by the government. Gentleman from NAVAIR PAX said he knows who to contact to get the LEAP GEIA documents adopted. Gary Horan mentioned that FAA adopts industry documents per revision to prevent future revisions (which may have changes that FAA does not agree with) from inadvertently applying to FAA.

DSCC Initiatives presented by Tom Hess of DSCC, Columbus, OH
Lead-free activities

- Random testing of 5961 and 5962 components
- Incorporation of clause requiring marking of J-STD-609 e-code
- Qualified suppliers listing of distributors (QSLD) program
- Working with organizations to help get parts that are no longer available
- Work with J-STD-609 on part marking; adopted by DoD 9 January 2009.
- QSLD program: Criteria and Provisions for Qualified Suppliers List of Distributors document now available.

Other news from Tim Kalt

Air Force Material Command has signed the Air Force Lead-free Team Charter. Regarding the Government Panel, Tim suggested that the government vice-chair, from each task team, put together the panel for each PERM meeting.

10 Pb-Free Risk Management Contractual Flowdown Industry Panel, Steve Davidson

10.1 Pb-free flowdown remarks from Joel Heebink of Honeywell:

- How Honeywell flows down Pb-free Risk mitigation to sub-contractors

- Build to print (vast majority of how it's done) and supplier level of design control (another way that it's done). With the former, engineering documentation provides the requirements and with the later, some termination finish requirements will be flowed down. Also, for the latter, the supplier may have a LFCP.
- How has Honeywell received Pb-free Risk management requirements as flow down: Customer correspondence leads to contractual agreements. Some problems include multiple, redundant or inconsistent requirements.
- What steps does Honeywell take to verify compliance: Certificate of conformance, on-site audit, or incoming inspection. What steps do customers take to verify Honeywell: Some reviews of plan/procedures but no specific verification of hardware for Pb-free to date.

10.2 Pb-free Risk Management Contractual Flow Down presented by Michelle Voorheis of Boeing

- How does Boeing flow down Pb-free Risk mitigation to S/Cs: This presentation limited to B-1. Boeing does not have one corporate plan; plans are based on platforms. B-1 requires use of Sn60, Sn62, Sn63 in procurement specs; also they clearly state that use of Pb-free solders is prohibited. They call out specific surface finishes and Sn-based Pb-free finishes are prohibited. Also, parylene™ coating is required on all flight production units. Tin whisker control level is specifically cited for B-1 hardware. B-1 has an LFCP that is available for use of risk assessments and guidance.

- How does Boeing receive flow down from its customer (B-1): Boeing did not receive flow down from overall customer but worked specific B-1 issues and indirectly derived requirements from A and B level specifications. SIDE NOTE: Michelle mentioned that in many instances the critical needs (rapid response) has forced the government customer to require COTS. In this case, Boeing B-1 requests that this be GFE to alleviate "some of the problem" from BOEING.

10.3 Rockwell Collins presented by Matt Hamand

- How does Rockwell Collins flow down Pb-free risk mitigation: LFCP with Level 2A or 2B for tin whiskers. Open discussion is allowed regarding their flowed down LFCP
- How does Rockwell Collins receive flow down: Contractual requirements in 10 commercial programs and 22 government programs.

How does Rockwell Collins verify suppliers: some activity but no formal inspections. Work to be done in this area.

- How does Rockwell Collins get verified by its customers: Similarly much work to be done.

11 Technical Presentation #3

Polina Snugovsky, Celestica made a presentation on Wave: Cu Dissolution, Alternative Alloy Study, and Impact on Reliability. Her presentation is available on the PERM Meeting Pages.

12 Manhattan Project Report

Ed Morris, provided an update on the Status of the Manhattan Project. This presentation is available on the PERM Meeting Pages.

13 AIA TOC Action item review (Condra)

14 Breakout Activities

Vance Anderson and Ed Morris explained the process for the Break-out sessions.

Goals for the breakouts as follows:

- Initial face-to-face meetings for Task Teams and International Advisory Group
- Selected Chairs and Vice Chairs for ratification by the PERM Steering Committee
- Finalize 2009 Actionable Deliverables and Milestone Schedules
- Work on the Deliverables
- Prepare Status Brief for Thursday

15 Research Coordination Task Team

Dr. Stephan Meschter, reported. A detailed presentation is available on the PERM web Pages highlights of the discussion follow:

16 Supply Chain Risk Mgmt. Task Team

Bill Procarione reported.

1. Process and Description: representation of a generic aerospace supply chain process
2. Upcoming deliverable for 3rd Q: report on risks/opportunity in supply chain
3. Defining supply level categories for military and commercial

17 Standards & Handbooks Task Team (Latta)

Standards & Handbooks Team Out-Brief (Gary Latta)

1. Reviewed and updated charter

2. White paper: changes made and document updated
Deliverables:

- The list will be submitted middle of the week of 9/14
- GEIA-HB-0005-4 Reliability is slipping but latest is that document will be ready for ballot by December 2009
- GEIA-STD-0005-1 is in revision process; work continues
- GEIA-STD-0005-2: Anduin has some funding to work it
- GEIA-HB-0005-1: Trying to resolve P. Amick's funding issues
- Long-term sustainment: concern that PERM could "go away" and any time so how do the standards and handbooks continue to be maintained?

18 Advocacy Task Team

Dave Burdick reported.

1. Reviewed potential consequences of HR 2420; Latest info is that bill is going to be completely re-written
2. New tasks/responsibility: Establish contacts within other civilian and government agencies both foreign and domestic

19 Communications Task Team

Joseph Zaccari reported that the Communications Task Team.

1. Worked their charter
2. Their deliverables:

    - Establish PERM email comms network
    - Develop/Distribute PERM whitepaper to users 3Q 2009
    - Establish PERM website 3rd Q 2009
    - Develop PERM comms strategy 4Q 2009

3. Need to implement a process to communicate advisory type messages to PERM
4. Develop an information release protocol
5. Should we generate press releases for the PERM meetings?

20 Training Task Team (Kalt)

Tim Kalt Reported that the Trining Task Team:

1. 24 participants; 12 new
2. Charter review
3. Training survey
4. PERM white paper review
5. Focus on awareness training

6. Draft training questionnaire

21 International Advisory Group

Bob Gregory reported that the International Advisory Group:

1. Reviewed charter and white paper
2. Team's direction
   - Increase active membership
   - Identify gaps in knowledge base; indentify research
3. Review the developing Lead-free situation
4. Communicate back to the PERM
5. Deliverables
   - Formalize the International Advisory Team network by 18 December 2009
6. Work international meeting sites

22 PERM Feedback and Future Activities

22.1 Review of Functional Framework and Charters Updates (E. Morris)

1. International Advisory Group requested a more definitive role, depicted graphically, in the Functional Framework chart. Present version shows all beneficiaries to be U.S. Proposed change is to "encapsulate" the international beneficiaries into their own box (See latest chart).
2. Presented all associated updated charters of the task teams due to above
3. Note made by Gary Latta: We need to be careful not to interchange risk management with risk mitigation. Risk mitigation is a subset of risk management.
4. Question raised about what would we do if members from our "critical cousins" wanted to join PERM? They could attend and participate in our meetings. Regarding Steering Team membership, we would ask our Executive Committee.
5. Review of Memorandum of Collaboration (M o C): Use of this document adds some credibility. The document will be moved forward to AIA executive board for their approval. We are asking today's PERM attendees to consensus approve forwarding this document to the AIA leadership. Need to get consistency in how our industry is noted: Aerospace and Defense versus other descriptors.
6. Standard Operating Procedure: Got the wording consistent with the charter(s).
7. Review on consensus: The ability to support without agreeing with everything. Acid test: if one is ethically or professionally violated by the work, then this needs to be voiced.

22.2 Terminology:

1. Lead-free will be notated as Pb-free.
2. Use of AHP (aerospace and high performance) was prevalent in LEAP. Now, the term Aerospace & Defense (A&D) is being used. Which should we use? One suggestion: Aerospace, Defense, and other High Performance? Or Aerospace, Defense, High Performance (ADHP)? Straw poll indicates that ADHP is the most popular. For PERM organization documentation (charters, SOPs, etc.), use A & D. For the standards and handbooks and other deliverables, use ADHP. This was per consensus. Lloyd Condra suggests using A&D only in the Steering Team level charter and documentation.

22.3 Consensus Votes on PERM documentation:

1. Functional framework and charter and team charters : approved by consensus
2. Memorandum of Collaboration given AIA approval: approved reached to move Forward to AIA for Consensus approval
3. Standard Operating Procedure: approved reached to move Forward to AIA for Consensus approval
4.

Nominations for new officers via the nominating committee: Instructions will be coming out via e-mail very soon.

23 Sound Bites:

- Participation in PERM will position our company for successful implementation and deployment in A&D Pb-free electronic assemblies (in a most timely and cost effective manner) – Jeff Kennedy
- Helps Supplier and customer to align expectations.
- A coordinated and collaborative strategy to Pb-free electronics mitigations
- Work is not done, we have investment a lot, need to keep going.
- We are still discovering more technical problems and issues, than solutions
- PERM provide timely access to key information not easily available from other sources - Vance Anderson
- We have Pb-free electronics in the field; we still have risks
- Due diligence to be prepared for the Impending problem
- Best technical cooperation between DoD, Primes and Suppliers I have ever seen. – Denny Fritz
- The time-line for the eventual ingress of Pb-free electronics.
- It's happening, we need to deal with it.
- Awareness of the Pb-free electronics risk is still a major challenge. – Ed Morris
- Gives us foresight in what standards we need.
- Facilitate strategy and implementation and reduce risks in modern industry.

- The words “yes, but….. “ follows every statement you can make about Lead-free solder. – Steph Meschter
- Reliability is cost effective.
- Safety and performance is a requirement!
- The Risk is too great not to participate
- Complete the process: Define, Determine, Decide, Deploy.
- Transition to the PERM from LEAP-WG…..
- Access to industry leaders in Pb-free is invaluable.
- Non-attributional access to broad knowledge base of information is a valuable resource.
- Access to group of subject matter experts.
- Networking opportunity…..
- Perm industry government participation solves tomorrow’s Pb-free problems.
- Effective relationship for working the issue of Pb-free Electronics.
- Passion

24 Next Meeting:

Next Meeting (No. 3): Dates: January 5-7, 2010, Hosted by Y-12 National Security Complex in Oak Ridge, TN 37830.

Need to determine an international venue for Meeting No. 4. Some ideas: Japan, Netherlands, etc. Need ideas.