



Reliability Summit

“Keeping industry reliability test protocols current
with rapidly changing markets”

Friday February 23, 2007

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Executive Director - HDP User Group

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HDP User Group Overview



Agenda

- HDP User Group Background
- HDP User Group Project Life Cycle
- Project List
- Project Example – Mild Acceleration Factors

The HDP User Group's Mission



To reduce the costs and risks for the **Telecommunications** and **Computer** industries when utilizing electronic packaging, by improving cooperation between System Integrators, Contract Assembly Manufacturers, and Suppliers in the high-density packaging development and design process, with member resources supplemented by a small staff.

History - Positioning



- Non-profit organization with about 25 members. Most members are key global players
- True international - there are no regional barriers
- Members contribute resources
- Small expense budget
- The work is market oriented because system integrators influence the direction
- Global presence
 - Headquarter and North American Office in Scottsdale AZ USA
 - European Office in Stockholm, Sweden
 - Asia Office in Tokyo

HDP History



- Founded 1994 by Ruben Bergman
- Completed over 60 projects
- Published over 20 conference papers
- Has worked with organizations such as:
SEMI, ITRI, IPC, the US EPA, JPCA
- Founder of the GEI (Global Environmental Initiative)



Reliability characterization quickly became a key activity.

BGA Reliability

WSCSP Reliability

BGS with flip chip

Lead-free Reliability I

CSP Reliability

PWB Via Integrity I

Environment was the next area being addressed

Design for Environment (Three projects)

Lead-free Optimization

Halogen-free Printed Wiring Boards (Two projects)

Infrastructure is another primary focus

GPLF Application Guideline

(GPLF stands for General Purpose Lead-free)

Member List



Executive Level

Corporate Level

Celestica – Thilo Sack	Albemarle	Intel
IBM – Jim Wilcox	Alcatel	National Semi
Juniper Networks – Michael Kluwin	AMD	Nihon Superior
Lucent Technologies- Richard Coyle	Artesyn	NEC
Sun Microsystems – David Towne	Clariant	Samsung
	Dell	Supresta
	EIT	Siemens
	Flextronics	TI
	Fujitsu	Tekelec
	HP	Viasystems
	Hitachi	



Project Life Cycle



- **The Project Idea**
- **Defining the Project (Definition Stage)**
- **Project Approval**
- **Project Execution (Implementation Stage)**
- **Ending the Project**

The Project Idea



A project idea can be generated by:

- Any member
- Any potential member
- The Staff
- Board of Directors

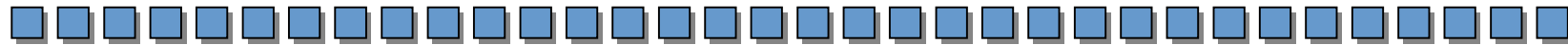


Definition Stage

The HDP User Group Staff works with the Project Team of 2 or more companies including non-members, to complete the project proposal containing:

- Project description (Statement of Work)
- Project Execution Plan
- A list of project team participants
- Team Leader
- HDP User Group Staff facilitator
- Resources needed that Participants can't provide
- A plan for sharing the project results

Project Approval



Board of Directors acting on behalf of all members:

- Evaluates the value of the project with respect to the mission of HDP User Group
- Determines that the project plan is complete and thorough
- Approves the project if in line with the HDP mission and makes efficient use of resources

Project Execution



Implementation Stage

The project team consisting of only Members and special guests executes the project plan

- The progress of the project is reported to the membership on a regular basis
- The HDP User Group facilitator is monitoring progress and providing assistance

Ending of the Project



Key activities:

- Board of Directors approves the project as finished
- The project report is posted on the member website
- The project results are made available to the public
 - Presentation at a conference
 - Sold as an HDP report
 - Made public after a period of time



GPLF (General Purpose Lead Free) Reliability Characterization

- Finish date late 2006
- Comprehensive reliability characterization of solder joint reliability using a test vehicle with many different types of components

Lead-free Acceleration Factors

- Finish date early 2007
- Comprehensive characterization of lead free solder joint reliability using different testing conditions



SAC Microvoids

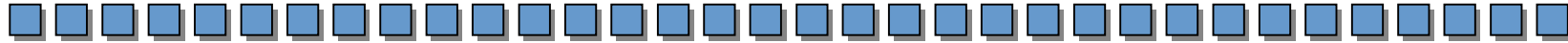
- Finish date late 2007
- Establishing an understanding of the cause and reliability impact of microvoids in lead free solder joints

Component Terminal Finishes Phase 2

- Finish date late 2006
- Reliability characterization of Nickel/Palladium type terminal finishes, particularly moisture level sensitivity

BMPS (Board Mounted Power Supply) Guideline

- Finish date late 2006
- Establishing a comprehensive guideline for using Board Mounted Power Supplies



Lead-free Board Materials Reliability

- Move to implementation late 2006
- Finish late 2007
- Comprehensive reliability characterization of FR4 and Halogen-free boards using lead-free processing

Lead-free Copper Erosion

- Move to implementation early 2007
- Finish 2008
- Understanding copper erosion rates for various lead free solders and establishing design rules for PWB interconnections and rework



Halogen-free Product Properties

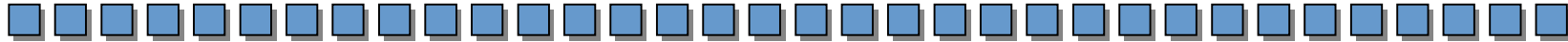
- Move to implementation early 2007
- Finish late 2007
- Establishing a comprehensive Guideline for using halogen-free products
- Establishing a distributed halogen-free Product Properties Database

BMPS Modules, 2nd Level Interconnection

- Move to implementation late 2006
- Finish late 2007
- Establishing design rules for interconnections BMPS modules to PWB

SAC Reliability - Mild Acceleration Project

- Move to implementation early 2007
- Finish mid 2008
- Evaluate reliability of SAC mounted devices vs tin/lead in mild temp cycle to test hypothesis: Field condition ΔT (and thus strain) is significantly $< \Delta T$ (and thus strain) of industry accelerated tests, accelerated test conditions are (may be) introducing failure modes that don't exist in the field, and therefore high strain component types will (may) perform better in actual field conditions.



HDP User Group International, Inc.

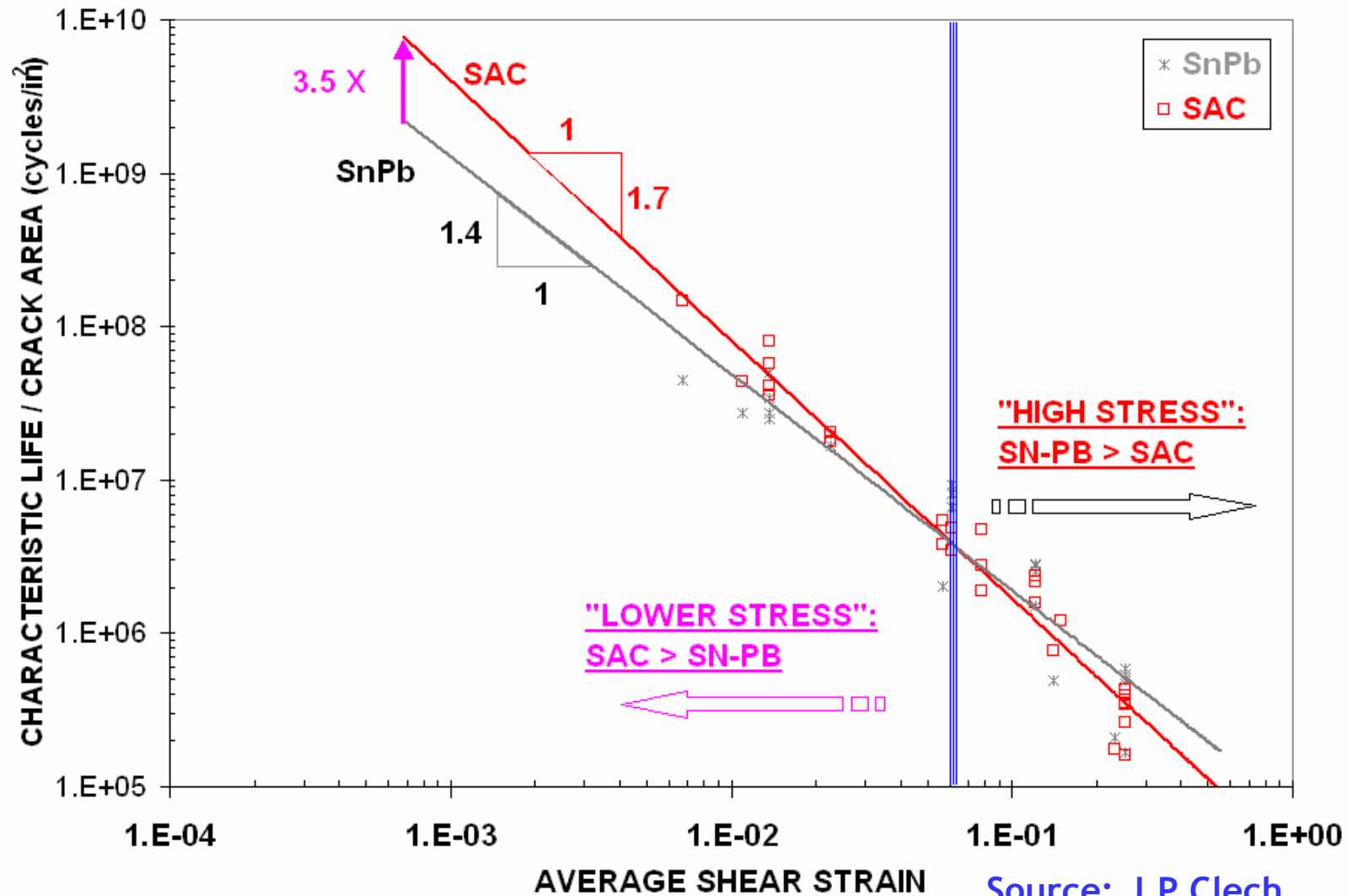
SAC Reliability – Mild Acceleration Factors



Joe Smetana – Team Leader
Joseph.Smetana@alcatel-lucent.com

High Stress/Strain Components – Fail faster in Accelerated Testing with SAC

Induced by the testing? Or also true in the field? TBD – HDPUG Mild AF Project



Mild AF Project/Hypothesis/Test Proposal/Purposes

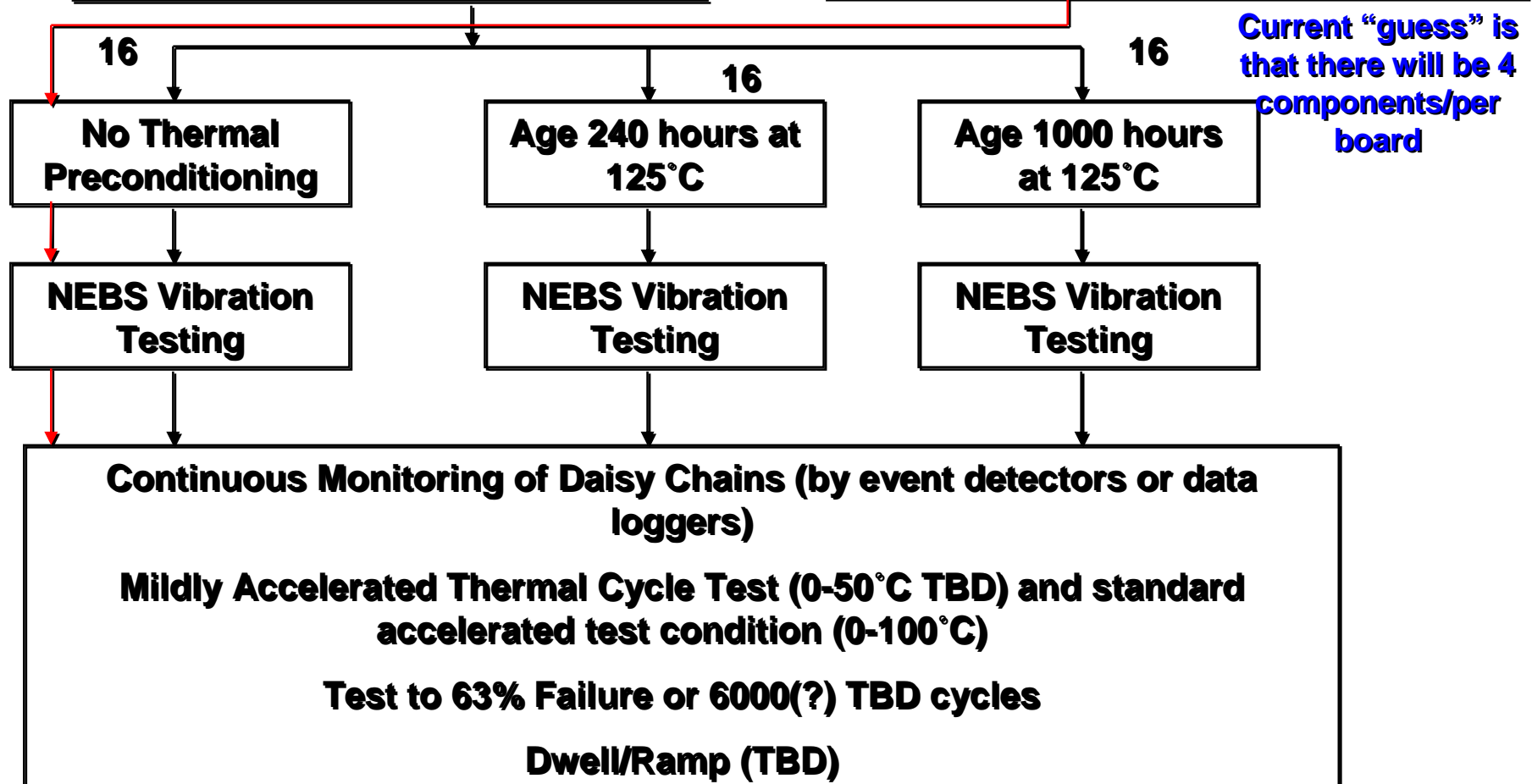


- Hypothesis
 - Since field condition ΔT (and thus strain) is significantly $< \Delta T$ (and thus strain) of industry accelerated tests, accelerated test conditions are (may be) introducing failure modes that don't exist in the field, and these high strain component types will (may) perform better in actual field conditions
- Test Proposal
 - Reduce the ΔT and perform a mildly accelerated temperature cycle after appropriate preconditioning to test the hypothesis. SnPb products otherwise identical are used as the control/baseline.
- Purpose(s)
 - Provide data for business decisions on reliability of moving to Pb-free in High Reliability/Long Life Applications (if successful). If unsuccessful, provide data to address industry/and regulatory areas.
 - Add additional data points to support modeling/acceleration factor work.

Test Flow Chart for Test Vehicle Testing



48 components (each type) (SAC) for each T/C condition 32 components (each type) (SnPb) for each T/C condition



Project Team



Joe Smetana - Team Leader

Joseph.Smetana@alcatel-lucent.com

Alcatel-Lucent	Intel	Volterra	Amkor
Juniper	IBM	TI	Artysen
Nortel	Sun	FCI	Honeywell
AT&T	Cookson/Alpha	Ericsson	Adtran
Celestica	ADC	Tatien	Agilent
Tekelec	Fujitsu	NSC	

Rapid Project Start



- Proposed as a Project Idea in late October 2006
- In 4 Months:
 - Lined up a team of 23 Companies
 - Firm Commitments for all Components
 - 132 SAC 68 Sn/Pb 8 different component types
 - Test Chambers and Data loggers Available
 - Design begun and Assembly Committed
 - Testing Scheduled to start April 2007

Time/Cost Benefit



The Real Benefit comes from doing the work
in Parallel rather than Serially.

- Companies share the cost
- All that participate “Buy-in” to the results
- Results & Recommendations are shared with Standards Organizations