



**INEMI**<sup>®</sup>

International Electronics Manufacturing Initiative

## Next Steps & Additional Opportunities

*Jim McElroy*

Advancing manufacturing technology

# Next Steps

1

SELECTION

2

DEFINITION

3

**PLANNING**

4

**EXECUTION / REVIEW**

5

**CLOSURE**

Open for Industry input

SOW Approved May 8, 2009

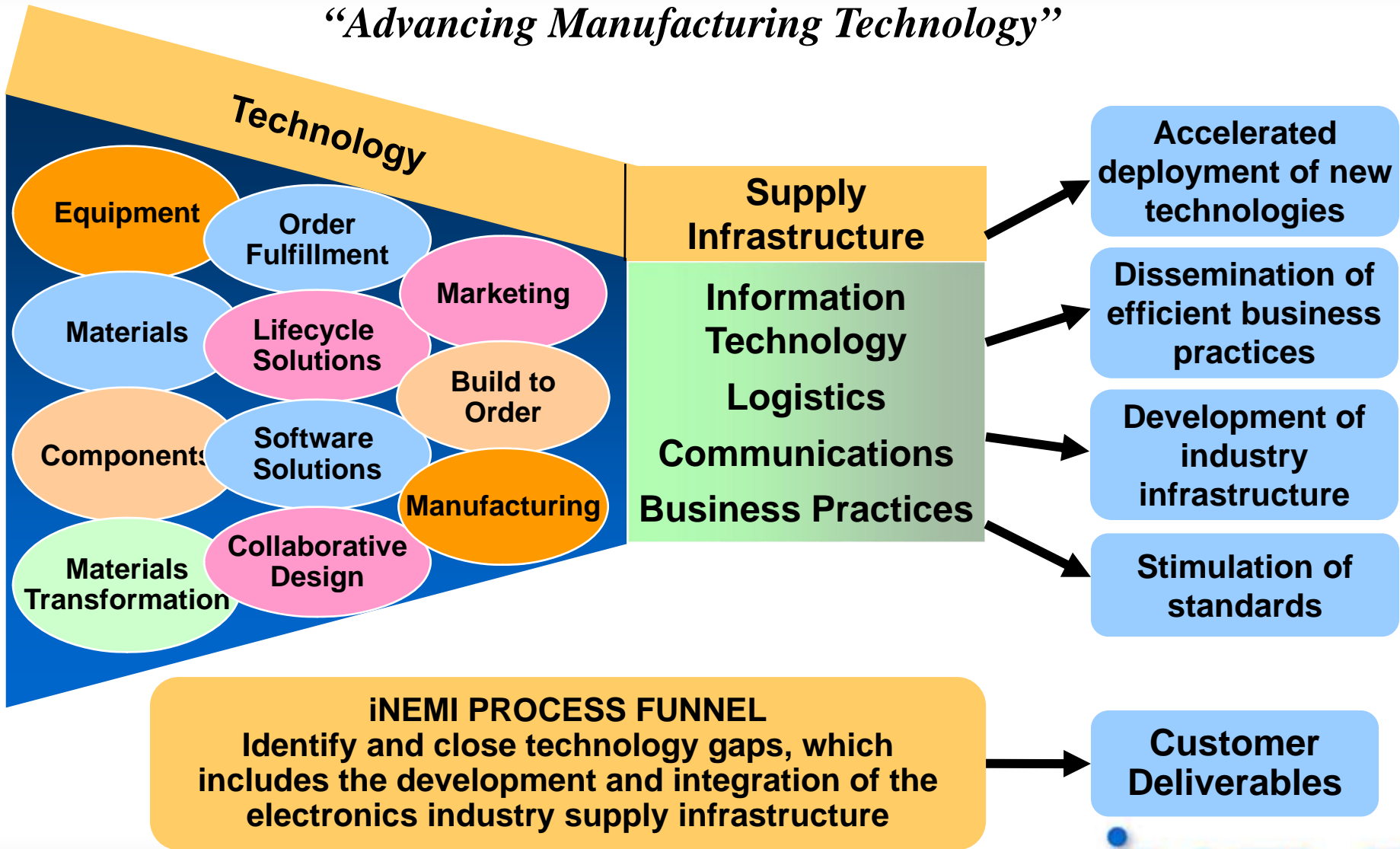
PS Approved May 8, 2009

Project Closed June 16, 2009

Limited to committed Members

# The iNEMI Mission

*“Advancing Manufacturing Technology”*



# Leadership through Innovative Projects

- **A proven approach for identifying the technology needs and gaps of the industry through our roadmapping process**
- **A strong track record of developing supply chains to introduce new materials, processes, and technologies into production**
  - **HDI supply chain**
  - **Board Assembly supply chain**
  - **Board/System Test supply chain**
- **iNEMI has projects in 7 different areas (TIGs)**
  - **Currently 20+ projects**
  - **Projects address technology gaps**

# 7 Technology Integration Groups (TIG)

Board Assembly TIG

Chair: Ian Williams



Board & Systems Manufacturing Test TIG

– Chair: Rosa Reinoso



– Co-chair: JJ Grealish



Environmentally Conscious Electronics (ECE) TIG

– Chair: Scott O’Connell



Medical TIG

Chair: Anthony Primavera



Optoelectronics TIG

– Chair: Brian Roche



– Co-chair: Tatiana Berdinskikh



Organic PCB TIG

Chair: John Davignon



Organic Packaging Substrates TIG, Chair: Hamid Azimi



## TIGs are currently:

- Identifying 2009 Gaps
- Prioritizing New Projects to Close Gaps



# Environmentally Conscious Electronics TIG

- **Current Projects and Initiatives**
  - Pb-Free Rework Optimization
  - Pb-Free Wave Soldering
  - PVC Alternative Initiative
  - Eco-Impact Evaluator for ICT Equipment Initiative
  - HFR-Free Leadership Initiative
    - HFR-Free PCB Materials
    - HFR-Free Signal Integrity
- **Projects defined by OEMs based on requests from customers and regulations**
- **Projects are focused either on the entire industry or one sector.**
- **Involve ODM/EMS, Equipment Providers, component, and material providers**
- **Examples include Pb-Free, HFR-Free**

# Environmentally Conscious Electronics TIG

- **Current Projects and Initiatives**
  - Pb-Free Rework Optimization
  - Pb-Free Wave Soldering
  - PVC Alternative Initiative
  - Eco-Impact Evaluator for ICT Equipment Initiative
  - HFR-Free Leadership Initiative
    - HFR-Free PCB Materials
    - HFR-Free Signal Integrity
- **Results and Benefits:**
  - **iNEMI efforts accelerated convergence of Pb-free to SAC alloys**
  - **iNEMI members were better prepared for introduction ahead of non-members and shared the cost for this market advantage**
  - **Pb-free reliability better understood**
  - **Methodologies developed & deployed to reduce tin whisker risk**
  - **Pb-free rework processes more robust**
  - **Initial HFR-Free project identified challenges with complex boards (High Rel. PCB project is follow-on)**

# Published Results from Pb-Free Work

## LEAD-FREE ELECTRONICS

iNEMI Projects Lead  
to Successful Manufacturing



Edited by

Edwin Bradley • Carol A. Handwerker • Jasbir Bath

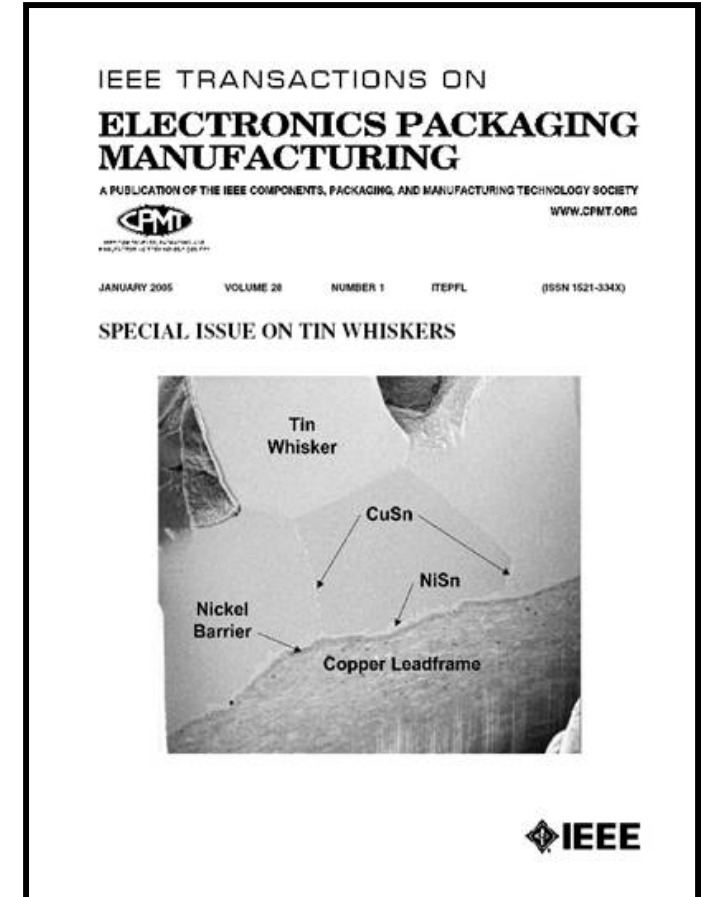
Richard D. Parker • Ronald W. Gedney

- Published by IEEE
- Edited by Edwin Bradley (Motorola), Carol Handwerker (NIST/Purdue University), Jasbir Bath (Solectron), Richard Parker (Delphi Electronics & Safety) and Ron Gedney (iNEMI, retired).
- Available for purchase

**iNEMI**

# Available Resources: Tin Whisker R&D

- **Over 7 years of effort with key researchers from:**
    - Academia
    - Industry
    - Government Labs (e.g. NIST)
  - **Documented results and recommendations available:**
    - Standards & Specifications
    - Five IEEE/CPMT Workshops
    - Position Papers
- [http://www.inemi.org/cms/projects/ese/tin\\_whisker\\_activities.html](http://www.inemi.org/cms/projects/ese/tin_whisker_activities.html)



# Board Assembly TIG

- **Current Projects and Initiatives**
  - Board Coplanarity in SMT
  - Pb-Free Component & Board Finish Reliability
  - Solder Paste Deposition
  - Pb-Free Nano Solder Phase 2
  - iNEMI Alloy Alternatives Phase 2
  - Pb-free Reliability Test Method (Asia)
  - Test Method Platform for Surface Finish (Asia)
- **Projects defined by OEMs, ODMs, and EMS firms**
- **Over time leadership has shifted from OEMs to EMS**
- **Involve EMS, Equipment Providers, component, and material providers**
- **Over time focus has shifted from technology feasibility to process enhancements**
- **Examples include the ongoing leadership program on Pb-Free Technology.**

# Board Assembly TIG

- **Current Projects and Initiatives**
  - Board Coplanarity in SMT
  - Pb-Free Component & Board Finish Reliability
  - Solder Paste Deposition
  - Pb-Free Nano Solder Phase 2
  - iNEMI Alloy Alternatives Phase 2
  - Pb-free Reliability Test Method (Asia)
  - Test Method Platform for Surface Finish (Asia)
- **Results and Benefits:**
  - **Better understanding of package/board flatness budget**
  - **Feasibility demonstrated for temp. reduction for Pb-free Nano**
  - **Standard qual. test being developed for Alloy alternatives (reduce risk of process/reliability issues)**
  - **DPMO characterized for package types at assembly**
  - **Semiconductor Chip placement machine developed.**

# High Speed Placement Machine for Direct Chip Attach (DCA)

- **1994 NEMI Roadmap Identified Gap**
- **1995 Technical Plan provided a detailed five year research, development, and implementation plan.**
- **Technology Implementation Group (TIG) developed a specification for a machine.**
- **Universal Instruments agreed to meet the High Speed DCA specifications defined by the Technical Plan.**

## **Results:**

- **OEMs received the machine they needed in time to support their schedules.**
- **Supplier reduced his market risk in developing a new machine.**

# Board & Systems Manufacturing Test TIG

- **Current Projects and Initiatives**
  - Board Flexure Standardization
  - Boundary Scan Adoption
  - Functional Test Coverage Assessment
  - Test Cost Model (Asia)
  - Built in Self Test (Asia)
- **Projects Typically defined by OEMs**
- **Involve test equipment vendors**
- **Test TIG has identified the need for active ODM/EMS Participation**

# Board & Systems Manufacturing Test TIG

- **Current Projects and Initiatives**

- Board Flexure Standardization
- Boundary Scan Adoption
- Functional Test Coverage Assessment
- Test Cost Model (Asia)
- Built in Self Test (Asia)

- **Results and Benefits**

- Have brought leading OEMs and Test Equipment Providers together to develop next generation test strategy
- Pushing Semiconductor Houses to Strengthen Boundary Scan
- Industry survey completed on boundary scan; will help adoption
- Board flexure measurement reduces damage & latent defects
- Test cost model released to industry; helps determine optimum test
- New test cost model project proposed.

# ODMs have Unique Position on Test

- **Manufacturing is the responsibility of ODMs**
  - ODMs need to engage in the solving the test challenges that iNEMI test TIG is addressing
  - ODMs design products
    - Excellent visibility of the challenges ahead
    - Can drive change early in the process
- **ODMs will be the ultimate user of any technologies, standards and/or solutions from iNEMI test efforts.**
  - They ought to be present to ratify such solutions, standards & technologies.
- **The ODMs customers and suppliers are driving test solutions.**
  - ODMs can help structure solutions so that they are usable and cost effective.
- **ODMs have the manufacturing & test expertise.**
  - We could be missing critical items.
  - Participation in the process will improve project outcomes.

# Medical Electronics TIG

- **Current Projects and Initiatives**

- Medical Reliability for MLCC Project
- Substrates Initiative
- Current Focus is on implantable devices

- **Results and Benefits:**

- Strategy is to use iNEMI as a forum to develop reliability requirements that would be adopted by industry
- Strategy is to avoid government regulations with increased cost
- Use-case driven requirements developed for components for implantable devices
- Testing underway to validate requirements

# Substrates and PCB TIGs

- **Current Projects and Initiatives**
  - **Pb-Free Component & Board Finish Reliability**
  - **BFR-Free High Reliability**
- **Projects Typically defined by OEMs and Semi Conductor Manufacturers**
- **Involve ODM/EMS, PCB Manufacturers, component, and material providers**
- **Examples include pioneering HDI projects started in 1996 & Pb-Free surface finish projects**

# Substrates and PCB TIGs

- **Current Projects and Initiatives**
  - **Pb-Free Component & Board Finish Reliability**
  - **BFR-Free High Reliability**
- **Examples include HDI projects started in 1996 & Pb-Free surface finish projects**
- **Results and Benefits**
  - **HDI supply base developed and evaluated by 1998 for utilization by members for cell phones and IC packages (schedule advantage over competition)**
  - **Better understanding of performance and reliability of various Pb-free finish combinations (improve mfg. yield, reduce life cycle cost)**
  - **Closing knowledge gaps for use of BFR-Free for high end PCBs (determine likely phase-over schedule; reduce risk of conversion)**
  - **Embedded passives program led to deployment in cell phones.**

# Advanced Embedded Passives Technology Consortium Participants



- iNEMI's Embedded Passives Project became part of the Advanced Embedded Passives Technology Consortium.
- Work performed by this group received funding from the U.S. Department of Commerce, National Institute of Standards and Technology, Advanced Technology Program, Cooperative Agreement Number 70NANB8H4025
- Project Achieved its goals, developing Several Alternative Material Technologies

# Conclusions

- **Most effective collaboration occurs when all critical links in supply chain are represented.**
- **For HFR-Free Leadership program following segments are important:**
  - OEM
  - EMS/ODM
  - PCB Fabricators
  - Laminate suppliers
- **iNEMI can provide an efficient mechanism to develop and deploy technology across the global supply chain.**
- **Other TIGs are looking for increased EMS/ODM Participation and the key suppliers in their area of interest.**

# iNEMI Membership

- **For Additional Information contact iNEMI Staff:**
  - **Haley Fu**
  - **Jim McElroy**
  - **Bob Pfahl**
- **Materials on iNEMI can be provided for presentation to Corporate Decision Makers**
- **Further discussions on membership can follow this meeting**
- **iNEMI Staff is Available to Discuss Membership with Decision Makers on Friday April 17.**



[www.inemi.org](http://www.inemi.org)

Email contacts:

Jim McElroy

[jmcelroy@inemi.org](mailto:jmcelroy@inemi.org)

Bob Pfahl

[bob.pfahl@inemi.org](mailto:bob.pfahl@inemi.org)

Haley Fu - Asia

[haley.fu@inemi.org](mailto:haley.fu@inemi.org)



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