Agenda Item 4C2

iNEMI Process For Supply Chain Communication

Chuck Richardson

Director of Roadmapping

JIC 10

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Agenda

- Introduction
- Methodology
- Roadmap Overview
- Business Issues
- Technology Issues and Needs
- Gap Analysis/Planning
- Project Development/Output
- Summary & Conclusions

Who Are We?

- iNEMI organization:
  - Corporate membership
  - Not-for-profit, R&D consortium
  - Collaboration defined by organization by-laws, intellectual property policy, and project agreements.
- Member companies/organizations:
  - Leadership OEM, EMS, and Supplier companies
  - Government labs
  - Academic Institutions.
- Small staff provides services to facilitate global collaboration (USA, Asia & Europe):
  - Support to help organize & manage projects
  - Communication services for collaboration
  - Manage Relationships with other Organizations.

Global Operations

- iNEMI is headquartered in Herndon, Virginia, USA.
- Started iNEMI China Collaboration in 2003.
- Opened an office in Shanghai and added a team member in Europe in 2007.
- Dr. Haley Fu is leading operations in Asia, based in Shanghai, China.
- Grace O'Malley is representing iNEMI in Europe from her base in Ireland.

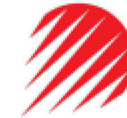
OEM/EMS Members

Agilent Technologies

Alcatel·Lucent

Boston Scientific
Delivering what's next.™

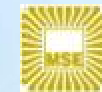
lenovo


Celestica™

DELPHI

FOXCONN®

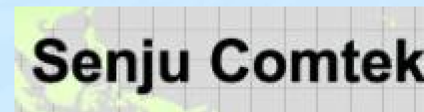
FLEXTRONICS



MICRO SYSTEMS ENGINEERING

PLEXUS®

Supplier Members



Association/Consortium, Government, Consultant & University Members

Deliverables

"Advancing Manufacturing Technology"

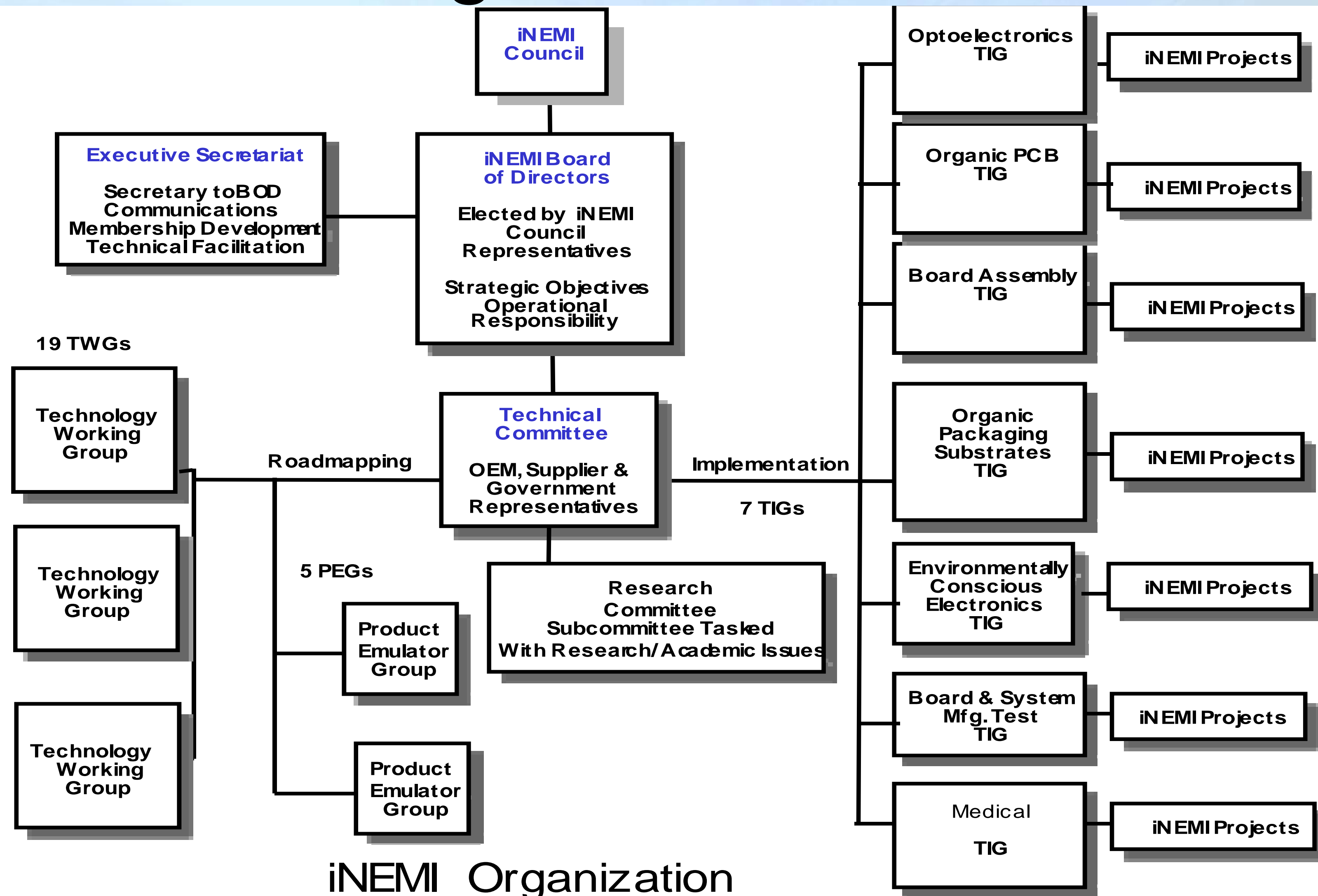
iNEMI provides five important deliverables:

1. **Technology roadmaps**
2. **Technology deployment projects**
3. **Research priorities**
4. **Forums on key industry issues**
5. **Position papers to focus industry direction**

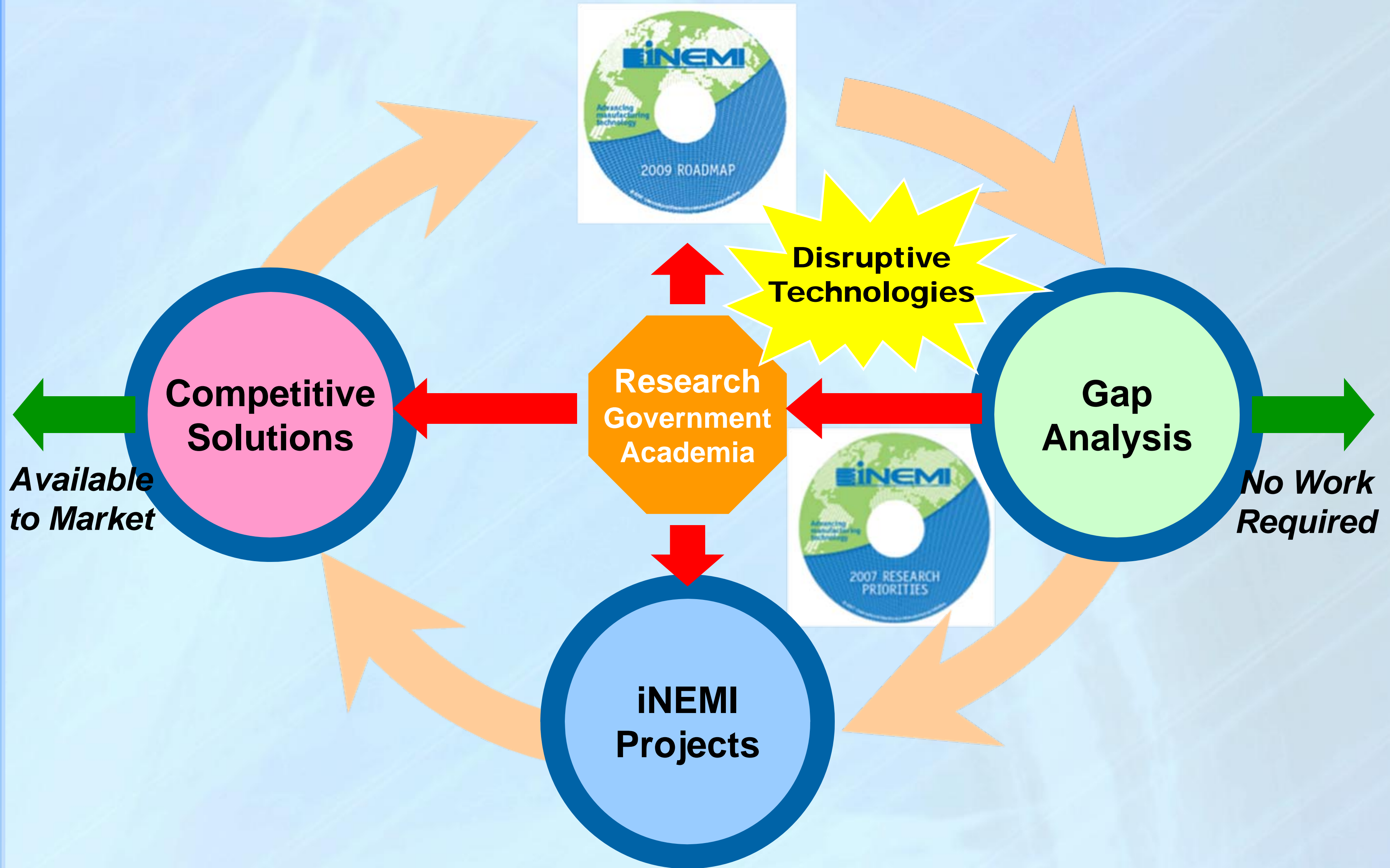
Leadership through Innovation

- 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
- A research vision with three major thrusts:
  - Energy & the environment
  - Miniaturization
  - Medical electronics

iNEMI Organizational Chart



iNEMI Methodology



2009 iNEMI Roadmap

Statistics for the 2009 Roadmap

- > 550 participants
- > 250 companies/organizations
- 18 countries from 4 continents
- 20 Technology Working Groups (TWGs)
  - New roadmaps on Solid State Illumination, Photovoltaics and RFID Item-Level Tag
- 5 Product Emulator Groups (PEGs)
- > 1400 pages of information
- Roadmaps the needs for 2009-2019

2009 Technology Working Groups (TWGs)

Modeling, Simulation, and Design

Connectors

RF Components & Subsystems

Test, Inspection & Measurement

Sensors

Passive Components

Thermal Management

Solid State Illumination

Large Area, Flexible Electronics

Semiconductor Technology

Photovoltaics

Packaging & Substrates

Optoelectronics

RF Identification/Item Level Tag

Ceramic Substrates

Mass Storage (Magnetic & Optical)

Organic PCB

Board Assembly

Final Assembly

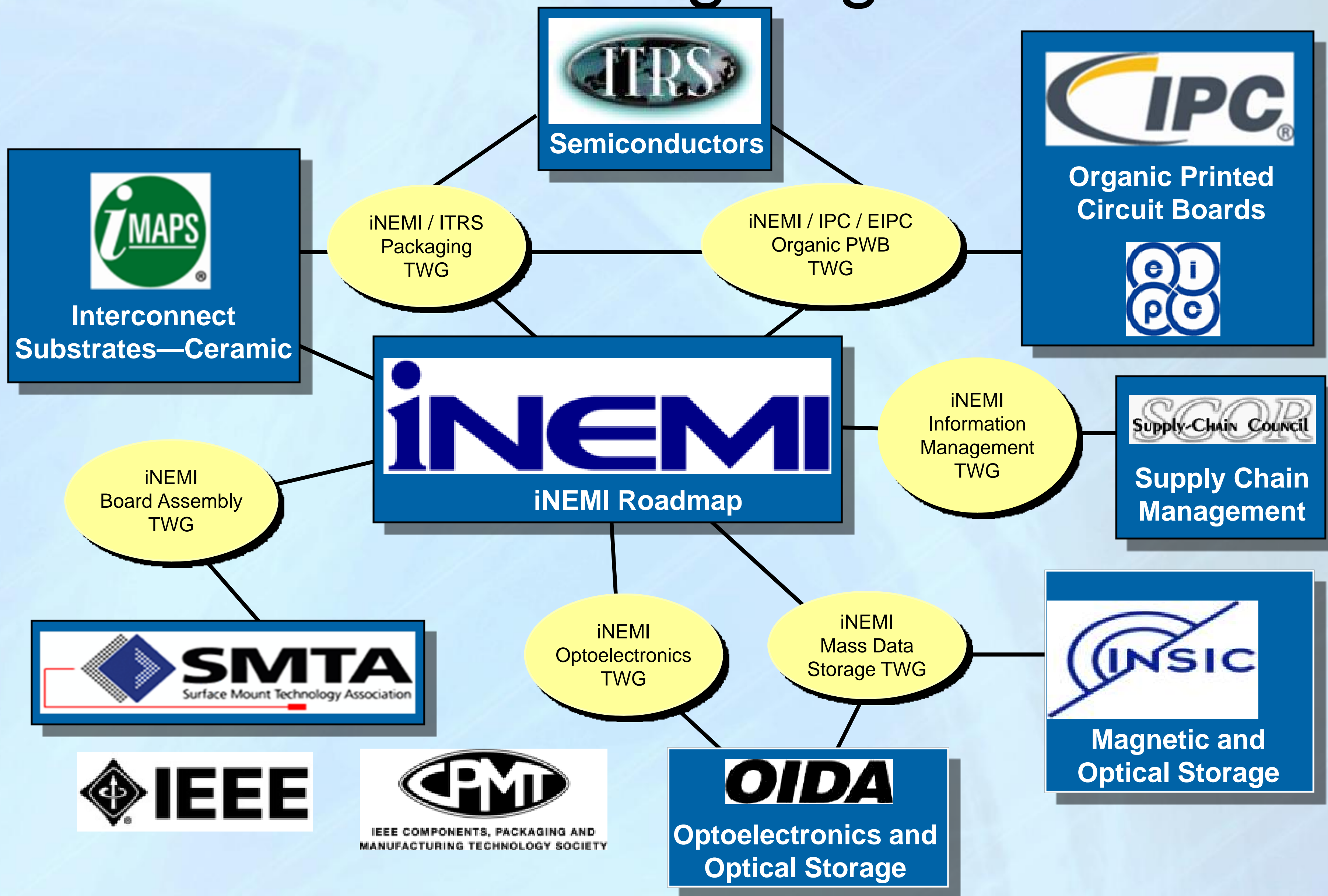
Customer

Information Management

Environmentally Conscious Electronics

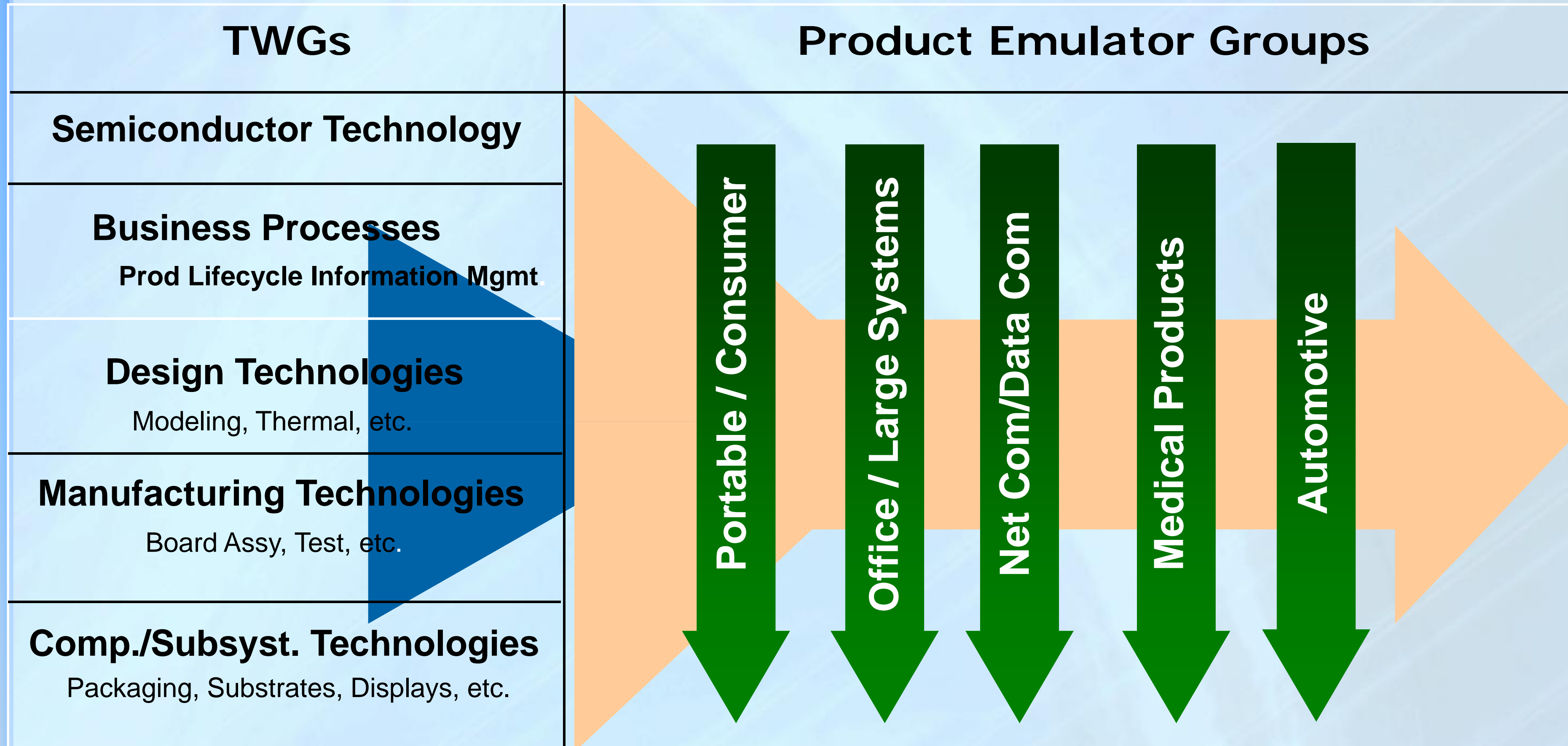
Red=Business Green=Engineering Blue=Manufacturing Blue=Component & Subsystem

Nine Contributing Organizations



Roadmap Development

Product Sector Needs Vs. Technology Evolution



2009 Product Emulator Groups

Product Emulator	Chair(s) 2009
Automotive Products	Jim Spall
Medical Products	Anthony Primavera, MSEI Bill Burdick, GE Research
Consumer / Portable Products	Susan Noe, 3M
Office/Large Business System Products	David Lober, Intel David Copeland, Sun
Network, Data, Telecom	John Duffy, Cisco

2009 TWG Leadership

Business Processes / Technologies	Chair(s)	Co-Chair(s)
Information Management	Eric Simmon, NIST	Jeff Pettinato, Intel
Design Technologies		
Modeling, Simulation & Design Tools	Yishao Lai, ASE	S.B. Park, Binghamton U.
Environmentally Conscious Electronics	Bob Pfahl, iNEMI	
Thermal Management	Ravi Prasher, Intel	Azmat Malik, Consultant
Manufacturing Technologies		
Final Assembly	John Allen, Celestica	Reijo Tuokko, Tampere U.
Board Assembly	Dongkai Shangguan, Flextronics	Aaron Unterborn, Flextronics Ravi Bhatkal, Cookson
Test, Inspection & Measurement	Mike Reagin, Delphi	Michael J. Smith, Teradyne

2009 TWG Leadership (cont.)

Component / Subsystem Technologies	Chair(s)	Co-Chair(s)
Semiconductor Technology	Paolo Gargini, Intel	Alan K. Allan, Intel
Optoelectronics	Dick Otte, Promex	William Ring, WSR
Photovoltaics	Alain Harrus, Cross Link Capital	Jim Handy, Objective Analysis
Packaging	Bill Bottoms, NanoNexus William Chen, ASE	
Passive Components	Philip Lessner, Kemet	John Galvagni, AVX
Connectors	John MacWilliams, Consultant	
RF Components	Ken Harvey, Teradyne	Eric Strid, Cascade MicroTech
Large Area, Flexible Electronics	Dan Gamota, Motorola	Jan Obrzut, NIST Jie Zhang, Motorola
Interconnect Substrates (Ceramic)	Howard Imhof, Metalor	Ton Schless, Sibco
Interconnect PCB (Organic)	John T. Fisher, IPC	Henry Utsunomiya, Consultant
Mass Data Storage	Roger F. Hoyt, Consultant	Tom Coughlin, Coughlin Associates
Solid State Illumination	Marc Chason, Consultant	

Business Issues

Situation Analysis

- Growth of Automotive Electronics
- Convergence (Driven by wireless/portable products)
  - Medical-Consumer
  - Automotive-Entertainment
  - Communication-Entertainment
- Medical Electronics focus shifting towards diagnostics/prevention vs. therapy.
  - Motivations: reduce cost & improve outcomes
  - High volume consumer oriented
  - Challenge for getting quick regulatory acceptance

Situation Analysis

- Miniaturization and Thinner
- Quality, reliability, cost
- Counterfeit Products
- Time to market
- Increasing Material Restrictions
- Increased focus on Energy Reduction
  - Both product & manufacturing
  - Life-cycle approach

Strategic Infrastructural Changes

- The restructuring of the electronics industry over the last decade from vertically integrated OEMs to a multi-firm supply chain has resulted in a disparity in R&D needs versus available resources.
- Restructuring has created skill gaps at various nodes of supply chain.
- Critical needs for research and development exist in the middle part of the supply chain (IC assembly services, passive components and EMS assembly) and yet these are the firms least capable of providing the resources.
- A partial solution has been the development of vertical teams to develop critical new technology while sharing the costs.

Technology Issues and Needs

Paradigm Shifts

- Touch Screens becoming main stream.
- MEMs oscillators replacing quartz crystals.
- Emergence of photovoltaics.
- Energy Efficient Lighting.
- Printed electronics.
- Flash memory instead hard drives for lower power.
- Wafer level packaging is coming of age.
- ODMs for Cell Phones:
  - Especially for low cost models
  - Can also be used to level load OEM factories
- Migration of where and how passive devices are used.

Roadmap Conclusions

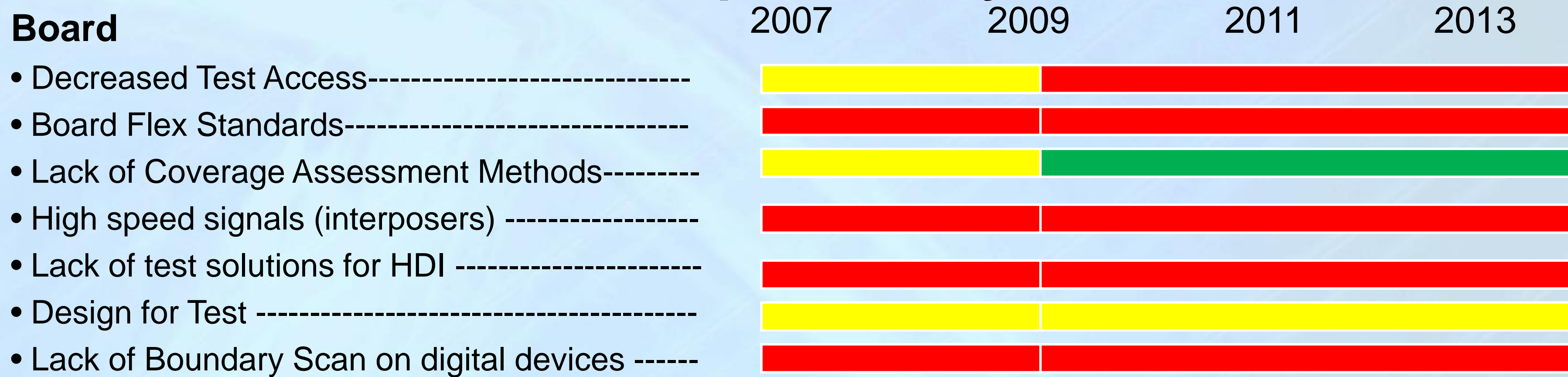
- Consumer electronics has become the major driving force for our industry:
  - New technology to enable miniaturization
  - Relentless cost reduction
  - Volume manufacturing capability
- Packaging is Key Enabler providing higher density & smaller size:
  - More than Moore
  - 3D configurations, Improved performance
- New global environmental requirements continue to multiply – faster than industry can effectively respond
  - iNEMI and its members plan to play a significant role in preparing industry for these future needs.
- Sustainability will be a major undertaking for industry as well as society.
- Electronic solutions can help to empower people to live a more sustainable lifestyle.

Gap Analysis And Planning

Gap Analysis Spreadsheet

"TWG Name"/Gaps/Technology Needs Summary - "T.C. Reviewer Name"			
Priority	**< 5 Years (Tactical) Gaps/Needs**	**Category**	**Comments:**
Priority	**> 5 Years (Strategic) Gaps/Needs**	**Category**	**Comments:**
H=High	**Category for < 5 years (Tactical Gaps)**		**Category for > 5 year (Strategic) Gaps**
M=Med	Standards = S		Design = D
L=Low	Optimization = O		Energy & Environment = E
	Research = R		Manufacturing = Mfg
	Other = NA		Materials = M; System Integration = S

Test Gap Analysis



Functional, System

Test equipment/Tools/Capabilities

Green = No Gap Issues or Resolved

Yellow = Known Gap Mitigation Techniques

Red = No Known Solution – Development Required

Test 5 year plan

Drivers
- Limited board test access
- Cost reductions
- Process optimization
- Test time reduction
- Outsourcing
- Environmental Requirements
- Time to Market

2007

Attributes

Min Test Pad Size (mils) - 20
Via / Pad Size (mils) – 24/10
BGA pitch – .4mm /.7mm
LF Substrate Materials
LF Board Finishes
Board node count – <15k
New LF solder alloys –
I/O Signal speeds – 10Ghz
High Density Interconnect (HDI)
Fault Coverage
Evolving fault spectrum
Bonding and Underfill of BGAs

Deployed Technology

Repeatable LF processes
Bead Probe
Adv. ICT
Adv. Boundary Scan & BIST

Research /Development

Bead Probe
Board Flex impact due to Pb-Free
Board Flex standard
Design for Test
Fault Coverage Metrology

2009

Attributes

Min Test Pad Size (mils) - 20
Probeable Micro Via / Pad Size (mils) – 11/5 (HDI)
BGA pitch – .4mm /.6mm
LF Substrate Materials
LF Board Finishes
Nodes – >15k
New LF solder alloys –
I/O Signal speeds > 20 Ghz
High Density Interconnect
Evolving fault spectrum

Deployed Technology

Bead Probe
Adv. Test Solutions
Adv. Boundary Scan & BIST
Common Diagnostics Model
Adv. Functional Test Solutions
Fault Coverage Metrology

Research /Development

Bead Probe
Board Flex impact due to Pb-Free
Board Flex standard
Design for Test
Adv. Test Solutions (HDI)

2011

Attributes

Min Test Pad Size (mils) –18
Micro Via / Pad Size (mils) – 12/5 (HDI)
BGA pitch – .3mm /.5mm
LF Substrate Materials
LF Board Finishes
Nodes – >15K
New LF solder alloys -
I/O Signal speeds >30 Ghz
High Density Interconnect
Evolving fault spectrum

Deployed Technology

Adv. Test Solutions
Adv. Structural Test
Adv. BIST
Virtual Access
Common Diagnostics Model
Adv. Functional Test Solutions

Research /Development

Adv. Test Solutions
Design for Test
New test techniques

2013

Attributes

Min Test Pad Size (mils) - 18
Micro Via / Pad Size (mils) – 12/5 HDI
BGA pitch – .3mm /.5mm
LF Substrate Materials
LF Board Finishes
Nodes – >15K
New LF solder alloys -
I/O Signal speeds >100 Ghz
High Density Interconnect
Evolving fault spectrum

Deployed Technology

Adv. Test Solutions
Adv. Structural Test
Adv. BIST
Virtual Access
Common Diagnostics Model
Adv. Functional Test Solutions

Research /Development

Adv. Test Solutions
Design for Test
New test techniques

iNEMI Projects – Closing The Gaps

Key Elements in Value of iNEMI Projects

- **The companies represented**
  - OEMs who are market leaders in innovative products
  - EMS providers who are global leaders in manufacturing
  - Leading suppliers for manufacturing equipment, materials, components, and software.
- **The specific participants within those companies**
  - Board of Directors
  - Technical Committee
  - Council Members

How Projects are Defined

- **Hold project formation meeting**
- **Members develop Statement of Requirements**
  - User/business case driven
  - What is needed
  - Desired outcome of project
- **Identify leaders**
- **Members develop Statement of Work**
  - Project plan with identified tasks, check points and end dates
  - Companies expected to participate
  - Results expected and how they will be shared outside project
- **Members sign Project Participation Statement**
  - Formally commit resources as agreed
- **Carry out project, report quarterly**

iNEMI Projects Close Gaps

- Develop/evaluate processes and/or protocols
- Evaluate alternative technologies
- Identify equipment needs
- Identify/evaluate communication schemes
- Determine component requirements
- Develop standards proposals