



**iNEMI**

International Electronics Manufacturing Initiative

# 2007 Roadmap Overview

*Jim McElroy, iNEMI  
Celestica-iNEMI  
Technology Forum  
May 15, 2007*

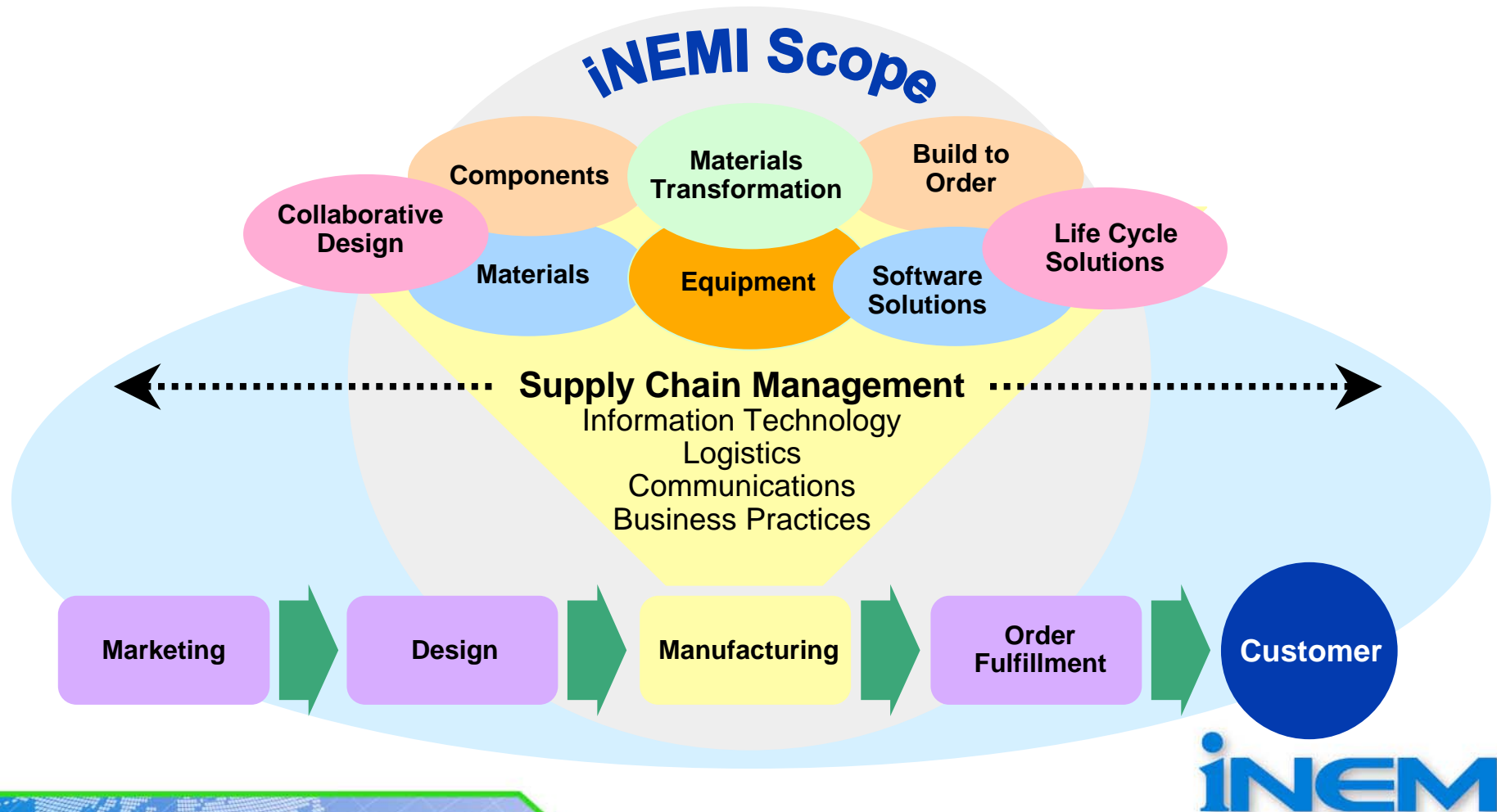
Advancing manufacturing technology

# Topics

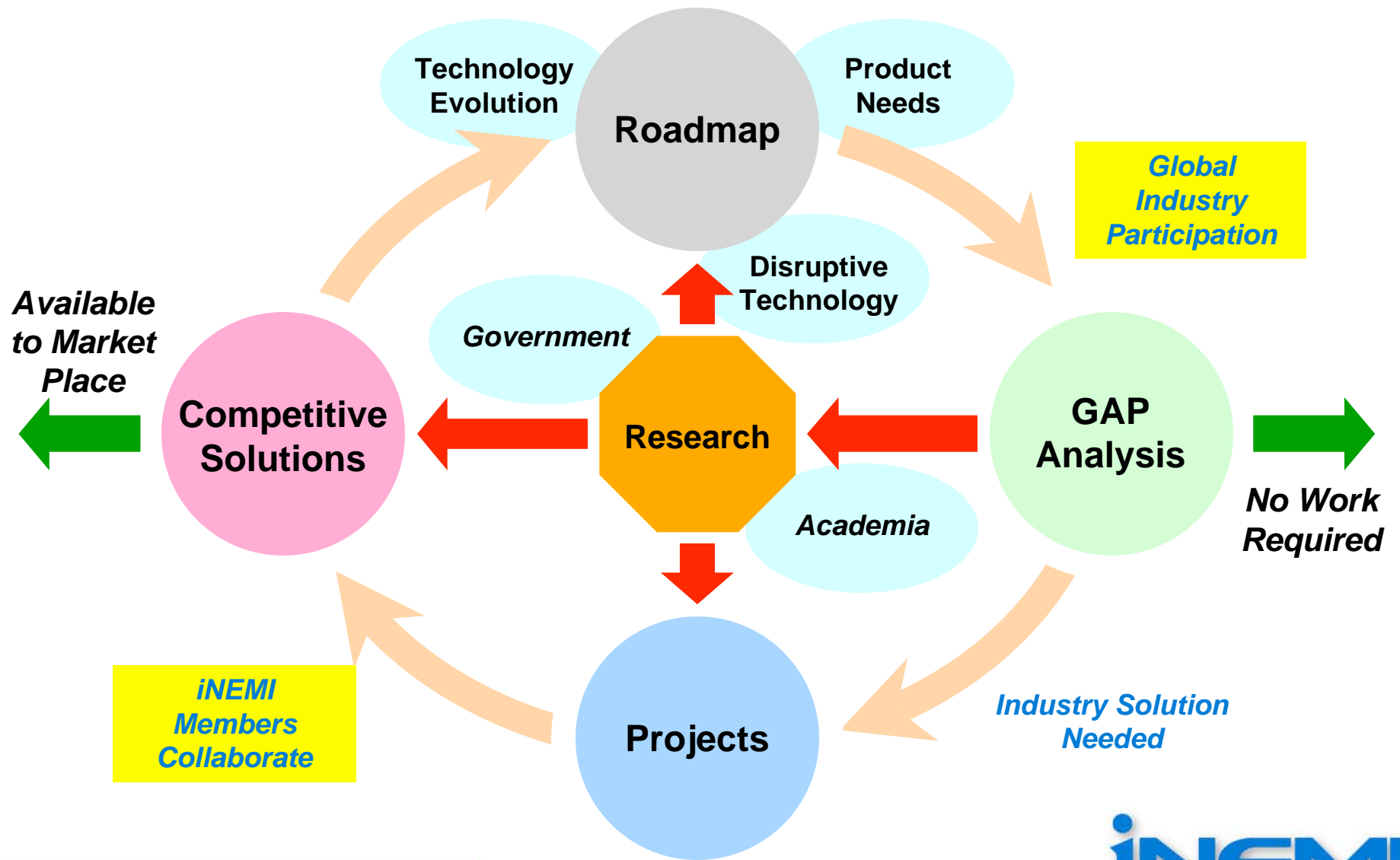
- **iNEMI Overview**
- **iNEMI Roadmap**
  - **Definitions**
  - **Structure**
  - **Linkages**
  - **International participation**
  - **Leadership**
  - **Conclusions**
  - **Next steps**

# iNEMI Mission

***Identify and Close TECHNOLOGY GAPS, which includes the development and integration of the electronics industry supply infrastructure.***



# Methodology



# OEM/EMS Members



# Supplier Members



Ciba



# Association/Consortium, Government, Consultant & University Members



ASSOCIATION CONNECTING  
ELECTRONICS INDUSTRIES®



**NIST**

National Institute of Standards and Technology

Développement  
économique  
et régional

Québec



**iNEMI**

# Some Definitions...

- **PEGs – Product Emulator Groups**
  - “Virtual Product” defining future product technology attributes
  - Key cost and density drivers
- **TWGs - Technology Working Groups**
  - Develops roadmaps
  - Presently 19 TWGs of “content experts”
- **TIGs - Technology Integration Groups**
  - Develops technical plan based on:
    - Roadmap findings
    - Gap analyses
  - iNEMI projects are formed under TIGs

## 2007 Roadmap Priorities

- **Maintain strong linkages with other roadmaps.**
- **Strengthen and realign product emulators.**
- **Expand regional, global roadmap meetings.**
- **Expand emphasis on disruptive events (business & technical).**
- **Expand emphasis on identifying market needs and business situations.**
- **Increase quantification of needs.**
- **Prioritize research and deployment needs.**
- **Increase strategic vision of the roadmap: 2013-2017**
- **Initial release at APEX 2007**
  - **China SMT Forum, March 23**
  - **SMT Nuremberg Seminar, April 26**

# International Roadmap Workshops

- **Gained additional participation by holding regional workshops in Asia, Europe, and North America.**
  - **Asian Workshop held in conjunction with HDP '06 Conference at Shanghai University.**
  - **European Workshop held in conjunction with Semicon Europa at Messe Munchen.**
  - **North American Workshop held at iNEMI headquarters in Virginia.**
- **Goal of increased participation achieved!**
- **Laying foundation for further participation on future cycles.**

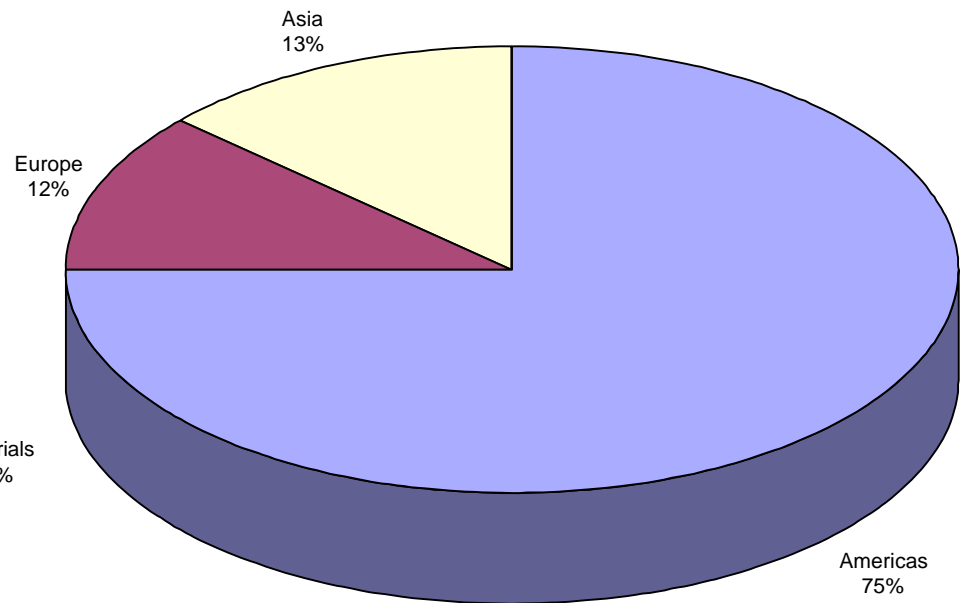
## Statistics for the 2007 Roadmap

- **> 500 Participants**
- **> 265 Companies/organizations**
- **17 Countries from 4 continents**
- **19 Technology Working Groups (TWGs)  
(added Organic & Printed Electronics)**
- **5 Product Emulator Groups (PEGs)**
- **Over 1300 pages of information**
- **Roadmaps the needs for 2007-2017**

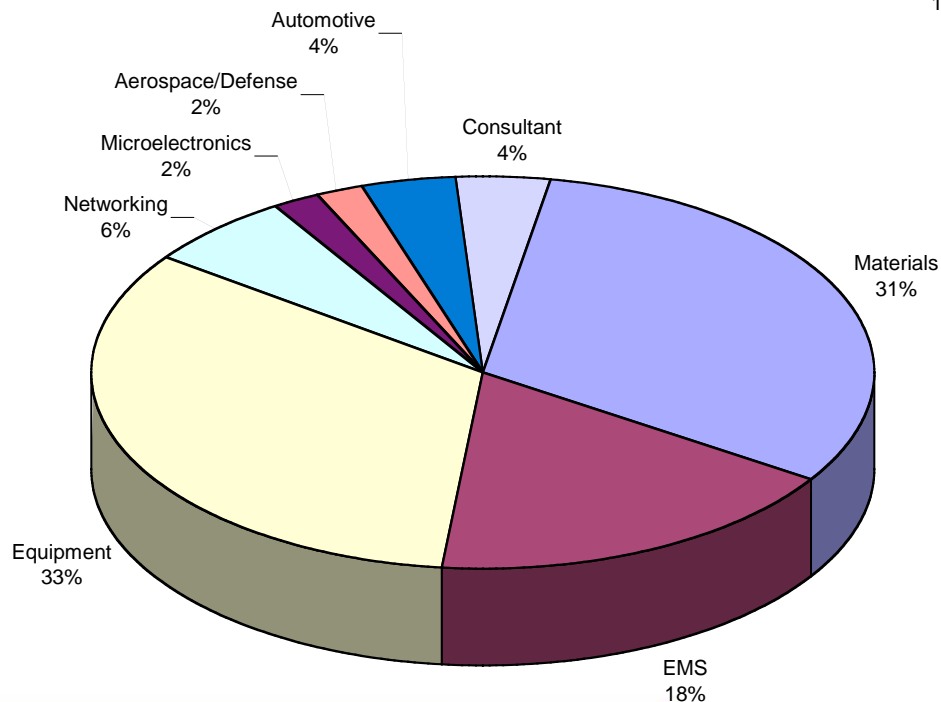
# Board Assembly TWG Members

Active Participants: 85

Participation by Region



Participation by Industry (45 firms)



# Why do Companies Participate in iNEMI Roadmap?

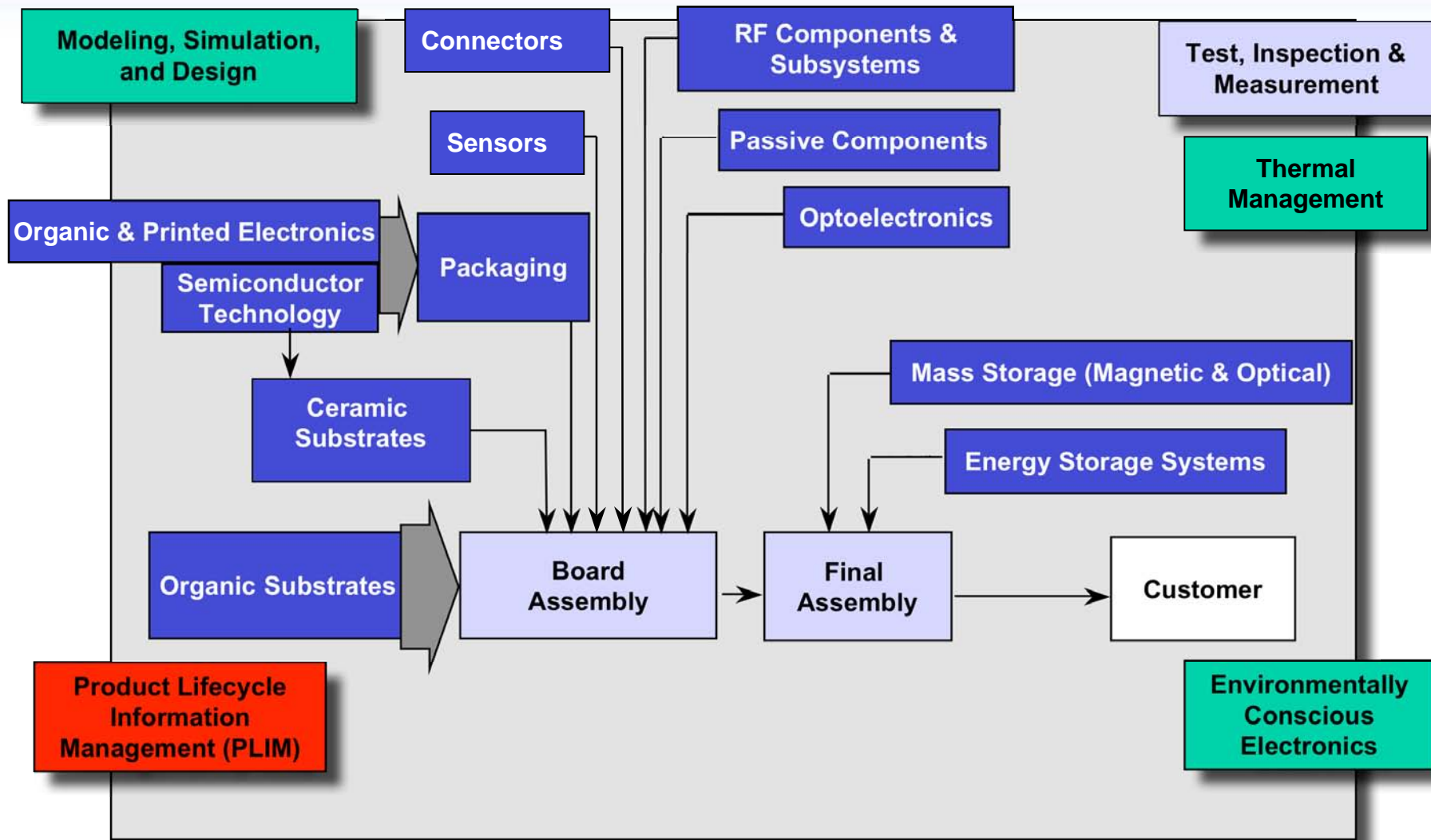
- Leads to a better understanding of the “state of the art” in those areas of participation.
- Early access to the roadmap chapter’s information.
- Opportunity to shape the industry’s future priorities concerning R&D.
- Opportunity to impact iNEMI’s future direction through “technology gap” identification and solutions most important to your company.
- Those who participate in the roadmap creation get a broad view of the supply chain landscape from customers, competitors, and suppliers.
- Roadmaps can become “self-fulfilling prophecies” as many within Industry focus on the identified challenges.
- As General Dwight D. Eisenhower was fond of saying, “It’s not the plan (that is created) but the planning (process) that provides maximum insight”.



## 2007 Product Emulator Groups (PEGs)

Emulators	Characteristics
Portable / Consumer	High-volume consumer products for which cost is the primary driver, including hand-held, battery-powered products driven by size and weight reduction
Office / Large Business / Communication Systems	Products that seek maximum performance from a few thousand dollar cost limit to literally no cost limit
Medical Products	Products that must operate within a highly reliable environment
Automotive	Products that must operate in an automotive environment
Defense and Aerospace	Products that must operate in extreme environments

# 2007 Technology Working Groups (TWGs)



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



## 2007 Technology Working Group (TWGs)

<b>Business Processes / Technologies</b>	<b>Chair(s)</b>	<b>Co-Chair(s)</b>
<b>Product Lifecycle Information Mgmt.</b>	<b>Eric Simmon, NIST</b>	<b>Joanne Friedman, Connekted</b>
<b>Design Technologies</b>		
<b>Modeling, Simulation &amp; Design Tools</b>	<b>Sanjeev Sathe, ASE</b>	<b>S.B. Park, Binghamton U. Yi-Shao Lai, ASE</b>
<b>Environmentally Conscious Electronics</b>	<b>Mark Newton, Dell</b>	<b>Joe Johnson, Cisco</b>
<b>Thermal Management</b>	<b>Cam Murray, Carl Fisher 3M</b>	
<b>Manufacturing Technologies</b>		
<b>Board Assembly</b>	<b>Dongkai Shangguan, Flextronics</b>	<b>David Geiger, Flextronics Ravi Bhatkal, Cookson</b>
<b>Final Assembly</b>	<b>Steven Davidson, Delphi</b>	<b>Reijo Tuokko, Tampere U.</b>
<b>Test, Inspection &amp; Measurement</b>	<b>Michael Reagin, Delphi</b>	<b>Michael J. Smith, Teradyne</b>



## 2007 TWG Leadership (cont.)

<b>Component Subsystem Technologies</b>	<b>Chair(s)</b>	<b>Co-Chair(s)</b>
<b>Semiconductor Technology</b>	<b>Paolo Gargini, Intel</b>	<b>Alan K. Allan, Intel</b>
<b>Optoelectronics</b>	<b>Rick Clayton, Consultant</b>	
<b>Passive Components</b>	<b>Philip Lessner, Kemet</b>	<b>Joseph Dougherty, PSU</b>
<b>Packaging</b>	<b>Joseph Adam, Skyworks Solutions</b>	<b>Bill Bottoms, NanoNexus</b>
<b>Connectors</b>	<b>John MacWilliams, Consultant</b>	
<b>RF Components &amp; Subsystems</b>	<b>Eric Strid, Cascade Microtech</b>	<b>J. Stevenson Kenney, GIT John Barr, Agilent, V.J. Nair, Intel</b>
<b>Sensors</b>	<b>Tim McBride, Sensata Technologies</b>	<b>Mike Azarian, U. Maryland</b>
<b>Interconnect Substrates (Ceramic)</b>	<b>Howard Imhof, Metalor</b>	<b>Ton Schless, Midas Vision</b>
<b>Energy Storage &amp; Conversion Systems</b>	<b>Dan Doughty, Sandia Labs</b>	<b>Ralph Brodd, Broddarp Randhir Malik, IBM</b>
<b>Interconnect Substrates (Organic)</b>	<b>John T. Fisher, Consultant</b>	<b>Henry Utsunomiya, Consultant</b>
<b>Mass Data Storage</b>	<b>Tom Coughlin, Coughlin Associates</b>	<b>Roger F. Hoyt, Retired</b>
<b>Organic &amp; Printed Electronics</b>	<b>Dan Gamota, Motorola</b>	<b>Jan Obrzut, NIST Jie Zhang, Motorola</b>

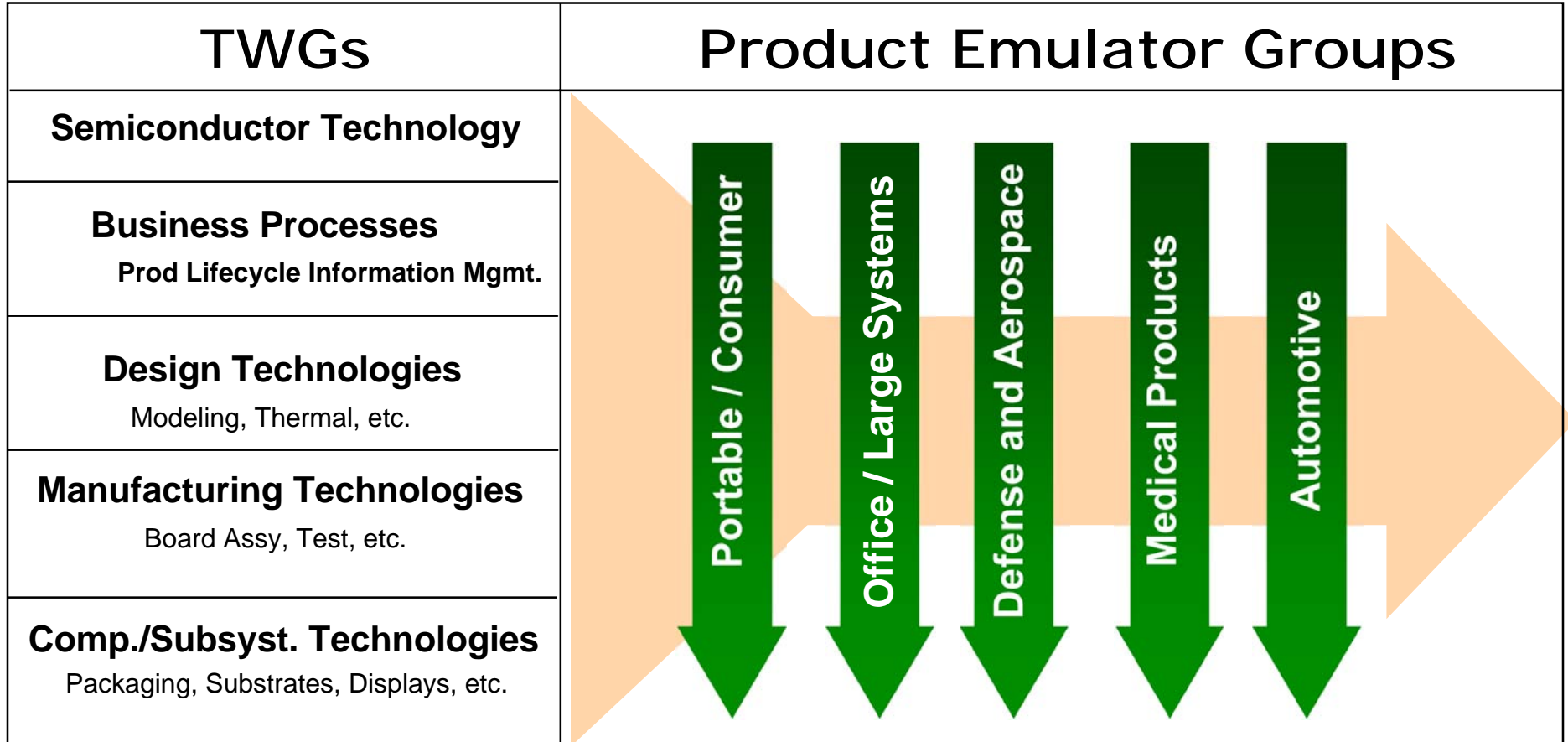


## 2007 Product Emulator Groups (PEGs)

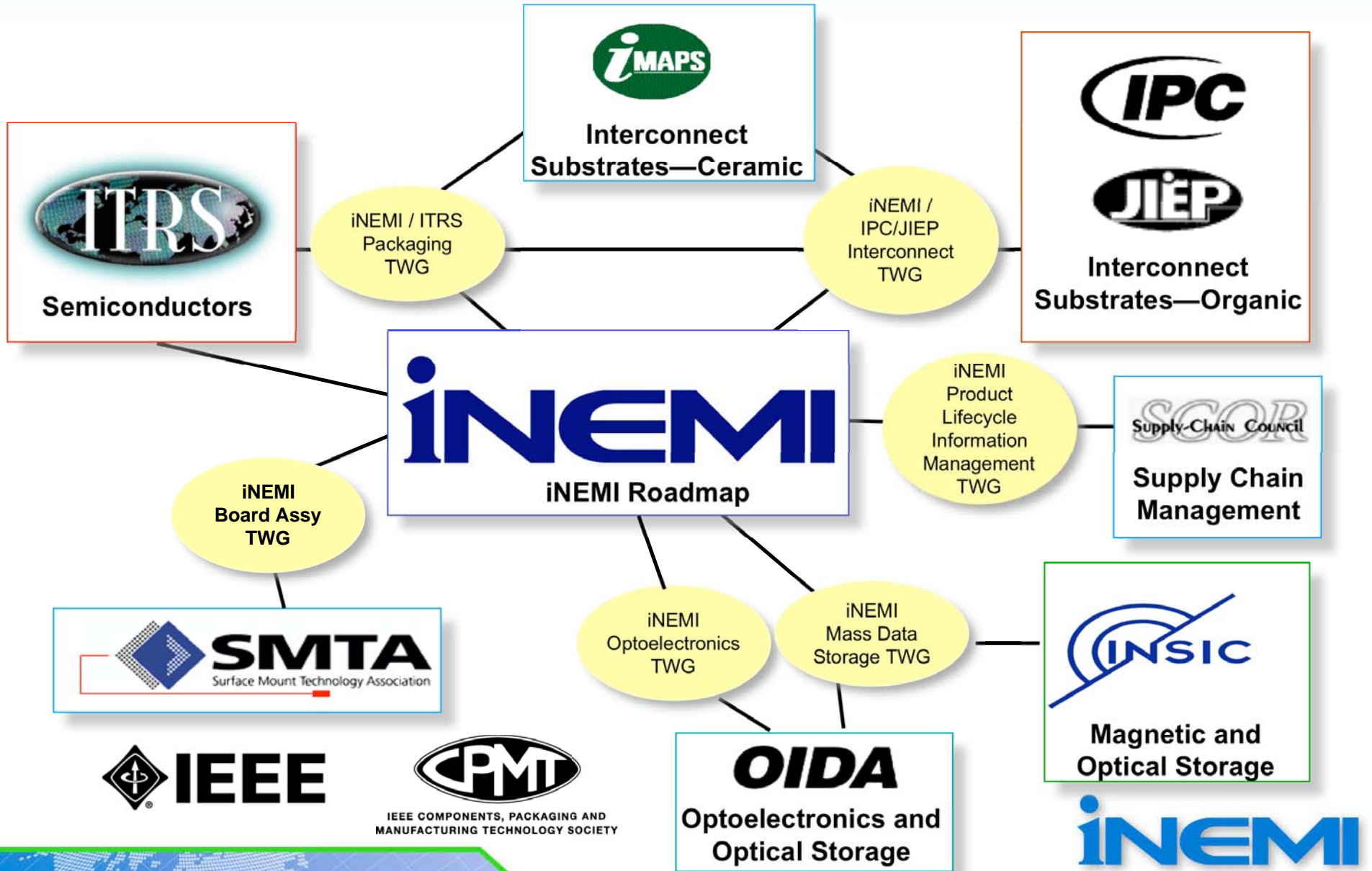
<b>Product Emulator Groups</b>	<b>Chair(s) 2006</b>
<b>Automotive Products</b>	<b>Jim Spall, Delphi</b>
<b>Aerospace &amp; Defense Products</b>	<b>William E. Murphy, Lockheed Martin</b>
<b>Medical Products</b>	<b>Anthony Primavera, Guidant Terry Dishongh, Intel</b>
<b>Consumer / Portable Products</b>	<b>Susan Noe, 3M</b>
<b>Office/ Large Business / Telecommunications Systems</b>	<b>Erich Klink, IBM Europe Tom Pearson, Intel</b>

# Roadmap Development

## Product Sector Needs Vs. Technology Evolution

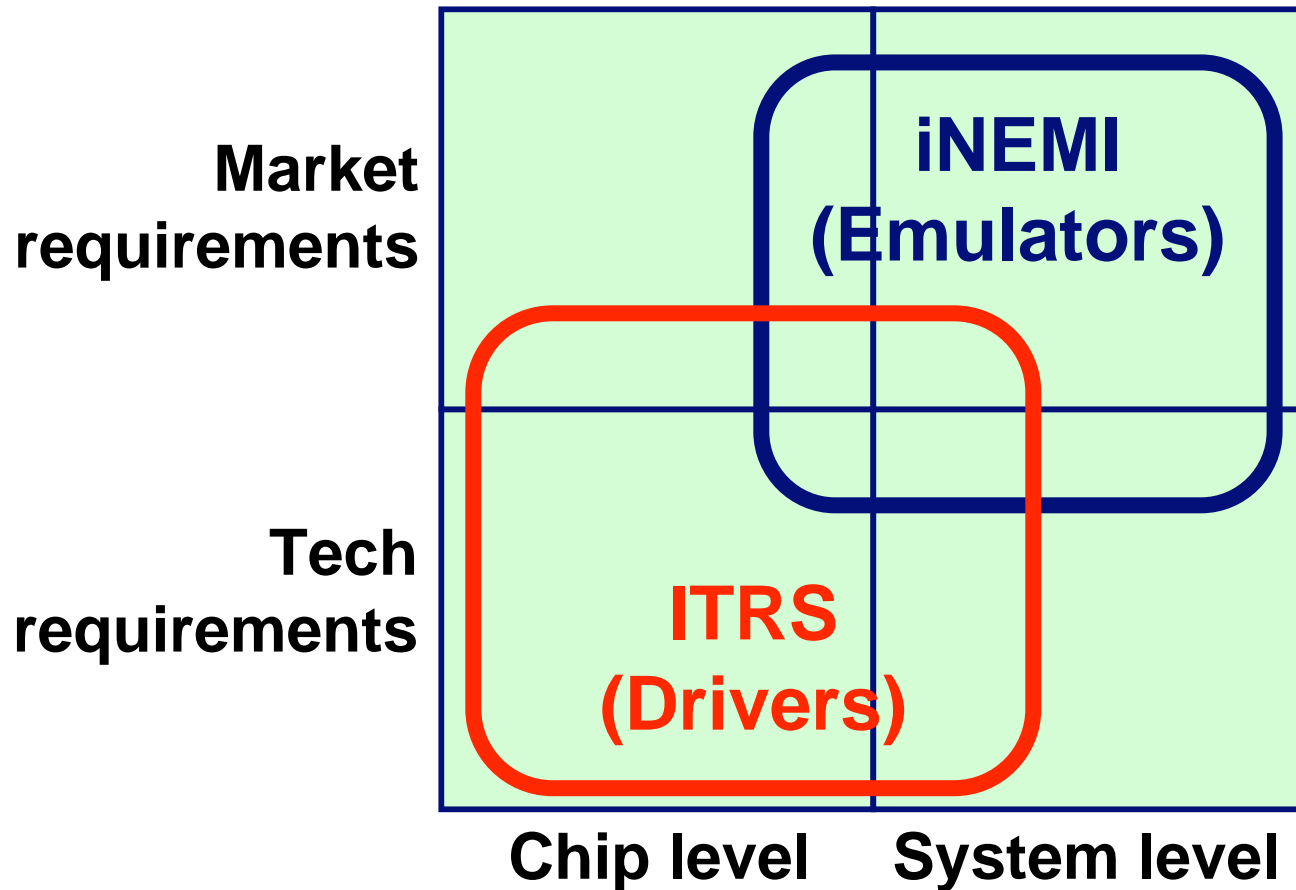


# 9 Contributing Organizations



# Identified Needs

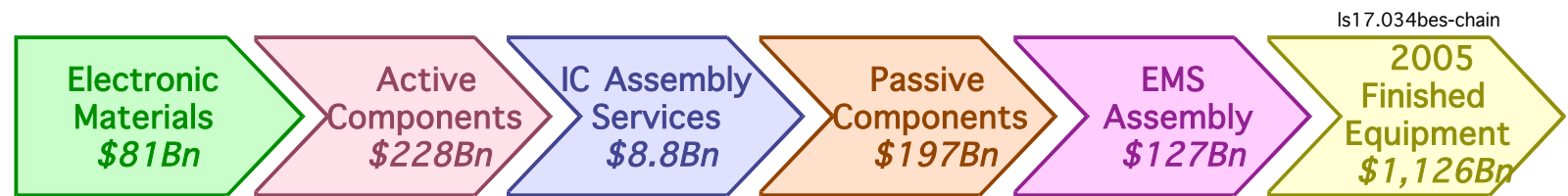
## Increased Linkage Between ITRS and iNEMI Roadmap



# Top Down Input to Roadmap

- **iNEMI Innovation Leadership Forum was helpful in establishing top down vision of the industry as the foundation for the roadmap:**
  - **Innovation driven by consumer: killer experience.**
  - **Innovation links invention to the market: must have social value**
  - **Concept of “open innovation” thru collaboration, partnering**
  - **Collaboration takes various forms, new business models**
  - **Intellectual property protection, management**
  - **Interoperability, open source/standards**
  - **On-demand, flexible: what/when/where you need it**
  - **Consumer electronics demands shorter cycle times**

# VALUE CREATION IN THE SUPPLY CHAIN



Typical Companies	Sumitomo Bakelite, DuPont, Ablestik	Intel, STMicro, LSI Logic	Amkor, ASE, SPIL	Tyco, Molex, AVX, Sharp	Solectron, Sanmina-SCI, Flextronics	Dell, HP, Cisco, Nokia, Teradyne, Visteon, Siemens
Gross Margin	30%	45%	17%	25%	6%	30%
Operating Margin	10%	15%	8%	8%	2%	8%
R&D	7%	15%	2%	5%	<1%	8%
Margin Value	\$8Bn	\$34Bn	\$0.7Bn	\$16Bn	\$3Bn	\$90Bn
R&D Value	\$6Bn	\$34Bn	\$0.2Bn	\$10Bn	\$1Bn	\$90Bn
%Total R&D	4%	24%				64%

Source: Prismark Partners



# iNEMI Roadmap Presentation Activities at 2007 Industry Venues

**IPC Printed Circuits Expo®, Apex®  
and the Designers Summit**

**IPC**  
**PRINTED CIRCUITS EXPO**  
**APEX**  
and the **DESIGNERS SUMMIT**

Tuesday – Thursday,  
February 20 – 22, 2007  
Los Angeles Convention Center  
**REGISTER NOW**

**iMAPS**

**Global Business Council**

*Addressing the business side of microelectronics*



**SMT HYBRID PACKAGING**

*System Integration  
in Micro Electronics*

Exhibition & Conference  
Nuremberg 24–26 April 2007



**China SMT Forum**  
2007

*China's Premier SMT & MPT Event*

THE 17TH INTERNATIONAL

**NEPCON**

MICROELECTRONICS CHINA 2007

第十七届中国国际电子生产设备暨微电子工业展

**ECTC 2007**

The 57th Electronic Components  
and Technology Conference

May 29 - June 1, 2007  
John Ascuaga's Nugget - Reno, Nevada USA

next is  
**now**

**SEMICON®**  
West 2007

**SMTA**  
International



**PRODUCTRONICA**  
13.-16. NOV. 2007



# 2007 iNEMI Roadmap — Highlights & Trends

## State of the Art

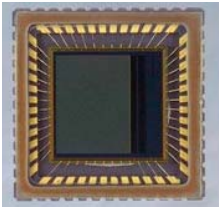
Situation	Examples	Implications
Market / product sector convergence:		
Medical-consumer	Home diagnostics	User-friendly interface, higher volume / lower cost
Automotive-entertainment	DVD in the car	Harsher environment for consumer products
Communication-entertainment	Transmission of music & pictures	Increased integration & greater miniaturization
Computing-entertainment	Integration of PC with media centers	Harmonization of interface standards
Miniaturization and thinner	Ultra-thin cell phones, low-profile packaging, stacked thin die	Ongoing technology and manufacturing investments in package and HDI.
NPI limited by environmental requirements	Growing list of requirements: China RoHS, EU REACH, etc.	Adds complexity and uncertainty to design and start-up. Global harmonization is needed.
Outsourcing of manufacturing continues to grow faster than overall industry	Migration to India and Vietnam	Integration of design & mfg. functions is more challenging than ever. More impetus for industry standard DFX methodology.
R&D moving to lower-cost regions / emerging markets	Technology centers in China & India	More responsive to local needs. Moving away from "one size fits all." Changing role for developed regions.



## Anticipated Paradigm Shifts

Shift	Examples	Implications
Packaging materials will change over the next decade to meet reliability requirements	As density increases, today's material properties present barriers: TCE mismatch, dimensional stability, etc.	Investments in new materials systems. May require rethinking traditional reliability validation methodology.
Optical interconnect by 2017? No!	Work remains at exploratory level.	Competing technologies can meet needs at lower cost.
Low-frequency (printed) electronics for data input	Alternative technology for RFID item-level tags	Facilitates low cost point required by some applications.
New forms of data Input: displays, cameras, sensors, speech	Collision avoidance, smart RFID tags (e.g., sensors).	Drives new growth areas for electronics. Simplifies or enhances user experience.

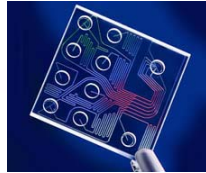
# Examples of Sensors



5MP CMOS Imager  
(Kodak)



Bioanalyzer (Agilent Technologies)



Silicon Microphone  
(Knowles Acoustics)



Angular Rate Gyroscope  
(Silicon Sensing Systems)



X-Wire Pedal Sensor  
(Hella)



Oxygen Sensor (Delphi)



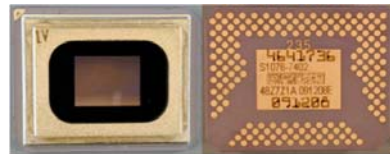
Adaptive Cruise Control Radar Module  
(Continental Automotive Systems)



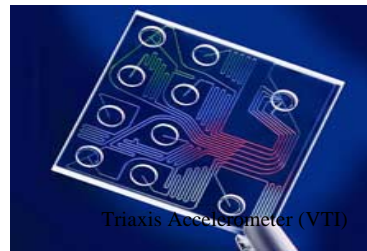
Methanol Concentration Sensor  
(Sensata Technologies)



Rollover Angular Rate Sensor  
(Robert Bosch)



Digital Light Processor DLP™  
(Texas Instruments)



Triaxis Accelerometer (VTD)



Side Impact Sensor  
(Robert Bosch)



Diesel Common Rail Sensor  
(Sensata Technologies)

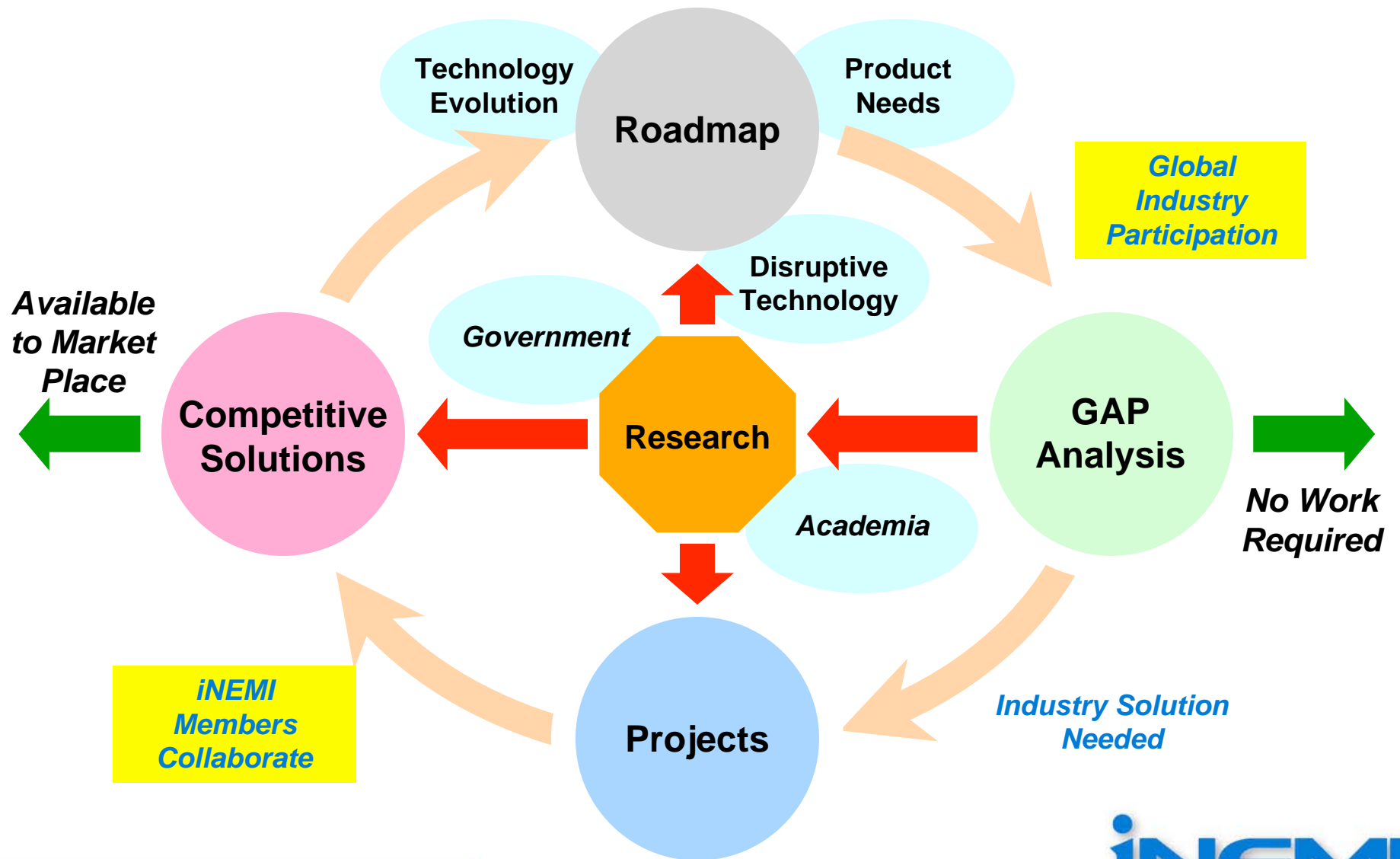


NOx Sensor  
(Siemens VDO)

# 10-Year Challenges

Challenge	Description
<b>Closing technology gaps:</b>	
Active device technology	New CMOS structures; “beyond CMOS” topologies.
Thermal management	New materials and active cooling techniques.
Communications bandwidth	Growing requirements for moving data across the environment (from hand-held devices through the network).
Design and simulation tools	Ability to do concurrent design for circuit, thermal, mechanical, etc.
Science-based environmental improvements	Current regulations may not consider full “cradle to grave” impact.
<b>Creating new product markets with social value:</b>	
Energy	Higher efficiency power supplies, new energy sources for portable products.
Healthcare	Home diagnostics connected to healthcare professionals.
Security	Tamper-proof recognition / validation.

# Next Step: Gap Analyses



# Agenda

- **2007 iNEMI Roadmap — Overview & Highlights: Jim McElroy, iNEMI**
- **Interconnect Substrates-Organic: Jack Fisher, Interconnect Technology Analysis, Inc.**
- **Connectors: John MacWilliams, Bishop & Associates**
- **Board Assembly: Joe Belmonte, Speedline Technologies**
- **Pb-Free BGAs in SnPb Assemblies Project: Jim McElroy, iNEMI**
- **Packaging: Bob Pfahl, iNEMI**
- **Nano-Attach Project: Hope Chik, Motorola**
- **IPC International Technology Roadmap for Electronic Interconnections: Dieter Bergman, IPC**
- **Fiber Connector End-Face Inspection Project: Tatiana Berdinskikh, Celestica**
- **Environmentally Conscious Electronics: Bob Pfahl, iNEMI**
- **Wrap-up**

Order your  
Roadmap now!

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

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