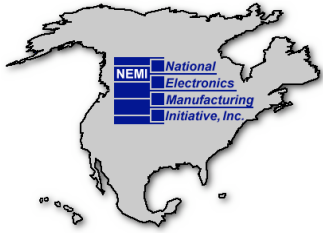




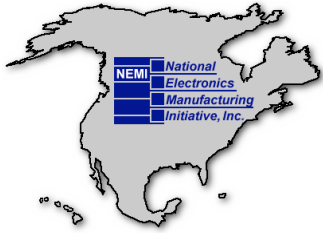
Drivers for Globalizing R&D

Bob Pfahl



Topics to be Discussed

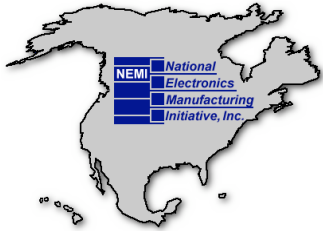
- **Introduction to NEMI: The National Electronics Manufacturing Initiative**
- **Drivers for Locating Operations in China**
- **Drivers for Globalizing R&D**
- **Competitive Concerns**
- **Alternative Approaches**



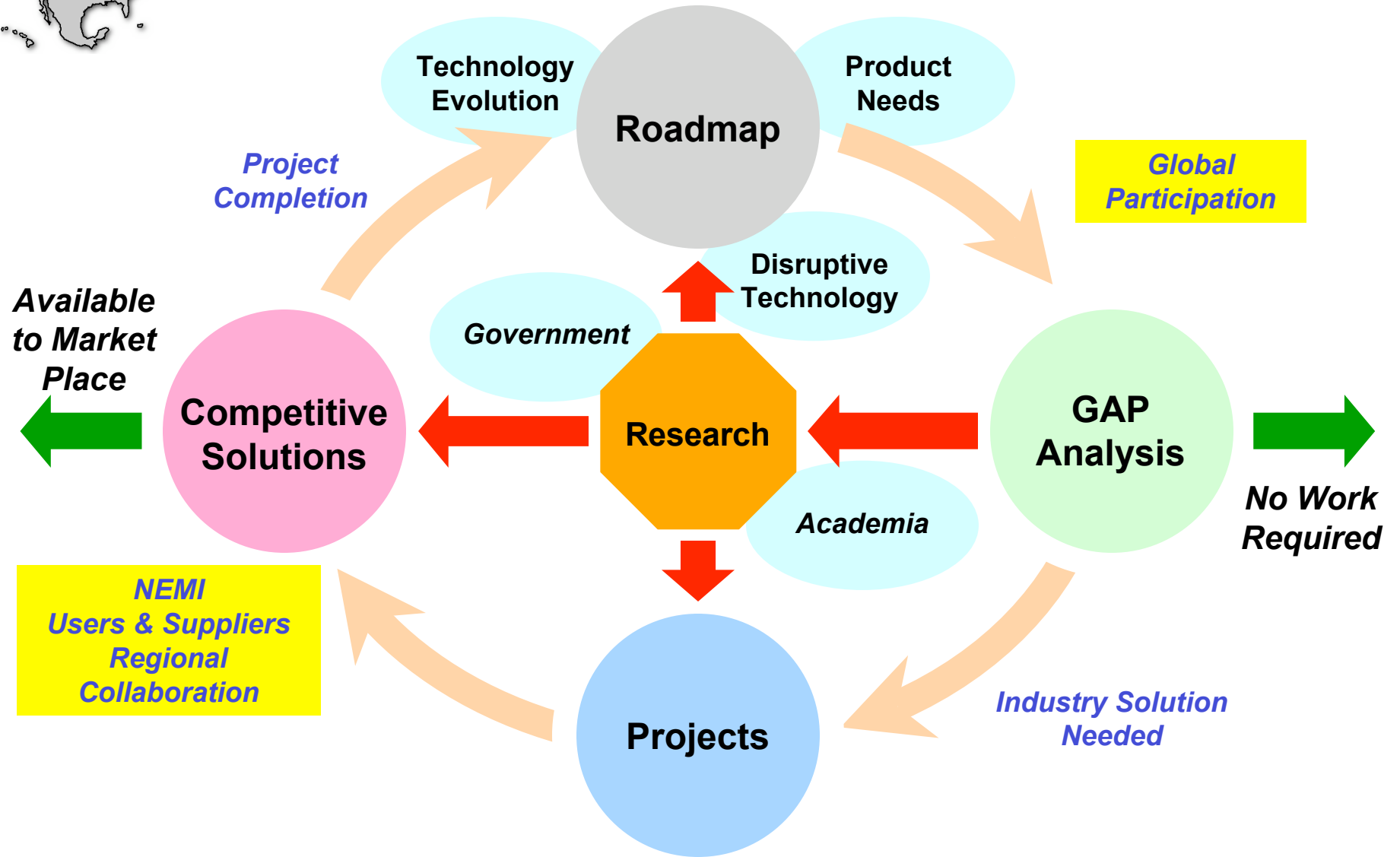
NEMI Mission Statement

NEMI is a North American based consortium whose mission is dedicated to providing leadership for the global electronics manufacturing supply chain for the benefit of its member companies and the industry.

Connect with and Strengthen your Supply Chain

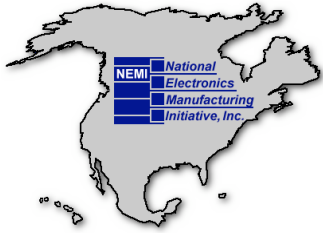


NEMI Roadmap Cycle



NEMI Implementation Cycle

Connect with and Strengthen your Supply Chain

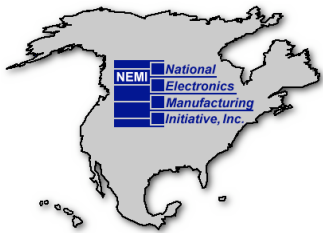


What Does NEMI Do?

Leverage the combined Power of Member Companies and their Partners to Provide Industry Leadership

- **NEMI Roadmaps the Global Needs of the Electronics Industry**
 - Evolution of existing technologies
 - Predictions on emerging/innovative technologies
- **NEMI Identifies Gaps (both technical & business) in the electronics Infrastructure**
- **NEMI Stimulates R&D Projects to fill these Gaps**
- **NEMI Establishes Regional Implementation Projects to Eliminate these Gaps**
- **NEMI Stimulates Global Standards to speed the Introduction of New Technology & Business Practices**

Connect with and Strengthen your Supply Chain



Industry Leaders belong to NEMI



Agilent Technologies



DELPHI



Lucent Technologies
Bell Labs Innovations



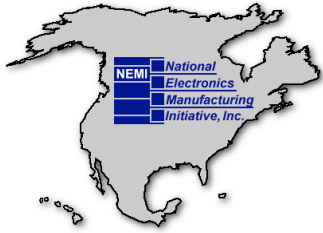
NORTEL
NETWORKS
BUSINESS WITHOUT BOUNDARIES



SANMINA-SCI



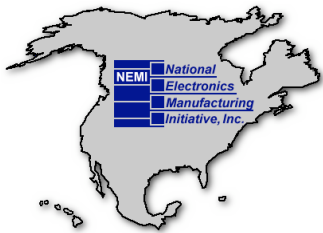
Connect with and Strengthen your Supply Chain



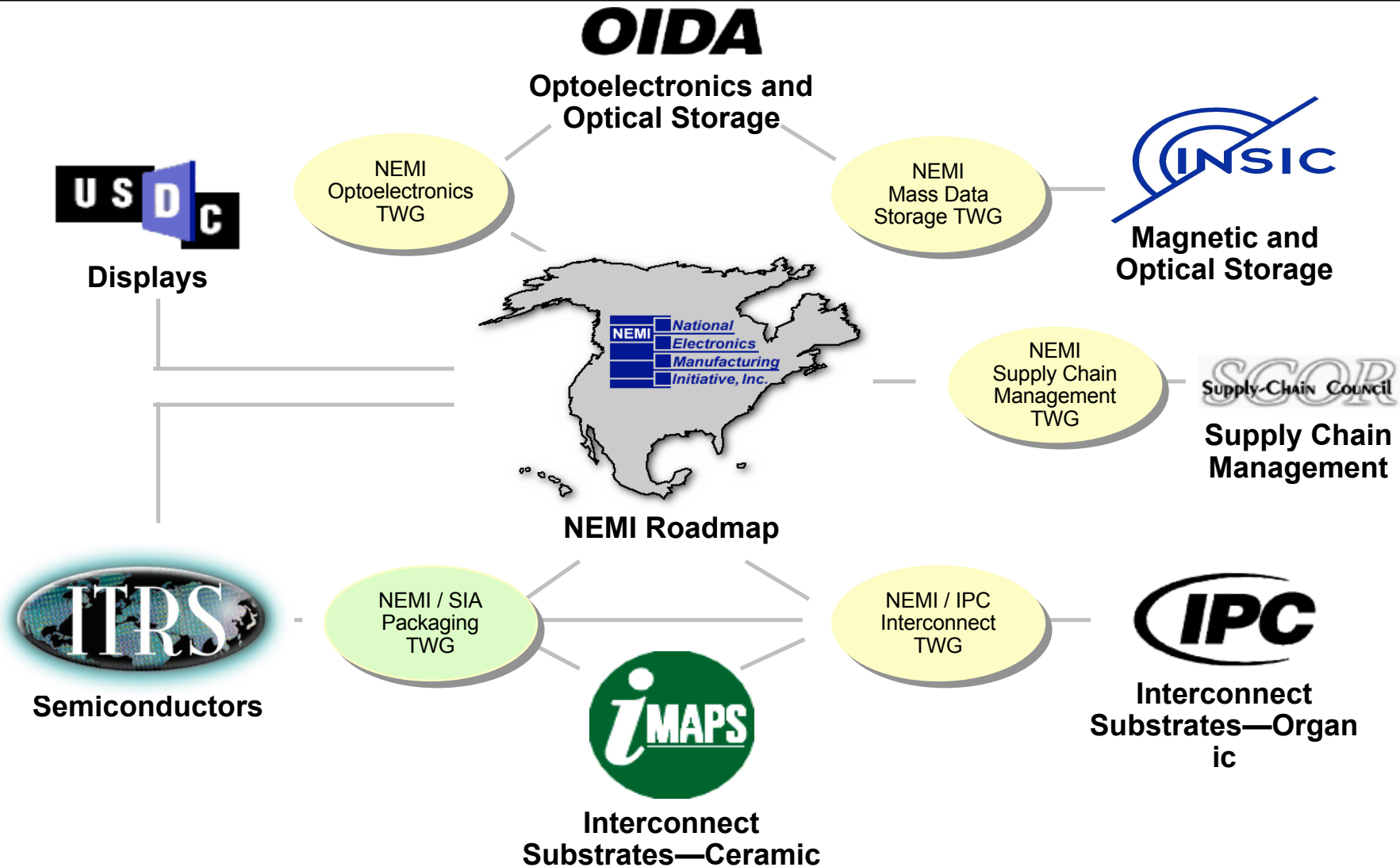
2002 Roadmap Input & Coverage

- **Developed by >350 individuals from 170 organizations (including non-member companies)**
- **Excellent reputation as representing the broad needs of industry**
- **Covers 18 technology, business practice and infrastructure topics in the areas of:**
 - **Semiconductor technology**
 - **Business processes/technology**
 - **Design technologies**
 - **Manufacturing technologies**
 - **Component subsystem technologies**
- **Roadmaps the needs for 2003-2013**
- **Over 1000 pages of information**

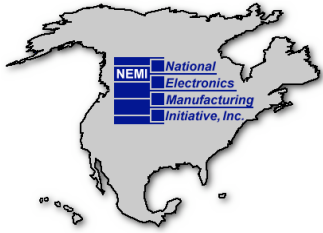
Connect with and Strengthen your Supply Chain



NEMI Roadmap Affiliations



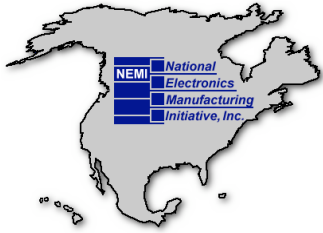
Connect with and Strengthen your Supply Chain



Drivers for Locating Operations in China

- **Source: NEMI China Forum II, October 21, 2003**
- **Firms:**
 - **Motorola: OEM**
 - **Intel: Semiconductor Manufacturer**
 - **Solectron: EMS Firm**
 - **Tyco: Component Manufacturer**
 - **Universal Instruments; Assembly Equipment Manufacturer**
- **Question: Why did you relocate to China?**

Connect with and Strengthen your Supply Chain



Drivers for Locating Operations in China

Summary

1. Market Advantage

Fast-Growing, Large Market for: Cell Phones, Automobiles, Beer, Steel, Electronic Materials, etc.

2. Cost Advantage

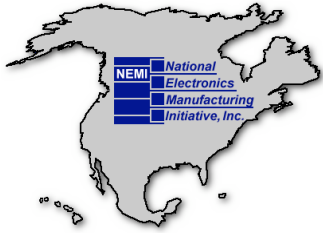
- Professionals
- Workers
- Material

3. Quality Advantage

Talent Base

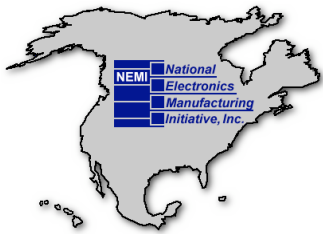
4. Political Advantage

Connect with and Strengthen your Supply Chain



Drivers for Globalizing R&D

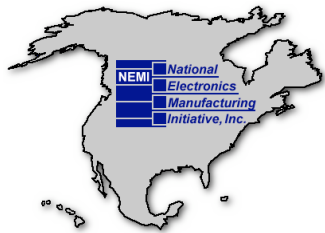
- **Acquire Superior or Regional Technology**
 - Example: Environmental Technology in Europe
- **Bring R&D Closer to the Market**
 - Example: Cell Phones for China Market
- **Support Regional Operations**
 - Regional Customers and Suppliers
- **Enhance Standing as “Complete” Local Company**
 - Customers and Government
- **Benefit from Government Incentives**
- **Reduce R&D cycle time (Around the clock development)**
- **Reduce R&D Costs**



Competitive Concerns

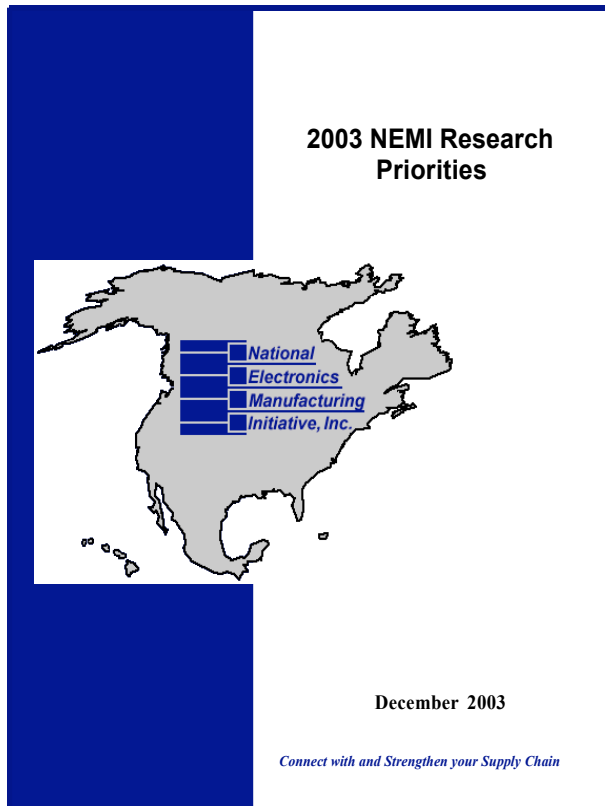
- **Concerns**
 - **Loss of Domestic Manufacturing Capabilities and Jobs**
 - **Downsizing of Industrial Research in North America**
- **Strengths**
 - **North American Creativity**
 - **North American Market**
 - **Strong Academic and Institutional R&D**
 - **Identification of Technology Needs through NEMI Roadmap**
- **Opportunities**
 - **Industry is waking up to potential of leadership shift/loss**
 - **Industry and the research community must work together to match Identified needs with emerging disruptive technologies to create new opportunities**

Connect with and Strengthen your Supply Chain

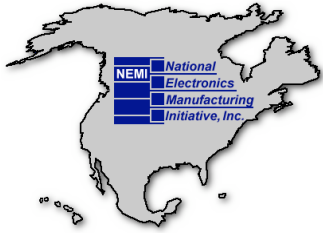


NEMI's First Step

2003 NEMI Research Priorities

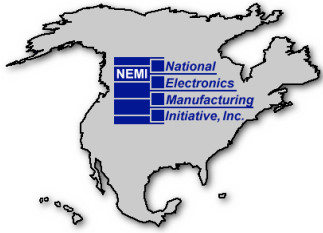


- **Extracted research needs identified in the 2002 National Electronics Manufacturing Technology Roadmaps**
- **Organized needs by five traditional research disciplines:**
 - **Manufacturing Processes**
 - **System Integration**
 - **Energy**
 - **Materials**
 - **Design**
- **Prioritized needs**
- **Identified Nanotechnology as a potential disruptive technology impacting all five research disciplines**



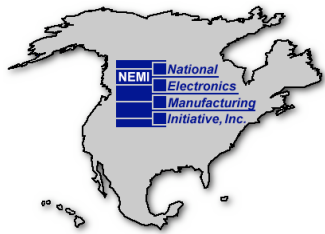
Identified Materials R&D Needs

- **Substrate materials with improved dimensional stability, planarity, low moisture absorption, and warpage**
- **Improved interfacial adhesion and strength between Cu/low k and wire bonds, bumps, and underfill**
- **Low loss resins for high frequency applications**
- **Cost-effective, reliable, environmentally conscious material alternatives that meet functional and performance requirements**
- **Multifunctional materials for low temperature joining of optoelectronics components**
- **Low cost, higher thermal conductivity packaging materials**



Possible Applications of Nano Technology in Electronics

- **Advanced fillers that are reinforcing, thermally conductive, electrically conductive, TCE modifying for mold compounds, underfills, adhesives and board materials; short term**
- **Mixed Nano and MEMS sensor technology; medium term**
- **Plasma display technology based on CNT emitters; medium term.**
- **Quantum computing using “peapod structures” based on carbon nanotubes (CNT) or Bose-Einstein atomic clusters; long term**
- **Transistors based on CNT or GMR layered structures; long term**
- **DNA strand self-assembly of electronic structures; long term**



Summary

-
- **Globalization is forcing American industries to make decisions.**
 - Leadership
 - Survival
 - “Deer in the headlights”
 - **Many leadership firms are following the growth market.**
 - **Their suppliers are following them.**
 - **Firms are globalizing their evolutionary R&D.**
 - Support Regional Operations
 - Enhance Standing as “Complete” Local Company
 - Benefit from Government Incentives
 - Reduce R&D Costs
 - **NEMI members are seeking a proactive leadership strategy.**
 - An Initial strategy is for North America to emphasize innovative and disruptive R&D that addresses the strategic needs of industry.
 - Innovative and Disruptive Technologies have the potential to Create New Opportunities for North American leadership.