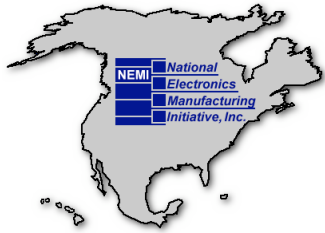


**NEMI Infrastructure:  
Roadmapping Industry Needs  
and Closing Technology Gaps**

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***Bob Pfahl***

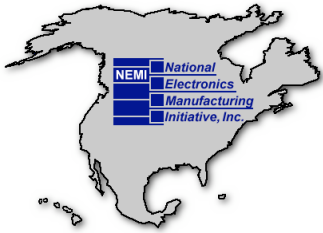
*January 30, 2003*



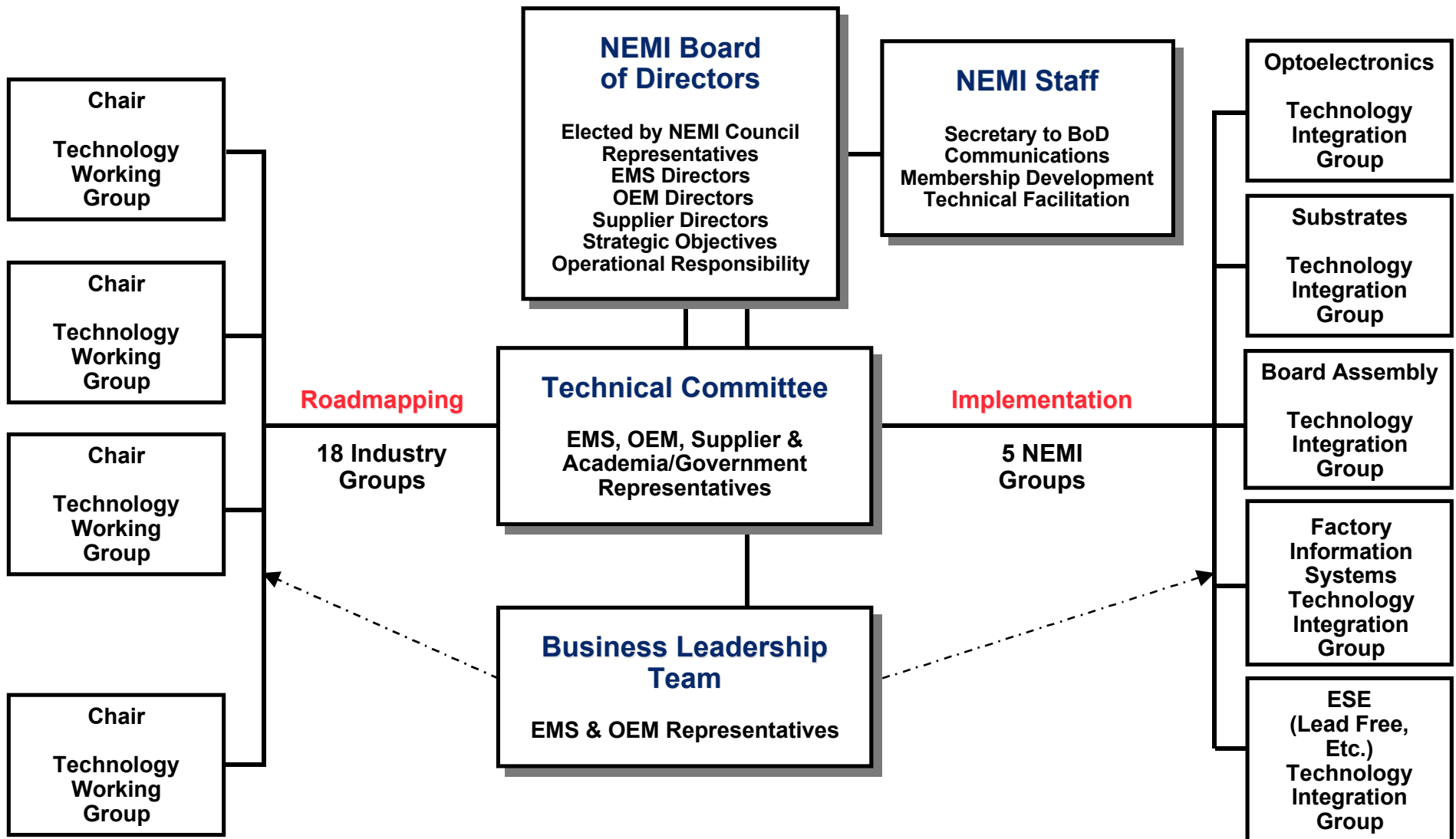
## What Does NEMI Do?

### *Leverage the combined Power of Member Companies to Provide Industry Leadership*

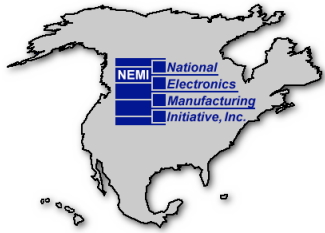
- **NEMI Roadmaps the Needs of the North American Electronics Industry**
- **NEMI Identifies Gaps (both business & technical) in the North American Infrastructure**
- **NEMI Conducts Industry Forums on Emerging Topics**
- **NEMI Stimulates R&D Projects to fill Gaps**
- **NEMI Establishes Implementation Projects to Eliminate Gaps**
- **NEMI Stimulates Standards to speed the Introduction of New Technology & Business Practices**



# NEMI Organization



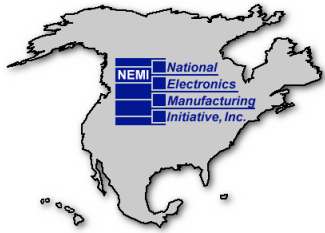
*Connect with and Strengthen Your Supply Chain*



# Current NEMI Membership

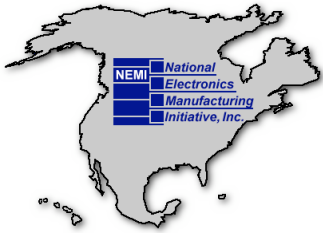
- 3M
- 3 SAE Technologies
- Adept Technology, Inc.
- Advanced Micro Devices, Inc. (AMD)
- Aerotech World Trade
- Agile Software Corporation
- Agilent Technologies, Inc.
- Alcatel Canada, Inc.
- American Electronics Association (AEA)
- AMR Research
- Asymtek
- Aurora Instruments
- BTU International
- CalNet
- Centre for Microelectronics Assembly & Packaging (CMAP)
- Celestica, Inc.
- ChipPac, Inc.
- Cimatrix, Inc.
- Compaq Computer Corporation
- Cookson Electronics
- CyberOptics Corporation
- Delphi Delco Electronics Corporation
- Dover Technologies International
- E2open
- Eastman Kodak Company
- Electronic Industries Association (EIA)
- FCI
- Georgia Institute of Technology
- GSI Lumonics
- Heraeus
- Hewlett Packard Company
- IBM Corporation
- Indium Corporation of America
- IPC
- IEEC SUNY, Binghamton
- Intel Corporation
- iManage
- Jabil Circuits
- Kester Solder
- KIC Thermal Profiling
- kSARIA
- Kulicke and Soffa Industries, Inc.
- LACE Technologies
- Loctite Corporation
- Lucent Technologies, Inc.
- Merix Corporation
- META Group
- Ministere de L'industrie et du Commerce Government du Quebec
- Motorola
- National Center for Manufacturing Sciences (NCMS)
- National Institute of Standards and Technology (NIST)
- Nextrom Photonics
- Nortel Networks
- Orbotech
- Plexus Corp.
- PTC Corp.
- Sanmina-SCI Corporation
- Shipley Company
- Solectron Corporation
- Storage Technology Corporation
- Sumitomo Electric Lightwave
- Sun Microsystems
- Technomatix-Unicam, Inc.
- Texas Instruments, Inc.
- Virginia's Center for Innovative Technology (CIT)
- Vytran

*Connect with and Strengthen Your Supply Chain*

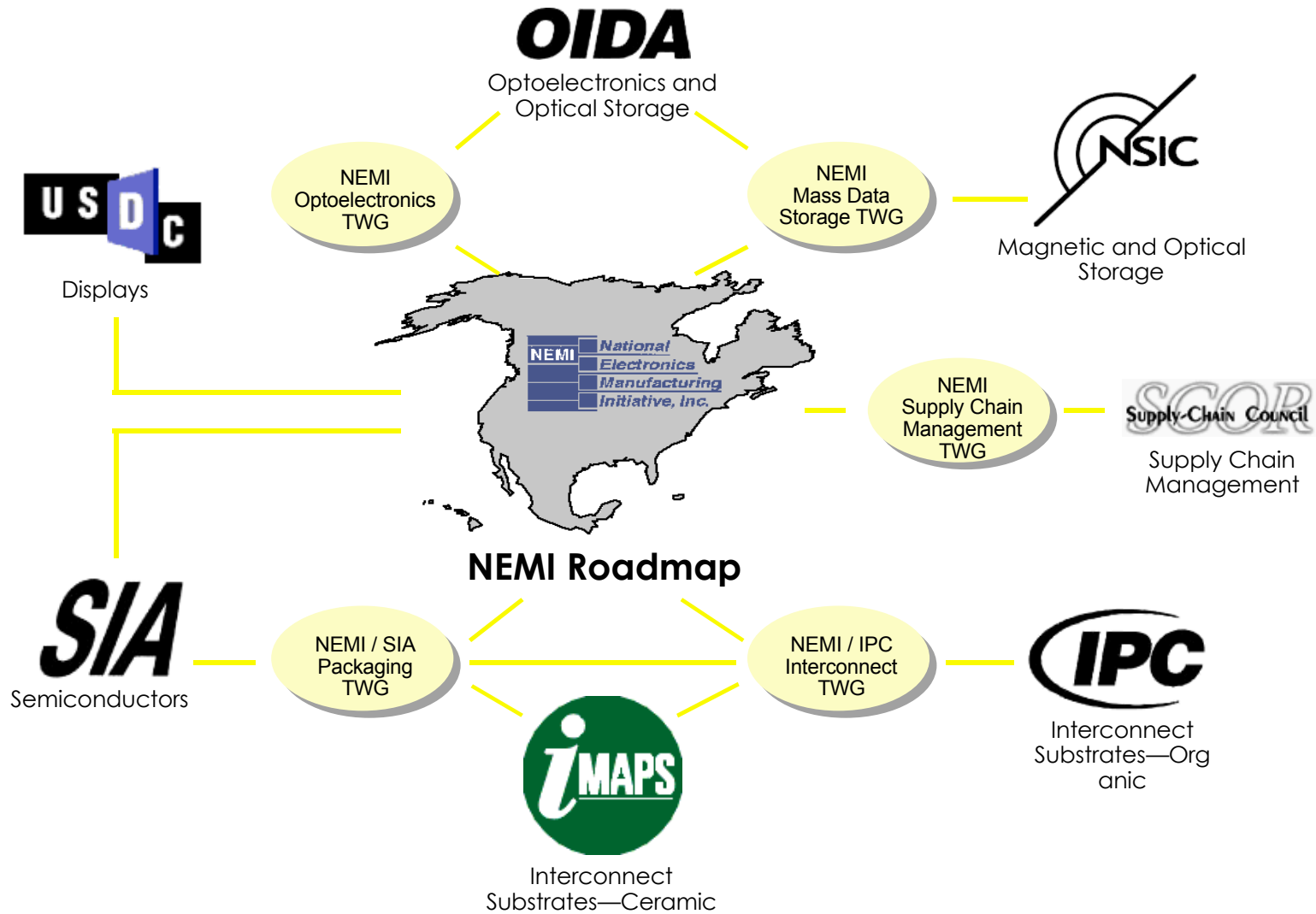


# Major Accomplishments

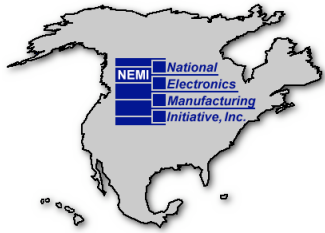
- **Roadmapping**
  - Global acceptance as **the** source that provides systems view of electronics manufacturing – published biennially.
  - Coordinated with other major organizations: SIA, IPC, OIDA, NSIC, Supply Chain Council, USDC.
  - Has accurately predicted emergence of a number of manufacturing technologies (e.g. Microvia PWB, open systems architectures in mfg. software).
  - Broad industry view (2002 version created by 370+ people from 170 companies/organizations).
  - Evolving to address changing priorities: Supply Chain Management, Environmentally Conscious Electronics, challenges of distributed manufacturing model.



# NEMI Roadmap Linkages

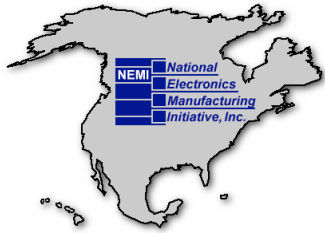


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## How TIGs are Defined

- **TWG chairs identify potential gaps during roadmap development process, recommend follow-up activities.**
- **NEMI Technical Committee (TC) reviews TWG recommendations.**
- **TC decides on formation of Technical Integration Groups (TIGs) to address gaps.**
- **TIGs review identified gaps and develop NEMI Technical Plan; TC approves.**
- **TIGs, with TC approval, undertake projects to close gaps.**

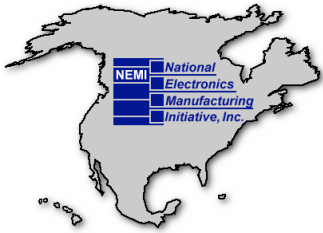


# 1998 NEMI Roadmap

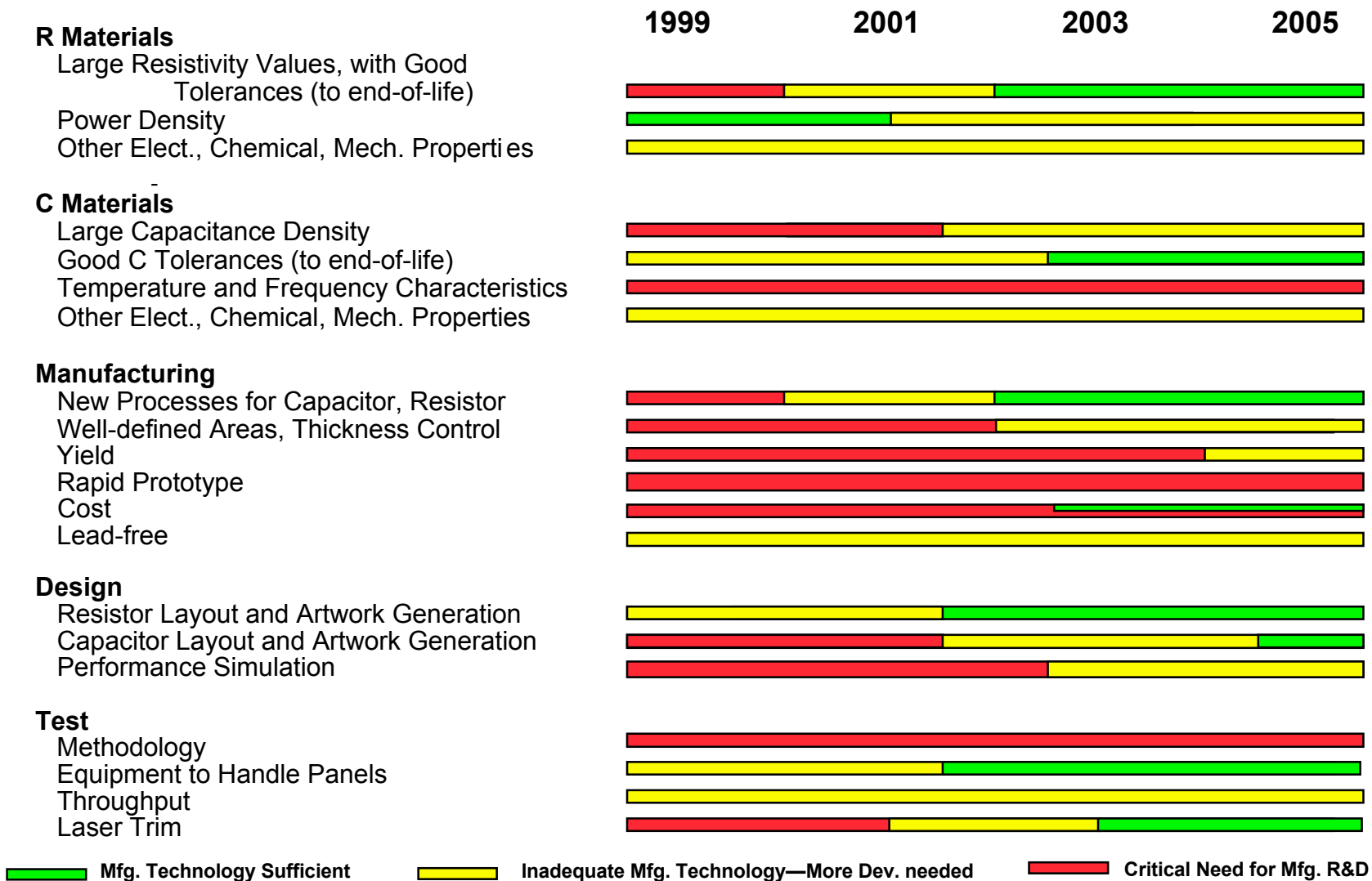
- **Identified Embedded Passives as a Potential Paradigm Shift**
- **Outlined a Gap Analysis on Technology Requirements**

	Area of Concern	2000	2003	2005	2011
EMBEDDED RESISTORS AND DISTRIBUTED PLANAR CAPACITANCE	Materials	Demonstrable	Meets Requirements		
	Manufacturing	Low Yields	Acceptable Yields, Existant Infrastructure	Available Cost-Effective Infrastructure	
	Design & Test	Demonstrable		Widespread Common Practice	
	Cost	High	Competitive Price	Cost Savings	
	Availability	Few Suppliers No Standards	Available from a Few Sources	Standard Parts Available from Multiple Sources	

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# 1999 Embedded Passives Gap Analysis



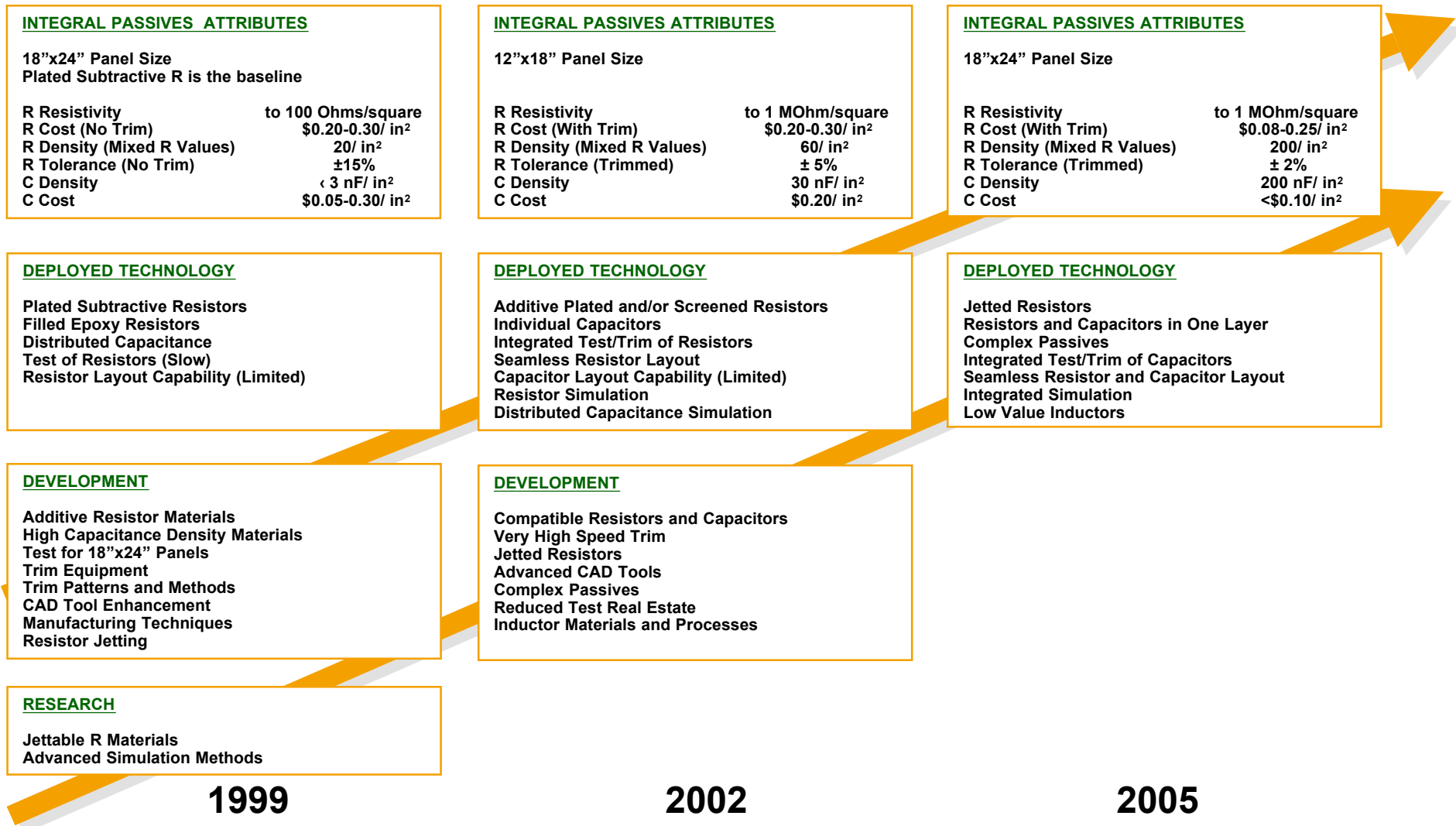
■ Mfg. Technology Sufficient    
 ■ Inadequate Mfg. Technology—More Dev. needed    
 ■ Critical Need for Mfg. R&D

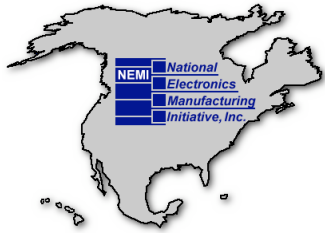
X = Not Req'd  
 R = Research  
 D = Development  
 I = Implementation

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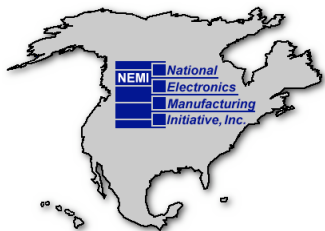
# 1999 Embedded Passives Implementation Plan





## Embedded Passives Project Goals

- **Develop materials, design and processing technology for embedding passive devices (resistors and capacitors) into circuit board substrates.**
  - Meet industry need for denser, higher-performance products.
  - Improve cost, space requirements, performance and reliability.
- **Target frequencies of 1–10 GHz.**
  - Use embedded passives to maintain signal integrity, enabling significant improvement in data transmission rates.
- **Reduce system cost of resistors to half that of chip resistors.**
- **Provide cost modeling and process design tools that can be easily used by project designers.**

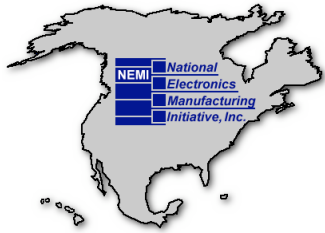


# Advanced Embedded Passives Technology Consortium Participants



NEMI's Embedded Passives Project is 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

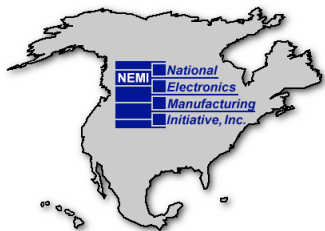
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# High Frequency Materials for HDI Project Goals

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- **To gain understanding of current materials and the novel material sets under development.**
- **Review the methods and equipment proposed to process high density interconnect (HDI) material sets.**
- **Benchmark the materials and the high density interconnect processes used in frequency applications from 2 to 38 GHz.**



# High Frequency Materials for HDI Project Participants



Agilent Technologies



NSWC CRANE



Georgia Tech

HITACHI

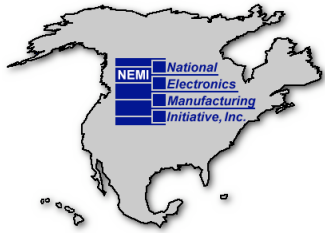


intel.



NIST

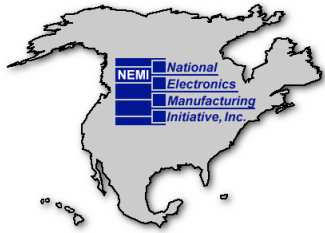




# High Frequency Materials for HDI Project Status

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- **Project is co-chaired by IPC and NEMI.**
- **Statement of Work approved and communicated to NEMI and IPC participants.**
- **Project currently underway.**



# Emerging Initiatives

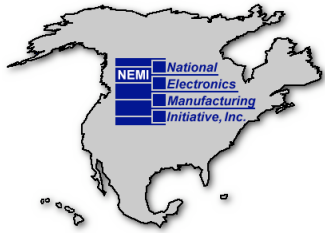
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## **Optoelectronics TIG:**

- **Optoelectronics for Substrates Project: (Jack Fisher, IPC)**

## **Substrates TIG:**

- **Integral Resistor and/or capacitor Testing Project: (Larry Marcanti, Nortel Networks)**

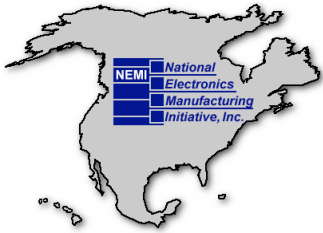


# Substrates TIG

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## New Initiative:

- **Integral Resistor and/or capacitor Testing Project:  
(Larry Marcanti, Nortel Networks)**
  - **Develop the methodology and tools to test embedded passives in a printed wiring board.**

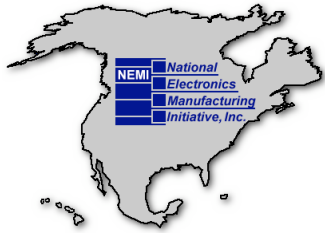


# Optoelectronics TIG

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## New Initiative:

- **Optoelectronics for Substrates Project: (Jack Fisher, IPC)**
  - The Study Group's goal is to perform a review of wave guides or fiber on a PC board for high performance applications. Initially the group will study state of the art; determine product needs in the future, and define projects that can achieve real goals.

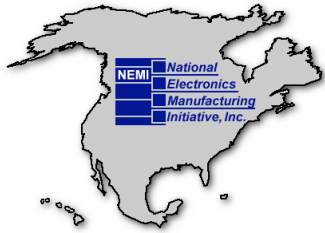


# Summary

- **1998 NEMI Roadmap identified Embedded Passives as a Potential Paradigm Shift**
- **1999 NEMI Technical Plan Identified Technical Gaps**
- **NEMI Worked with NCMS to Define and Establish Funding for the AEPT Project**
- **AEPT Project has resulted in closing many gaps**
- **The Technology is Being Deployed**
- **2002 NEMI Roadmap has identified additional needs**

Priority	Embedded Passives	Integrated Passive Devices
Critical	HDI (Microvia) North American Infrastructure	
Critical	Capacitor and Resistor Materials Research	Standards (EIA)
Critical	Design Tools	Standard Parts
Critical	Testing & Trimming	
Critical	Technology Sustainability (obsolescence)	

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## 2002 NEMI Roadmap 2003 NEMI Technical Plan

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- **Highlights will be presented at an Apex luncheon on April 2, 2003**
- **CD's will be available at that time.**
- **Gap Analyses will commence at the Apex Forum to identify Gaps and update the NEMI Technical Plan. We encourage industry participation.**
- **Updated Information on Gap Analyses will be available at the NEMI Web Site:**

**[www.NEMI.org](http://www.NEMI.org)**