NEMI National Electronics Manufacturing Initiative, Inc.

# North American Manufacturing: What will the future bring?

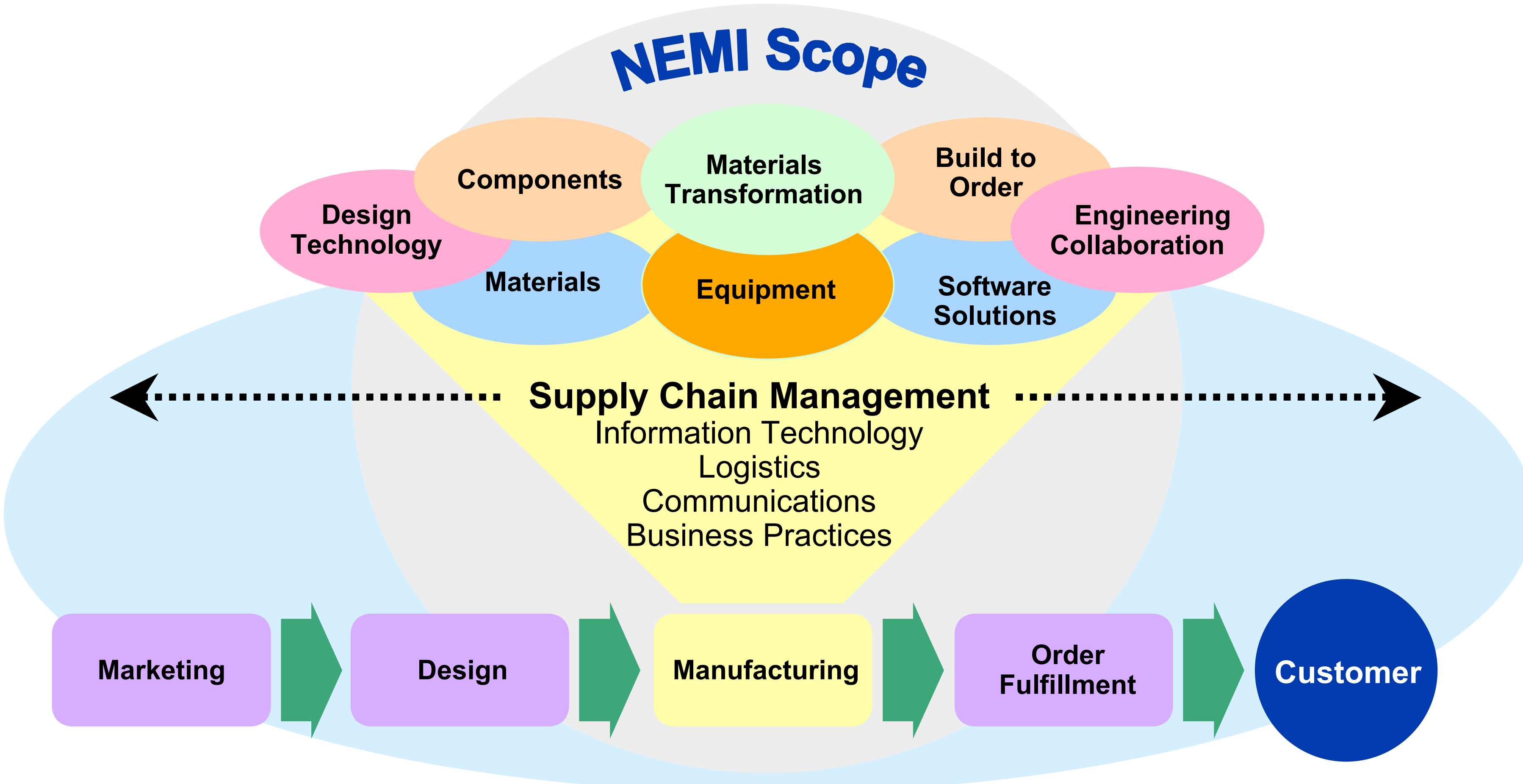
*IPC Annual Meeting – SMEMA Council*

# Topics

- Background
- Technology Roadmapping
- Preliminary Conclusions of 2002 Roadmap
- What does it mean?

# NEMI Mission

***Assure the Global Leadership of the North American Electronics Manufacturing Supply Chain***




*Connect with and Strengthen Your Supply Chain*

# What Does NEMI Do?

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

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

# Roadmap Structure - 18 TWGs

**Digital Silicon Technology**

**Business Processes/Technologies**

- Product Life Cycle Information Management

**Design Technologies**

- Modeling, Simulation, and Design Tools
- Thermal Management
- Environmentally Conscious Management

**Manufacturing Technologies**

- Board Assembly
- Test, Inspection, and Measurement
- Final Assembly

**Component/Subsystem Technologies**

- Packaging
- Connectors
- Interconnection Substrates - Organic
- Interconnection Substrates - Ceramic
- Passive Components
- RF Components
- Optoelectronics
- Displays
- Mass Data Storage
- Energy Storage Systems

# The Changing Landscape

- New Volume Drivers
  - 1 billion cell phones by 2005/6
    - Cell phone innovation slowdown has led to standard I/C's and commoditization of the technology
    - Overtake PC for web access by 2004/5
  - 2 billion Bluetooth by 2006/7
  - Optoelectronics growth stopped through 2003
    - Isolated areas of strong growth
  - PC growth stalled, market share shifting
  - Auto electronics growth remains strong (spurred by new functionality in the car)

# Board Assembly Chapter Highlights

- Board assembly handles most of the direct-material costs for electronics products and is critical to electronics supply chain
- Board assembly is being impacted by MEMS, optoelectronics and wireless communications packaging technology development
- Movement of volume board assembly to low cost areas of the world – primarily China – continues
- The majority of the remaining N.A. assembly will be related to NPI and service – areas needing improvement
  - Efficiency and utilization of high mix/low volume lines
  - Set up times and the adoption of factory information integration with real time optimization
  - Ramps to volume and line flexibility
  - Qualification processes for materials, process development
  - DPMO leverage to understand package performance
  - DFx tools level of integration with factory data systems

# Printed Wiring Boards

## PWB Suppliers have two, very different, markets

### Conventional PWB's

- Four layer boards typical
  - Portable
  - Office Products
- High end boards
  - 12 - 20 layers
  - Zo control
  - >0.1" thick
  - 100's Amperes
- Harsh Environment
  - Tends to be "standard"
  - Moving to 6 layers

### Chip Carriers

- May be single chip or few chip modules
  - Need HDI technology
  - Fine line/Spacing
- May be flip chip or wire bond
- Encapsulated
- Reliability equivalent to standard modules
  - Different from PWB testing

**HDI on conventional PWB providing function at lower cost with reduced layers (migrating to large Boards).**

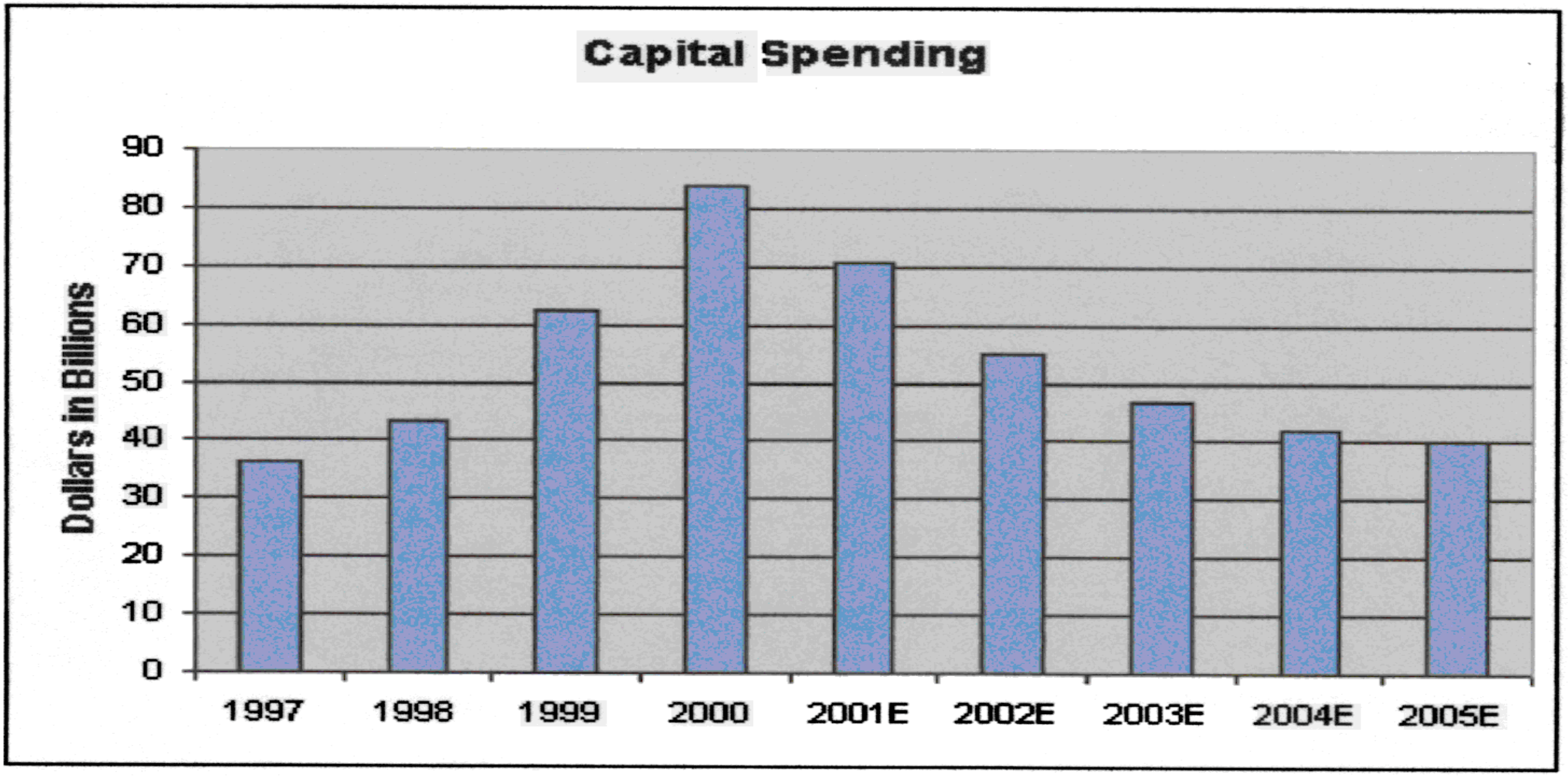
# Portable Product Emulator is Packaging Driver

**Key Parameters for Portable Product Sector**

| First Year of Significant Production | Metric | 2003 | 2005 | 2007 | 2013 |
|---|---|---|---|---|---|
| **Cost** | | | | | |
| Board Assembly (Conversion) Cost | ¢ per I/O | 0.5 | 0.45 | 0.4 | 0.3 |
| Substrate Cost (6-layer, blind/buried) | $\$/cm^2$ | 0.055 | 0.04 | 0.03 | 0.03 |
| Microvia Board Cost (4-layer) | $\$/cm^2$ | 0.04 | 0.03 | 0.025 | 0.015 |
| IC Package Cost | ¢ per I/O | 0.7 | 0.65 | 0.5 | 0.4 |
| **Design-Packaging Density** | | | | | |
| Average Component I/O Density | I/O per $cm^2$ | 70 | 80 | 100 | 140 |
| Max Component I/O Density** | I/O per $cm^2$ | 280 | 320 | 350 | 450 |
| I/O per Component, avg. | # | 6 | 7 | 7.5 | 9 |
| Package I/O Pitch (Perimeter) | mm | 0.5 | 0.5 | 0.5 | 0.5 |
| Max I/O per package | I/O/pkg | 324 | 400 | 424 | 480 |
| Package I/O Pitch (Area Array) | mm | 0.5 | 0.5 | 0.5 | 0.5 |
| Substrate Lines and Spaces | microns | 75 | 65 | 65 | 35 |
| Substrate Pad Diameter* | microns | 225 | 200 | 175 | 125 |
| Max # of I/Os per Product | solder joints | 5500 | 5500 | 5000 | 4000 |
| Components per $cm^2$ | $\#/cm^2$ | 15 | 15 | 17 | 25 |
| Max Components per $cm^2$ | $\#/cm^2$ | 50 | 55 | 60 | 25 |

# Optoelectronics Capital Expenditure Forecast

Capital Spending Totals




Source: Optical Oracle

# 2002 Roadmap Portable Product's Highlights

- Standard RF I/Cs have rendered new cell phone products commodities favoring I/C manufacturing
- Same result for portable SMT board assemblies in general
- Main driver for portable devices continues to be unit shipping volume

  - 400 M cell phones in 2002 still drive packaging and assembly trends for this cycle

  - Game boxes at 40M in 2002 and other future products with volumes > 10M/year may drive I/C design/packaging
- Present business cycle decline should end before next roadmap cycle
- N.A. manufacturing at same crossroads that precipitated the formation of NEMI in early 1990's

  - EMS outsourcing trend leading the transition to offshore labor

  - For many products, virtually complete

# Situation Analysis

- Most segments of market are either flat or still in decline
  - Companies struggling to get back to profitability
  - New technology investments impacted
  - In spite of this scenario, some are growing market share
- Relentless restructuring of industry
  - Driven by competitive forces
  - Focus on Core Competency; Outsource the rest
  - Expanding focus of EMS Providers (full service)
- Rapid and intense movement to China/Far East
  - Huge market potential (long term)
  - Low cost structure (short term)

# Future of Electronics Industry

- Like other industries before us, electronics is maturing to become more of a commodity
  - May no longer be fueled by technology as dominant driver
  - Winners will excel at meeting customer's needs
  - Low costs/low margins will be the norm
  - A few large players may dominate.
- Looking for next "killer Applications" to spurn future growth of industry (technology driven)
  - Wireless
  - Homeland Security
  - Medical
  - Small entrepreneurs may still flourish.
- Once electronics becomes true commodity, technology as a product differentiator could become both more important (for higher margins) and more elusive.

# North American Role

- Supply chains are increasingly Global
  - Not bound by geographic or political boundaries
  - Easily reconfigured to compete
    - Local market access
    - Competitive costs
- North America continues to excel in innovation
  - Web based services/infrastructure
  - Product Design (in some segments)
  - New Product Introduction
- Volume Mfg. continues its off-shore migration
  - China today
  - India tomorrow?
- Global Enterprises have decreasing loyalty to any particular region.

# Final Thoughts

- **Electronics is clearly moving in the direction of commodity**
- **Speed/timing of transition is in debate**
- **Long term survival will require**
  - **Learning how to compete/excel in high volume commodity markets**

    **OR**

  - **Transition to another industry/segment (with higher margins)**