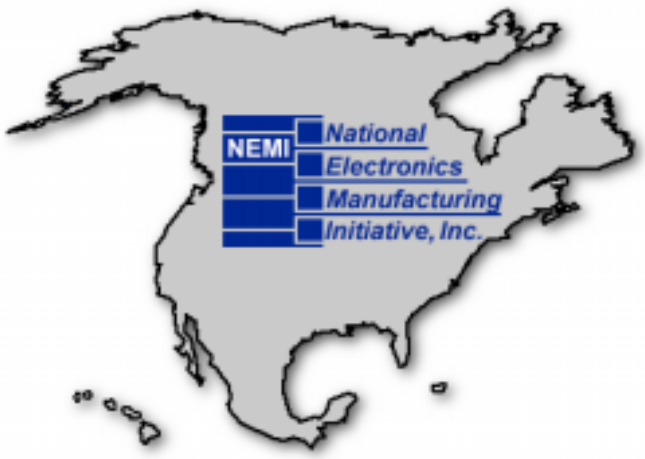
NEMI Optoelectronics Industry Initiatives



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National Electronics Manufacturing Initiative, Inc. (NEMI)

Strategies in Optoelectronics MANUFACTURING Conference

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San Mateo, CA

Outline of Presentation

- NEMI Overview
- High Level System Overview
- Business Overview
- Roadmap Highlights Level 1 and 2
- NEMI Projects and Standards Overview

NEMI Overview:
NEMI Mission and Structure

MISSION:

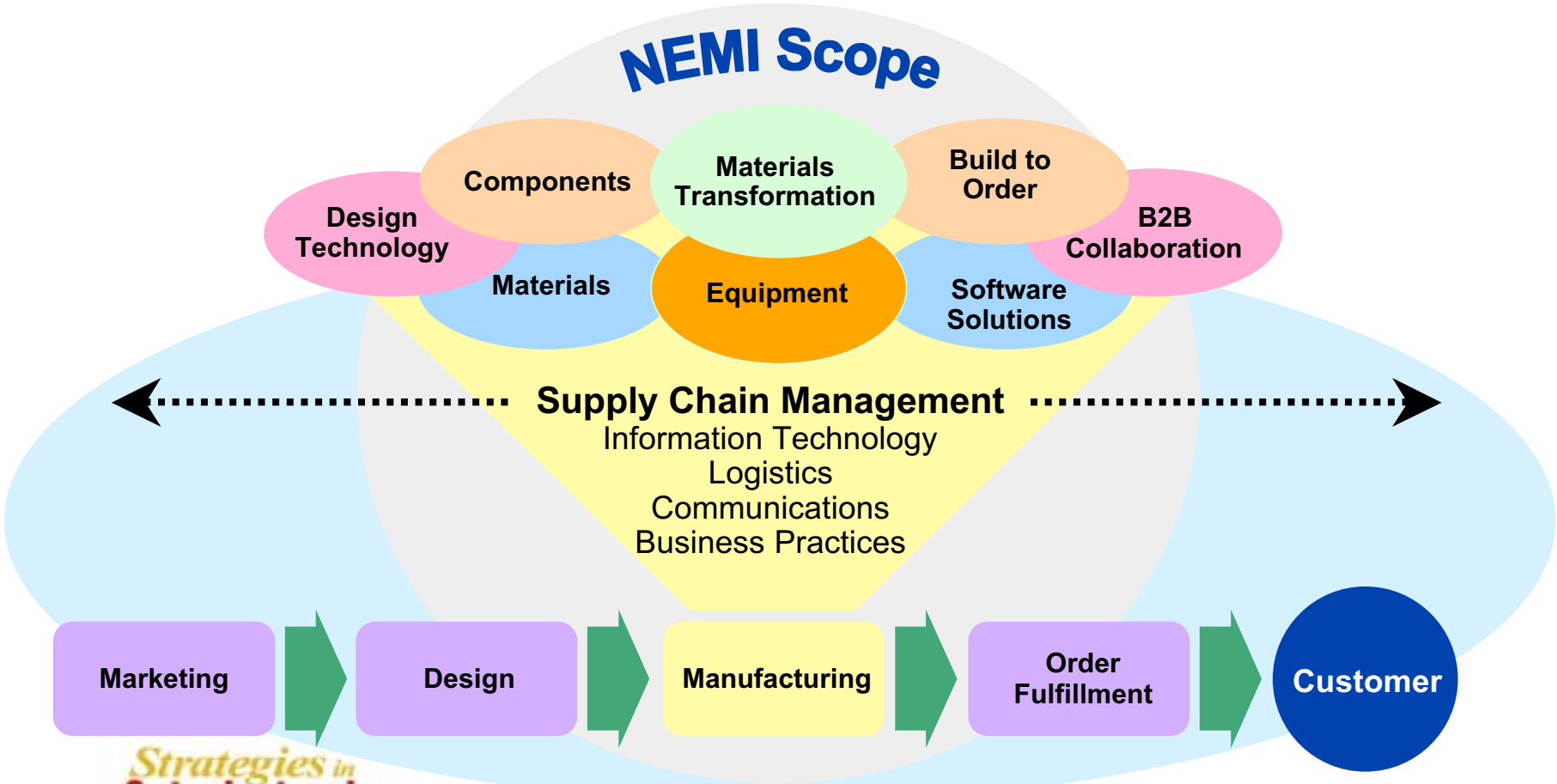
1. **NEMI is dedicated to improving the volume capabilities and competitiveness of North American electronics manufacturing companies**
2. **NEMI brings together North American electronic manufacturers with their suppliers to produce a world class volume manufacturing supply chain**

STRUCTURE:

1. **North American industry led consortium**
2. **Made up of electronic equipment manufacturers, suppliers, associations, other consortia, government agencies and universities**
3. **Virtual organization; small permanent staff**

NEMI Overview: Mission and Structure

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



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NEMI Overview:
NEMI Focus

Electronics Manufacturing Technology Above the Die Level

- Roadmaps the needs of the North American electronics industry
- Identifies gaps in the North American infrastructure
- Provides Industry leadership to address opportunities
- Stimulates R&D projects to fill gaps
- Establishes implementation projects to eliminate gaps
- Stimulates standards activities to speed the introduction of new technology

NEMI Year 2002 Optoelectronic Roadmap Technical Working Group (TWG)

- 47 engineers and technologist have participated in the Year 2002 NEMI Optoelectronics TWG representing 31 companies, N.I.S.T., IPC and Universities
- The industrial TWG members includes Optoelectronics Firms, EMS, Materials Suppliers, Equipment Suppliers and Consultants

NEMI Overview: Roadmap Process

- NEMI roadmaps technology in 18 different areas
- Each roadmap chapter is created by a Technology Working Group (TWG)
- NEMI has technology deployment activities in 5 different areas
- Each project area is organized by a Technology Integration Group (TIG)
- Business Topics being addressed by Business Leadership Team (BLT)
- Roadmap and project groups are made up of industry people (including leadership)

High Level System Overview:
Assembly Level Classification

Level 0 Device	Level 1 Package	Level 1.5 Hybrids & Modules	Level 2 Board	Level 3 Product
Laser Filter	Hermetic Molded	Mixed optics & electronics	Mixed optics & electronics	Rack mountable

High Level System Overview:
High Level Optical Communications Roadmap-1

Services/Networks	2005	2010
Services	Next Gen SONET, VPN's, Web Hosting, Remote Security Services, DTV Standard, Internet 2	Wavelength Services, VHS Remote Data Access, High Speed Multi-processor Memory Interconnects
Long Haul	40 G, Node Capacity 2.5 Tb/s, Wavelength Routing, Reconfigurable OADM	40 G, Node Capacity 40 Tb/s, Optical Burst Switching, Transparent OXC, ULH Transmission, Carrier Optical Wavelength Interchange

High Level System Overview:
High Level Optical Communications Roadmap-2

Services/Networks	2005	2010
Metro Regional	Early Feasibility AON, Node Capacity 1 Tb/s, Digital Private Video Networks	AON Deployment New Builds, Node Capacity 10 Tb/s
Metro Access	10 G Campus/Building Service, Uptake Of DWDM, Wavelenght Protection Services	AON Deployment New Builds, Node Capacity 10 Tb/s

High Level System Overview:
High Level Optical Communications Roadmap-3

Services/Networks	2005	2010
Enterprise	OC-48 Pipes, 10 GigE Campus, Broader Adoption Office Video, Remote Disk Farms, Continuously Connected Worker (RF)	Remote Server Farms, RF/Optical Converters, FTTB (10 Gb/s)
Home	Integrated Security/Control, High Speed Digital Image/ Video/ Audio/Processor Interconnect (RF/IR)	FTTH (150 Mb/s)

Business Overview:
The Roaring 90's

- Telecommunications was the driving force behind the boom of the late 90's.
- By the beginning of 2001 the telecom companies had reached a market value of $ 3 trillion, and their share of the GDP rose to almost 6 %

What Went Wrong in 2000?

- The Internet and wireless and other telecom services, spurred investment in information technology
- DWDM emerged as solution to capacity problem
- Public and private investment created many speculative startups at carrier, equipment and component levels
- Carrier stock values driven by miles fiber installed and technological advancement versus cash/profit
- Equipment and component companies driven by market share and revenue growth
- Supply shortages led to aggressive purchasing and inventory behavior
- Carriers derailed when debt payments came due RHK Inc. 2001 Optical Components Outlook

Business Overview:
The Status in 2002

- The Standard and Poors 500 Index reached a market peak of 1527 on 3/24/00 and now stands at 819
- The Telecom Industry has lost an estimated $ 2 trillion in paper value on the stock market since 1999 (i.e. about 2/3 its market value)
- Telecom is purported to have thousands of miles of excess capacity in fiber-optic cable and as much as $ 500 billion in questionable deb.
- 80% of businesses connected to the Internet use broadband but less than 10% of households with Internet service do so
- The rate of growth in the Internet is decreasing

Roadmap Highlights

Level 1

Technology	2005	2010
Package Type	Widespread use of leadframes and encapsulation but Kovar style remains for cooled packages. Some BGA style packages.	BGAs and surface mount packages prevalent. Mini-TECs and new chip designs eliminating the need for Kovar style packages.
Automation	Fully automated lines incorporating pick-and-place and automated pigtailing. Hybrid integration being designed for automation.	Hybrid integration fully automated allowing multiple OEICs to be integrated on a single platform using combination of passive and active alignment.

Roadmap Highlights
Level 1

Technology	2005	2010
Alignment	Passive and active alignment applied to hybrid assembly. Only highest end devices still using active alignment. Growing use of servo-feedback alignment approaches.	Widespread use of passive alignment for OEIC integration. Growing application of servo-feedback approaches for alignment.
RF	Integrated bead/shell up to 65Ghz. Some CPW transitions up to 40GHz.	Integrated CPW transitions up to 65GHz. BGA transitions to 40 GHz

Roadmap Highlights
Level 2

Technology	2005	2010
Component & Module	Standard package types, pluggable (no fiber pigtails) Molded plastic (non-hermetic) packages Pick & place, SMT compatible	Direct optical coupling between component and optical PCB, parallel I/O using VCSELs (1310 nm, possibly 1550 nm)
Optical Interconnects: fiber connectors and splicing	One step fiber termination "black box" Integrated automated splice process, for single or multi-up fibers	Direct optical coupling between component and optical PCB Parallel optical PCB edge and surface connectors

Roadmap Highlights
Level 2

Technology	2005	2010
Alignment	Passive and active alignment applied to hybrid assembly. Only highest end devices still using active alignment. Growing use of servo-feedback alignment approaches.	Widespread use of passive alignment for OEIC integration. Growing application of servo-feedback approaches for alignment.
RF	Integrated bead/shell up to 65Ghz. Some CPW transitions up to 40GHz.	Integrated CPW transitions up to 65GHz. BGA transitions to 40 GHz

NEMI Projects and Standards Overview:

NEMI, Board Assembly Technology Integration Group (TIG)

Paul Williams, Intel / Aichyun Shiah, Solectron Corp (Chair/ Co-Chair)

- **Optoelectronics Solder Automation Project <LEVEL 1,2>** Prashant Chouta, Cookson Electronics
- **Fiber Optic Splice Improvement Project <LEVEL 2,3>** Peter Arrowsmith, Celestica, Inc.

NEMI, Optoelectronics Technology Integration Group (TIG)

Alan Rae, Cookson Electronics (Chair)

- **Fiber Handling Project <LEVEL 1,2,3>** Dan Nelson, JDS Uniphase
- **Fiber Optic Signal Performance Project <LEVEL 1,2,3>** Dave Silmser, Alcatel Canada, Inc. / Tatiana Berdinskikh, Celestica
- **Optoelectronics for Substrates <LEVEL 1,2,3 >** Jack Fisher, NEMI Consultant

NEMI Projects and Standards Overview:
Standard Activities

IPC-STD-040 Standard Series:

- Addresses the implementation of optical and optoelectronic packaging technologies
- Identifies 23 areas for standardization - Fiber Handling, Splicing, Cleaning, Testing, Hermetic Sealing, Etc.

NEMI Current Contribution to Series:

- Optoelectronic Fiber Handling Project, IPC-3841 Specification for Process Carriers Used to Handle Optical Fibers in Manufacturing (IPC - Proposal – Standard)
- Future Proposed Contribution:
  - Optoelectronics Fiber Assembly Project , IPC-STD-040 , section, 10.2 Fiber splicing and test
  - Fiber Optic Signal Performance Project, IPC-STD-040

NEMI Projects and Standards Overview:
Projects

Optoelectronic Fiber Handling Project, Joint NEMI/IPC Project: (Chair Dan Nelson)

Status: Project Start, September 2001 - Completed June 2002, (With hand-off to IPC of IPC-3841 Standard, draft proposal)

Project objective:

- Objective: Define a standard for handling and carriers for optical fiber in fiber optic component manufacturing
- Facilitate process automation with reduced engineering
- Define enough specifications to create a carrier standard but still allow for industry innovation and process evolution.
- Developed jointly with IPC

Project Results:

- Set standards for fiber handling: buffer jacket protection, bend radius limit, handling stress
- Set standards and guidelines for fiber carriers: size, weight, frame of reference and alignment features, working envelop, carrier ID, fiber end locations, mating with other carriers, process requirements

NEMI Projects and Standards Overview:
Projects

Fiber Optic Signal Performance Project: (Chair Dave Silmser, Alcatel Canada, Co-Chair: Tatiana Berdinskikh, Celestica)

Status: Project Started, June 2002 - Project duration 18 Months

Project Objectives:

- Learn the effects that various anomalies have on the performance of a fiber optic signal
- Quantify the severity of optical signal loss due to the most common hazards found in the manufacturing processes.
- The investigation will cover insertion loss, return losses, bit error rate, etc., over a range of transmission speeds and power levels

Expected Results:

- Define criteria and specifications for fiber connector end-face inspection as a precursor to the development of standards
- Develop guidelines for cleaning procedures and contamination prevention.

NEMI Projects and Standards Overview:
Projects

Fiber Optic Splice Improvement Project: (Peter Arrowsmith, Celestica)

Status: Project Started, July 2002 - Project duration 18 Months

Project Objectives:

- Develop industry-wide splice quality criteria and test methods that will allow for systematic investigation of variability and comparison of equipment and procedures
- Improve yield and lower costs
- Development and validation of test methods for insertion loss, strength and extinction ratio
- Testing of splices made, using different equipment; and identification of major causes of splice variability

Expected Results:

- To use and validate existing methods of fiber splicing and, as appropriate
- Develop and submit to standards-making bodies drafts for:
  - Splice acceptance and performance
  - Fiber handling and reliability

NEMI Projects and Standards Overview: Projects

Optoelectronics for Substrates Initiative: (Chair Jack Fisher, NEMI/IPC consultant)

Status:

Initiative started January 2002

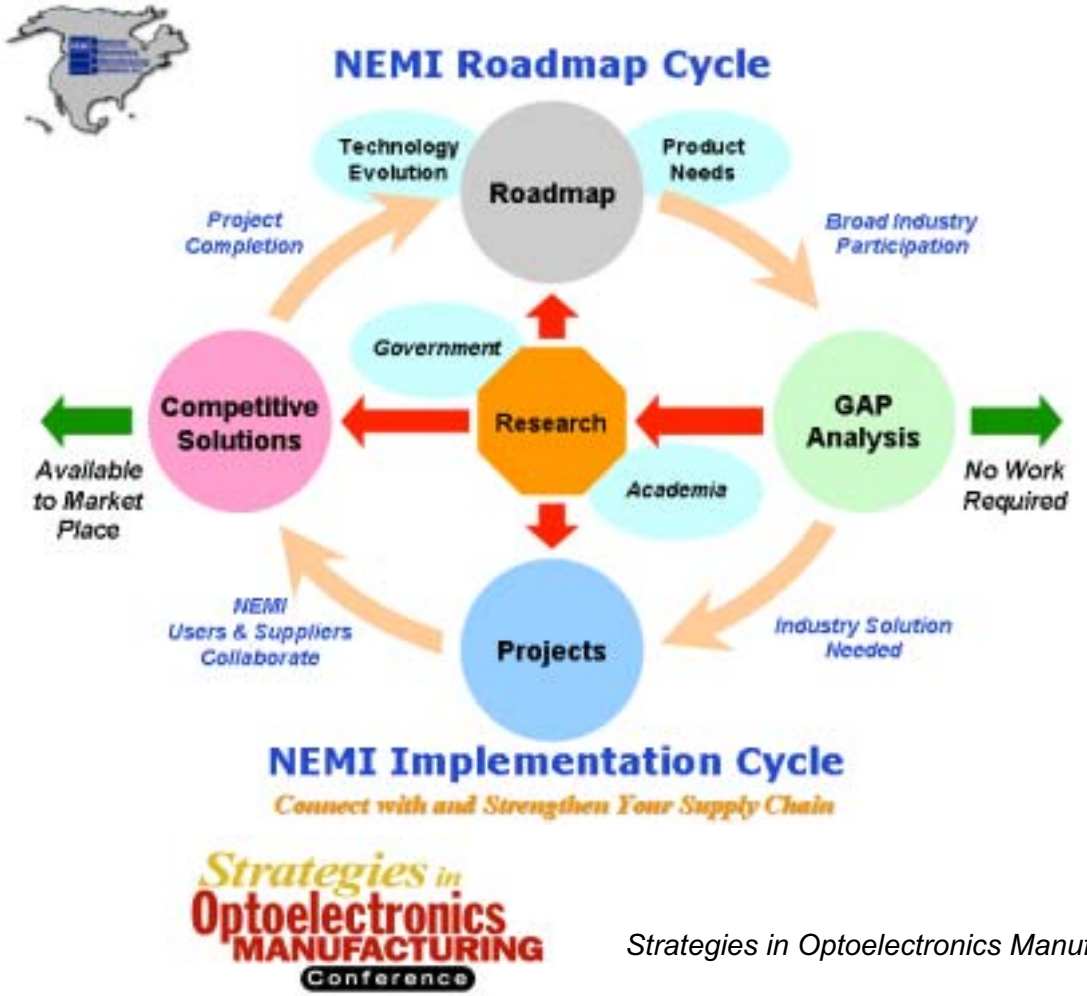
Initiative Objectives:

- To address the implementation of optical and optoelectronic technologies in printed wiring boards (PWBs) used in very high performance applications
- identify future product needs and define areas where NEMI can concentrate member efforts

Expected Results:

- To develop industry-wide solutions, leading to NEMI project definition

NEMI Cycle



- NEMI focused on improving Opto. Supply chain
- 2000 Roadmap identified gaps
- Projects are addressing those gaps
- May 1, 2002 gap analysis meeting scheduled, Alan Rae, Cookson, Chair

  OMI Optoelectronic 2003 Microsystems International Conference University, Ottawa, Canada

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