Industry groups partnering in nanotechnology

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Council for Chemical Research

The Council for Chemical Research (CCR) was created in 1979 to improve trust and collaboration between the public and private research sectors.

"CCR's purpose is to benefit society by advancing research in chemistry, chemical engineering, and related disciplines through leadership collaboration across discipline, institution, and sector boundaries."

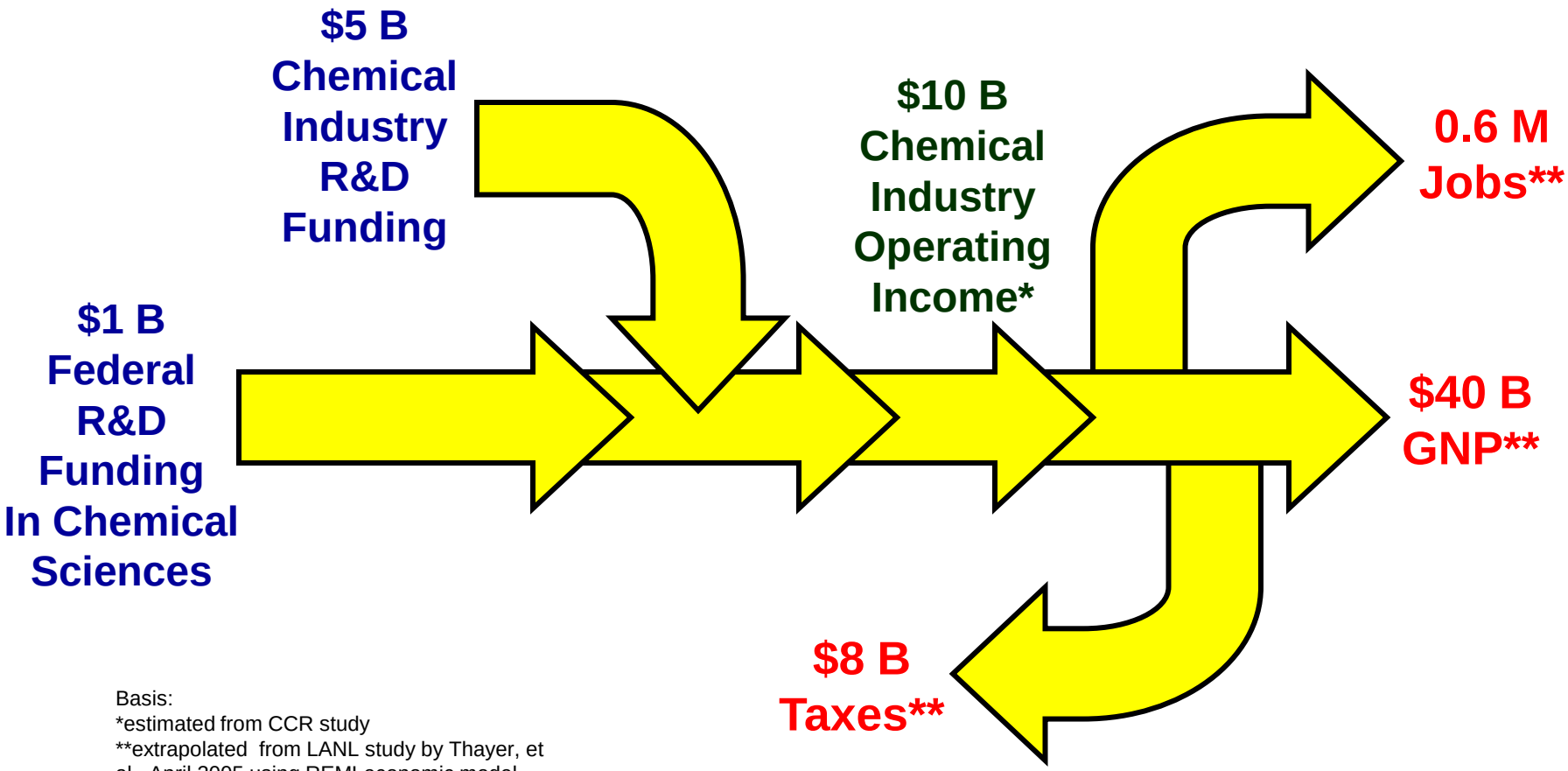
Globalization and Open Innovation

"Open Innovation means that companies should make much greater use of external ideas and technologies in their own business, while letting their unused ideas be used by other companies…With a more open business model, Open Innovation offers the prospect of lower costs, faster times to market and the chance to share risks with others."

Open Innovation: The New Imperative for Creating and Profiting from Technology
Henry W. Chesbrough

Globalization and open innovation necessitates more effective partnerships between industry, academia and government laboratories

Macroeconomic Implications



Basis:
*estimated from CCR study
**extrapolated from LANL study by Thayer, et al., April 2005 using REMI economic model

Industry Groups Partnering in Nanotechnology

- **What groups in your industry are engaged with government and local organizations to promote nanotechnology-base d economic development, what are the barriers for such partnerships, and what is needed to facilitate more partnerships?**

  - **Chemical Industry Vision 2020 Technology Partnership**
  - **Nano-Manufacturing Consortium**

    - ***Identifying Precompetitive Technologies***
    - ***Overcoming IPR issues***
    - ***Establishing long-term relationships based on trust and mutual interest***

Major IPR Issues Identified

- **Before negotiating a research agreement:**
  - Lack of understanding of partner's perspectives
  - Lack of knowledge of the specific project and how each party will contribute to it.

- **In the negotiation, how to handle:**
  - IP Rights, Control, and Patenting
  - Compensation for IP Rights
  - Research Costs
  - Tax-exempt status of University bonds
  - Processes for negotiating agreement and dispute resolution
  - Confidentiality

Industry Groups Partnering in Nanotechnology

- **How is innovation in your industry balanced between market pull and technology push? In light of this balance, what is the best model for cooperation among nanotechnologists from industry, academia, and government?**

  – ***We want to hear from our industrial colleagues***

Lockheed Martin Nanosystems

Moving Nanotechnology Into Defense Applications – April 2009

Dr. Brent M. Segal

Director & Chief Technologist
Lockheed Martin Nanosystems

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Company Organizational Chart

Nantero Inc.

Commercial

Government

NANTERO
NON-VOLATILE MEMORY SOLUTIONS

ADVANCED SCIENCE & TECHNOLOGY
NANTERO
AD TEMPUS...PRETIO PRAESTITUTO

One-Way Firewall

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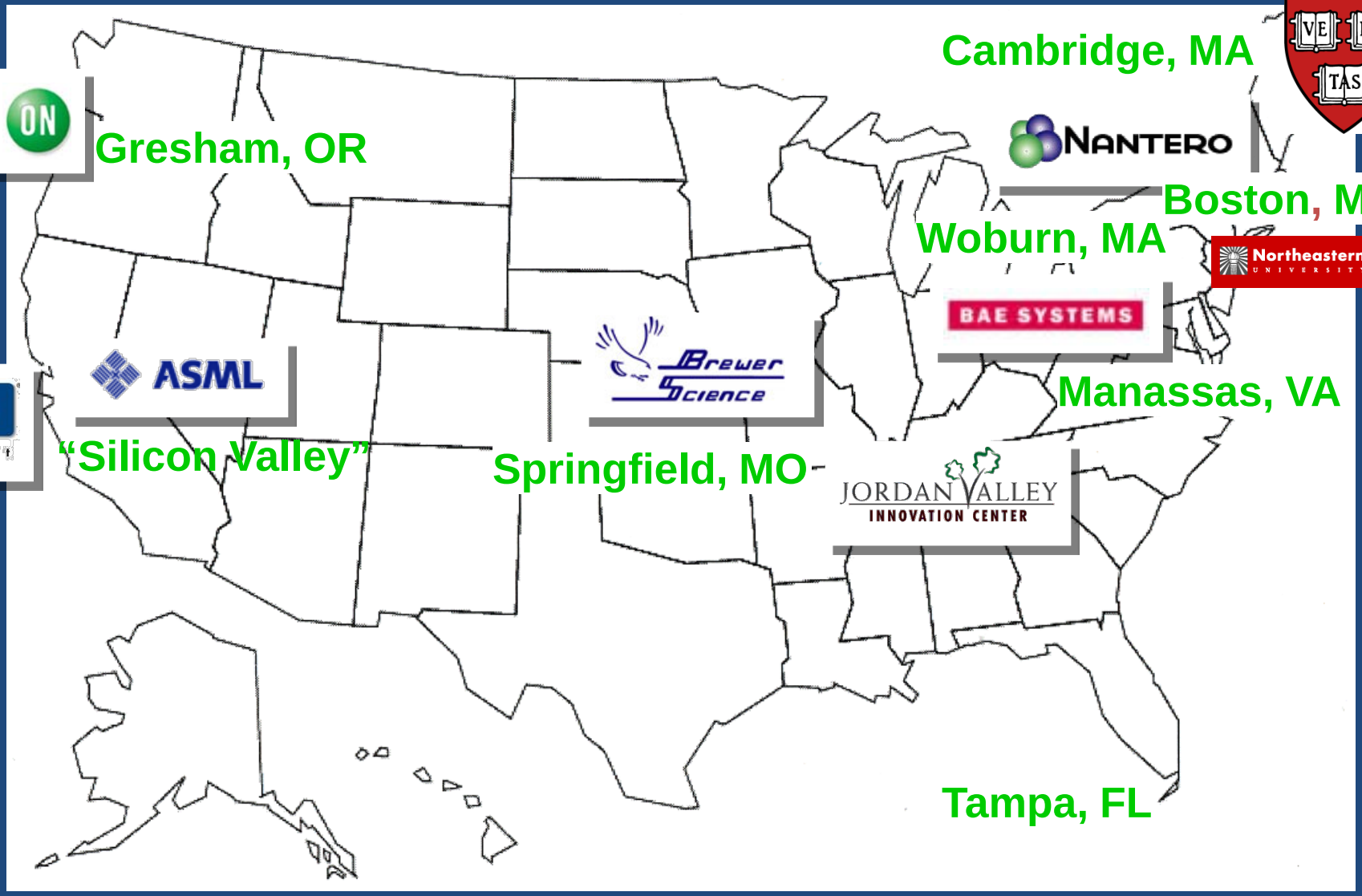
The Organization



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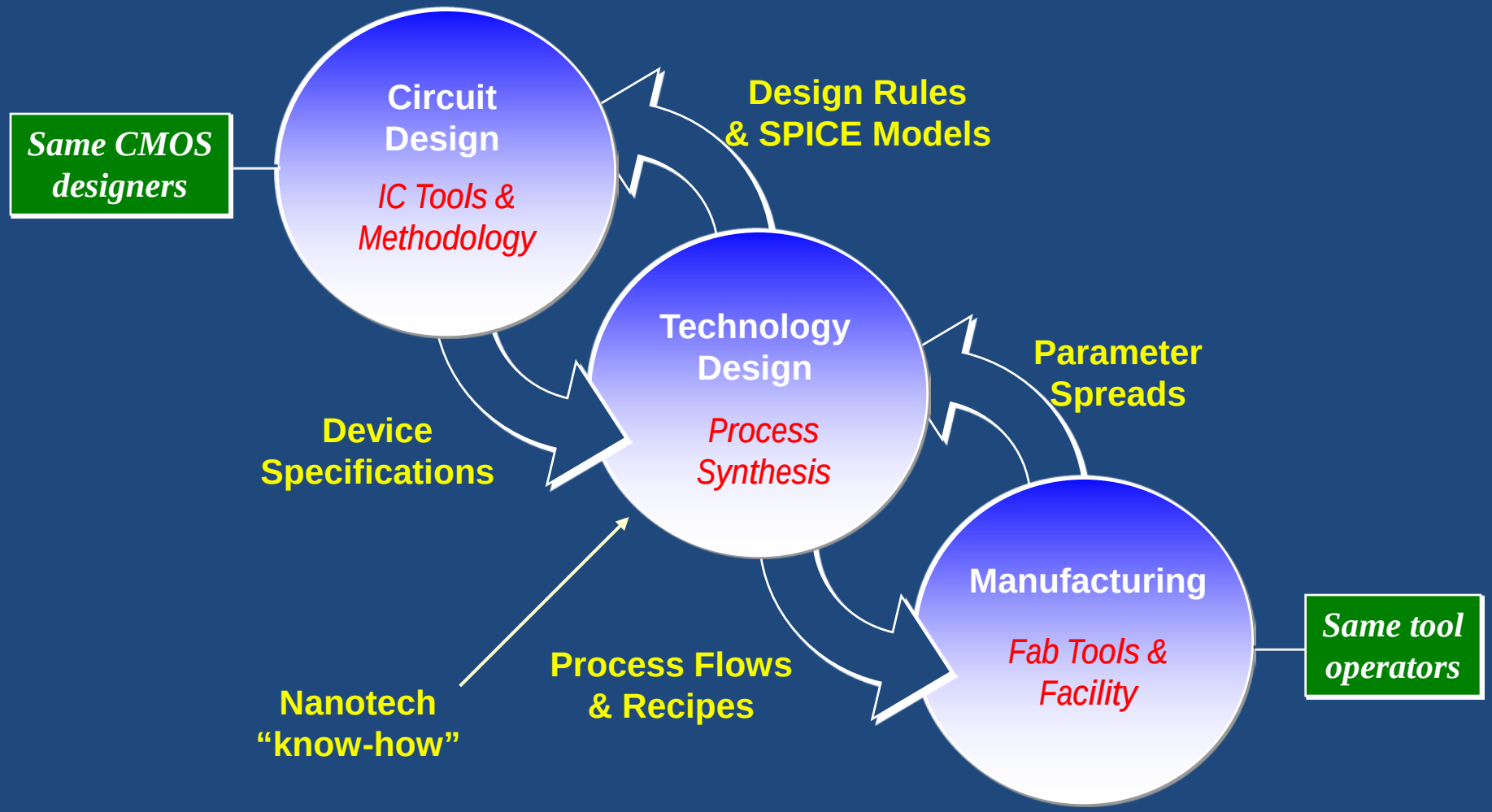
Transparency in the Design Chain is Key



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Landscape of Nanotech Standards

ASTM International Committee E56 Nanotechnology

- E2456-06* Terminology for Nanotechnology

IEEE NESR Nanoelectronic Standards Roadmap

- IEEE1650-2005* Electrical characterization of SWNTs
- IEEE1784-2008 Nanomaterials characterization and use in large scale electronics manufacturing

IEC TC 113 Nanotechnology Standardization for Electrical and Electronic Products and Systems

- JWG 1 Terminology and Nomenclature
- JWG 2 Measurement and Characterization
- WG 3 Performance assessment

ISO/TC 229 Nanotechnologies

- ISO/AWI TS 10797 TEM characterization of SWNTs
- ISO/AWI TS 10798 SEM & EDXA characterization of SWNTs
- ISO/NP TS 10867 NIR photoluminescence spectroscopy of SWNTs
- ISO/NP TS 10868 UV-Vis-NIR absorption spectroscopy of SWNTs

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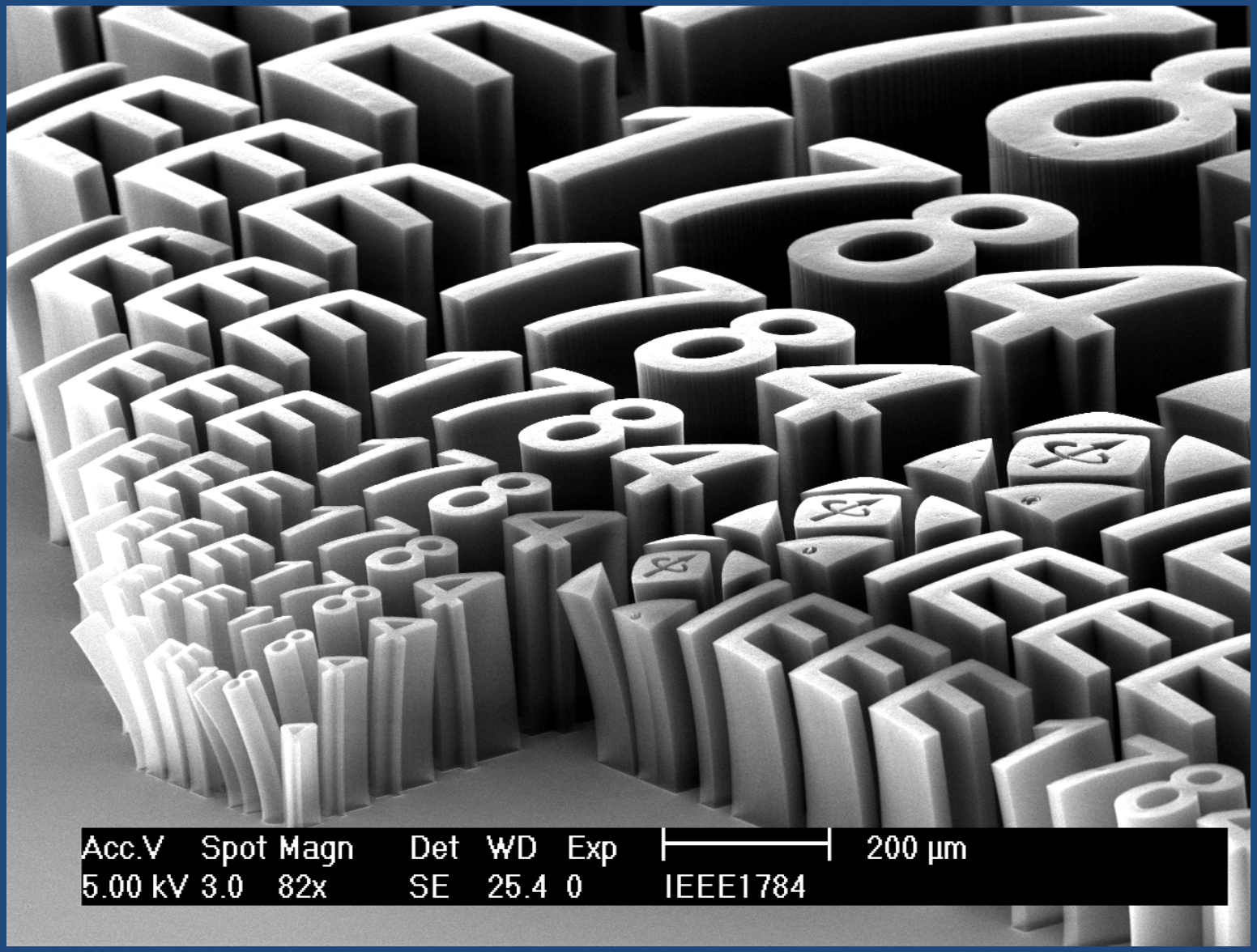
Vertically-grown Carbon Nanotubes



A.J. Hart, University of Michigan

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Thank You

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SWeNT
SouthWest NanoTechnologies

"making single-wall nanotubes a commercial reality"

Research

Supply Chain

Partnerships

NMSP

Oklahoma

ARNOLD & PORTER LLP

Innovation and Industry Partnering in Nanotechnology

Richard A. Johnson

Arnold & Porter LLP

National Nanotechnology Initiative Workshop

Oklahoma City, April 2-3, 2009

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ARNOLD & PORTER LLP

The Changing Nature of Innovation Drives Partnering in Nanotechnology (NT)

- **Complex ecosystem, not a linear process – multiple players, forces and feedback loops (industry, government, universities, economic development)**
- **Globalization of R&D and Multipolarity of Knowledge and Capacity**
- **Open Innovation on a Global, National, Regional and Local Scale**
- **Convergence -- New Global and Regional Value Chains and Networked Resources Cutting Across Multiple Disciplines and Sectors**
- **User-driven Innovation and Accelerating Cycle Times for Innovation**
- **Increasing role of "Hidden" Innovation and Knowledge Markets**
- **Collaboration at All Stages -- new business models and new types of collaboration (exploratory, research, development, manufacturing)**

Key Drivers for Nanotechnology Partnerships

- Risk-sharing and Cost-sharing/financing -- Investment required to develop next technology cycle grows by an order of magnitude
- Scalability and Leveraging Best-in-Class Technology
- Access and Diffusion: Share common technology cores - including equipment, infrastructures , IPR and tacit know-how
- “Portfolio management” and scanning intelligence
- Human capital -- “Not all smart people work for you” (Chesbrough)
- User-driven innovation and Linking R&D closer to users and demand side
- Synergies and risk-sharing with local S&T clusters and universities
- Federal, state, regional and local NT initiatives to enhance competitiveness, promote collaborations, and to assist with funding, organizational models and human capital

Barriers to Partnerships in Nanotechnology

- Conflicting business relations, misaligned objectives (university-industry-government), or bad partnership fit
- Openness, mutual trust, credibility, innovation culture
- Lack of sustainable and predictable funding (regional initiatives, technology platforms, federal-state funding)
- State-local programs and incentives ≠ MNE/SME global business needs
- Lagging government policies and framework conditions
- Outdated business models and approaches to innovation
- Insular university policies – including technology transfer, “cycle time”, residual views about business and markets

Facilitating More Partnerships in Nanotechnology

- Focus Policies on Promoting, Protecting and Enabling Today's New Approaches to Innovation, not outdated models
- Enable Entrepreneurship: entrepreneurship drives innovation – technology seeds must land on fertile fields
- Promote "Act Local, Think Global" Initiatives with global bandwidth
- Increase use of NT to address societal "Grand Challenges" (Health, Water, Environment, Energy, Sustainable Manufacturing)
- Refocus on Changing Role of Intellectual Assets for Value Creation
- Create Sustainable Financing and Aligned Economic Incentives

Innovation is Contextual and Complex: Market Pull and Technology Push are Only Part of the Partnering Picture

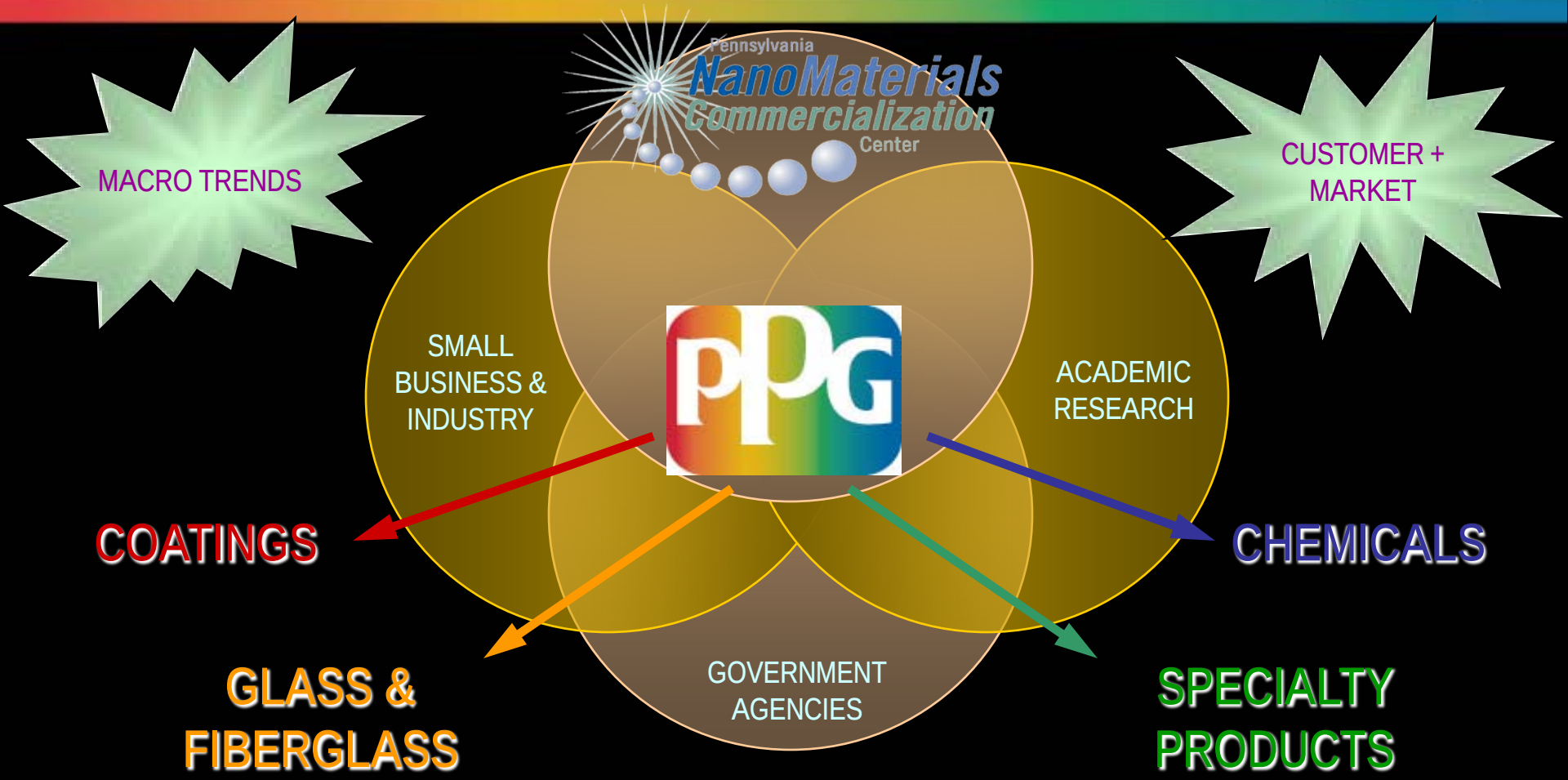
- Value-chain Innovation – adapting NT innovation into integrated NT environment; components and operations; need for technology, public policy and economics alignment
- Collaboration and Inventiveness
- Disruptive New Approaches – top down or bottom up; partnerships develop array of options and help select best one; prototypes, demonstration projects, scalability
- Output-based Innovation Modes
- Non-technological Innovation – organizational structures; know-how; design capabilities; human resource base
- Services and "Soft Infrastructure" are Critical to NT Growth

INDUSTRY GROUPS PARTNERING IN NANOTECHNOLOGY

- Nanotech based economic development ⟶ commercialization
  - ►Collaboration
  - ►Applied development
  - ►Job / revenue creation

  } Funding gap
- Technology push ⟶ market pull
  - ►Focus on customer needs and macro trends
  - ►Solutions to problems (nanotechnology = enabler?)
  - ►Large & small industry + academia + government agencies
  - ►Dual public / private use opportunities
- Poor economic conditions ⟶ reduced R&D spending
- Nanotechnology is a “how” not a “what”

Nano Commercialization Model



Supplier relationships *Partnerships* *Technology licensing*

Funded R&D *Commercialization* *Joint ventures*

PPG Is…

- A leading global manufacturer of coatings and specialty products and services
- Founded in 1883
- Headquartered in Pittsburgh, PA
- Composed of 13 strategic business units in six business segments:
  - Industrial Coatings
  - Performance Coatings
  - Architectural Coatings (EMEA)
  - Optical & Specialty Materials
  - Commodity Chemicals
  - Glass

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