

**Implementing 21st Century Smart Manufacturing**

**An Actionable Program Agenda**  
**"Meaningful Use" Priorities & Metrics**  
**Recommendations on a Public-Private Partnership Program**

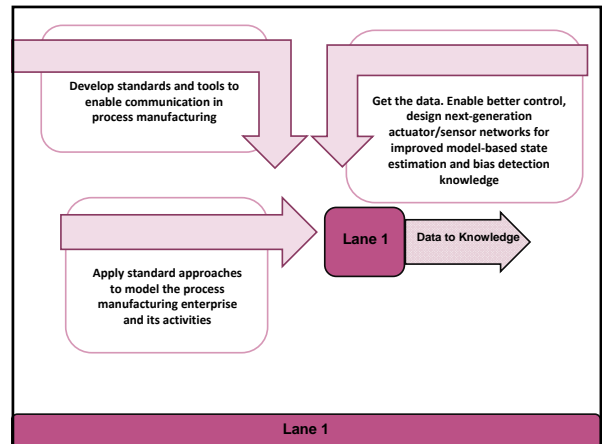
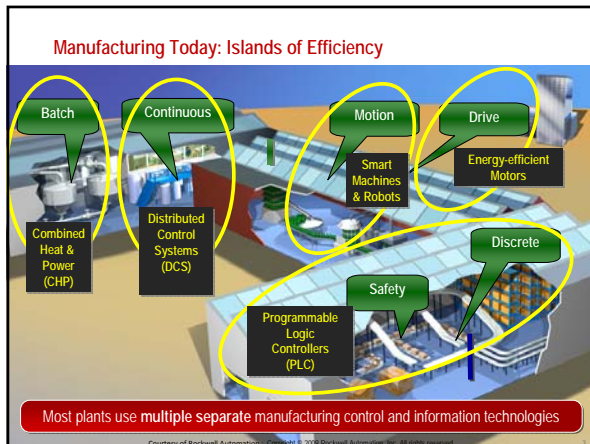
**Jim Davis**  
 UCLA

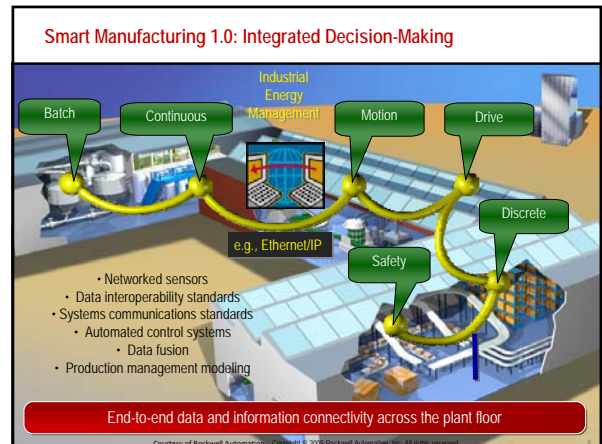
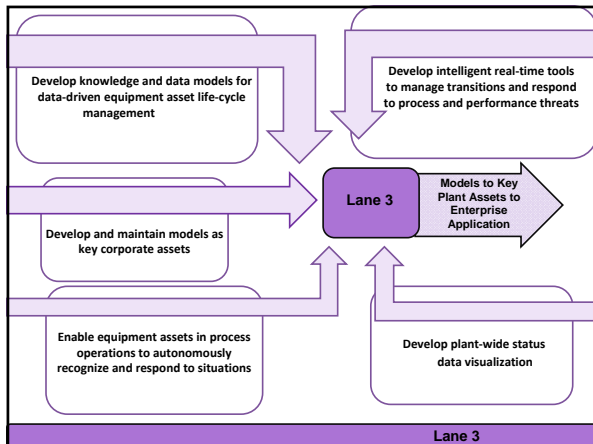
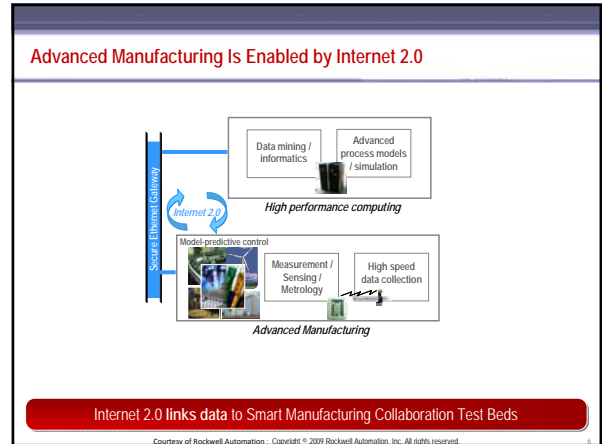
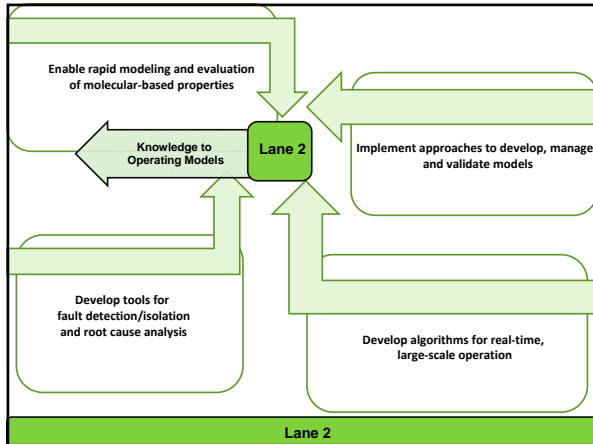
**Tom Edgar**  
 University of Texas Austin

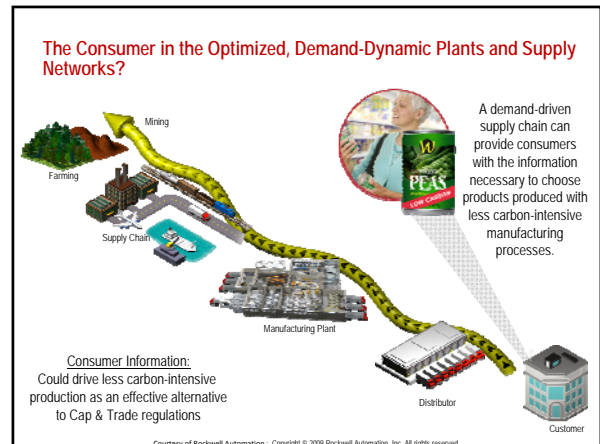
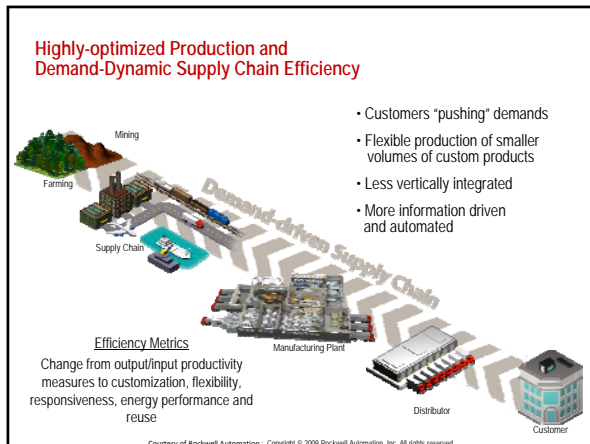
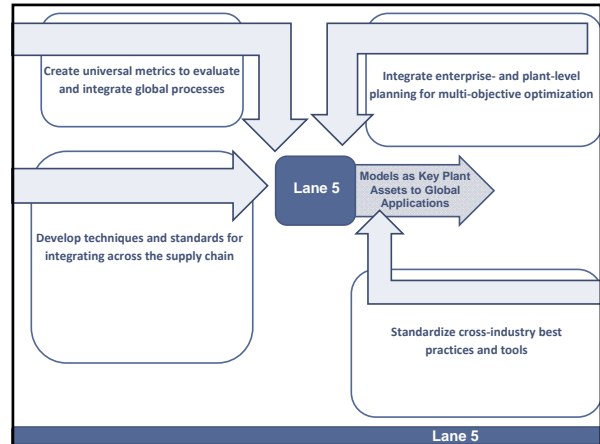
**Smart Manufacturing Leadership Coalition**

**Smart Manufacturing Transformation**

- **Vision**
  - Significant and measurable improvements in U.S. manufacturing competitiveness and exports
  - Revitalize the 21<sup>st</sup> Century industrial community model
- **Key Goals**
  - Move to proactive operations and life-cycle management to optimize production economics, quality, safety and efficiency
  - Drive energy, sustainability, EH&S and economic agility into meaningful integrated performance criteria
  - Transform manufacturing from fixed, supplier-driven production to flexible, demand-dynamic production
  - Enable sustainable production of nationally strategic goods (e.g., Bio/Nano, Clean Energy, Green/Tech, and DOD needs.)
  - Build manufacturing intelligence







### Closing the loop in Pulp & Paper Supply Chains



### International Center for Industrial Ecology

- Whereas productivity measures are used to improve a "linear" process
- Efficiency measures are used to improve a "closed loop" process
- Advanced modeling and software simulation are critical to improve the efficiency of very complex closed loop processes



The transformation of IT-connected manufacturing to optimized plants & supply networks may be essential to efficiently manage this vision

### Important Definitions

#### Smart Manufacturing

*Smart Manufacturing (SM) is a dramatically intensified knowledge-enabled industrial enterprise in which ALL business and operating actions are executed to achieve substantially enhanced energy, sustainability, environmental, safety and economic performance*

#### Meaningful Use Priorities

The value a defined system and approach delivers to the general public

*If you don't measure the right thing  
You don't do the right thing*

**Imply Infrastructure and Application  
Simulation Based Engineering & Science (SBE&S)  
Networked Information & Control Technologies (NICT)**

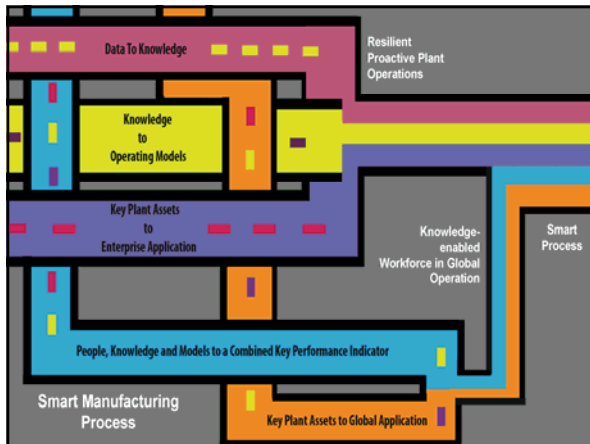
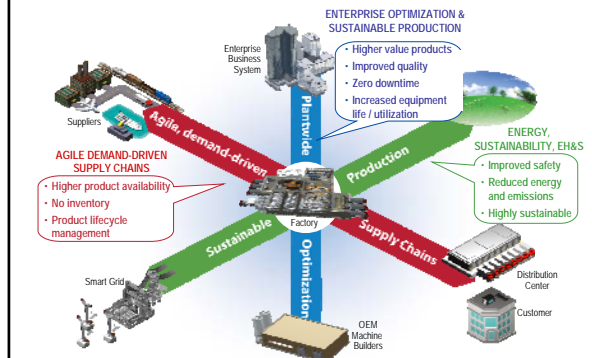
### Implementing 21<sup>st</sup> Century Manufacturing – September 2010

- Executive Office Leads:**
  - Ron Bloom, Senior Advisor for Manufacturing Policy
  - Aneesh Chopra, Chief Technology Officer, OSTP
  - Sridhar Kota, Assist Director Adv. Manufacturing, OSTP
- Agency Executive Leads:**
  - Kristina Johnson, DOE UnderSecretary
  - Henry Kelly, DOE, Principle Deputy Assistant Secretary
  - Patrick Gallagher, NIST Director
- Smart Manufacturing Leadership Coalition**
  - 24 Companies
  - 28 Practitioner Participants
  - 12 Supplier Participants
  - 5 Universities – systems, control, optimization, manufacturing, high performance computing
  - 4 High Performance Computing centers – government lab and university
  - 5 Manufacturing consortia/institutions
- Federal**
  - OSTP, DOE, NIST, DOD, NSF US Senate Committee

## Implementing 21<sup>st</sup> Century Smart Manufacturing

- |  |   |
|--|---|
| <ul style="list-style-type: none"> <li>• Air Liquide</li> <li>• Alcoa</li> <li>• American Council for Energy Efficient Economy</li> <li>• Applied Materials</li> <li>• Carnegie Mellon University</li> <li>• CH2M-Hill</li> <li>• Cisco</li> <li>• Council on Competitiveness</li> <li>• Dow</li> <li>• DuPont</li> <li>• Eastman</li> <li>• Eli Lilly</li> <li>• Emerson</li> <li>• Exxon Mobil</li> <li>• Ford</li> <li>• General Mills</li> <li>• General Motors</li> </ul> | <ul style="list-style-type: none"> <li>• Honeywell Solutions</li> <li>• Merck</li> <li>• National Council for Advanced Manufacturing</li> <li>• Oak Ridge National Laboratory</li> <li>• Owens Corning</li> <li>• Procter &amp; Gamble</li> <li>• Pfizer</li> <li>• Praxair</li> <li>• Purdue</li> <li>• Rockwell Automation</li> <li>• Sematech</li> <li>• Shell</li> <li>• Spitzer and Boyes</li> <li>• UCLA</li> <li>• U North Carolina - RENC</li> <li>• U Wisconsin</li> <li>• U Texas Austin</li> </ul> |
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## Optimized Plant & Supply Network: Meaningful Uses / Benefits



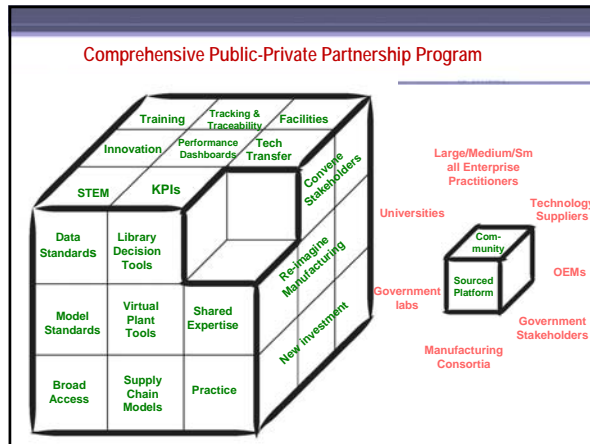
## Smart Manufacturing Leadership Coalition Recommendations

### Program Principles

- Manufacturing data is the essence of manufacturing intelligence
- Broadly accessible core data analysis, modeling and simulation capabilities
- A community source platform for access and innovation
- Meaningful use flows from agile, demand-driven supply chains, enterprise optimization and sustainable production
- Smart Manufacturing competitiveness depends on skilled workforce

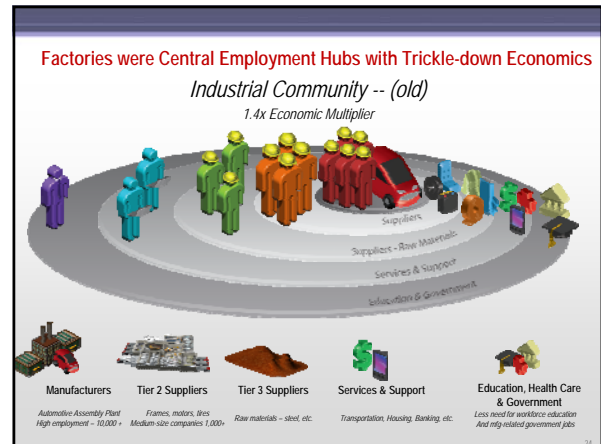
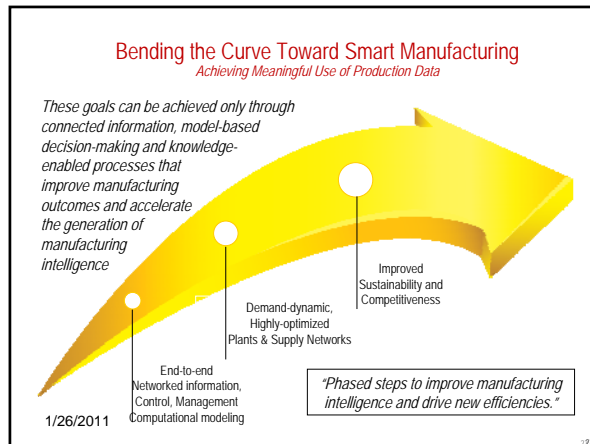
### Program Components

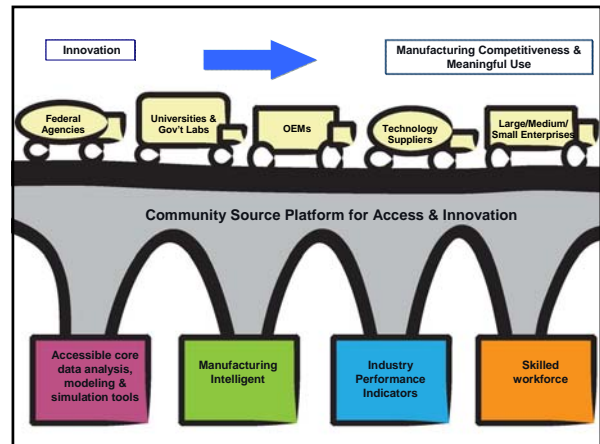
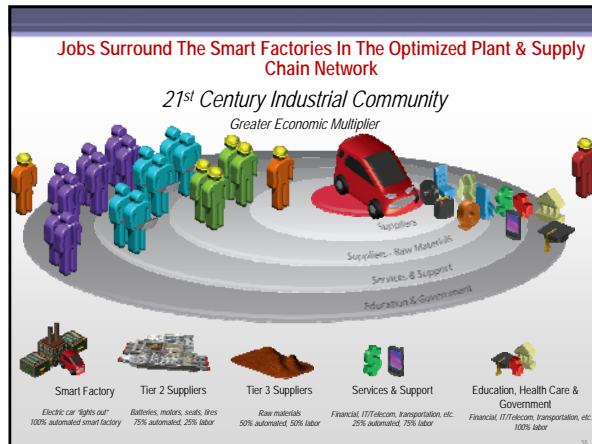
- Community-source platform with plug & play modeling functions
- Expertise to lower application cost and facilitated innovation
- Library of standardized business decision tools
- Generic application modules for rapid creation of virtual plant and test bed tools
- Supply chain models, real world reference architectures and standard platform
- Coordinated data and model sharing facilities
- Framework for tech transfer, training and rapid assimilation



### Achievable Meaningful Use Goals and Magnitude of Impact

- Demand-driven efficient use of resources and supplies in more highly optimized plants and supply
  - 80% reduction in cost of implementing modeling and simulation
  - 25% reduction in safety incidents
  - 25% improvement in energy efficiency
  - 10% improvement in overall operating efficiency
  - 40% reduction in cycle times
  - 40% reduction in water usage
- Product safety
  - Product tracking and traceability throughout the supply
- Sustainable production processes for current and future critical industries
  - 10x improvement in time to market in target industries
  - 25% reduction in consumer packaging
- Maintain and grow existing U.S. industrial base
  - Environment for broad innovation
  - 25% revenue in adjacent industries
  - 25% revenue in new products and services
  - 2x current SME's addressing total market
  - More highly skilled sustainable jobs created





**Smart Manufacturing and Workshop Details**

<http://smart-process-manufacturing.ucla.edu/>