Topic 2:
Extremely Efficient & Effective Manufacturing

Affordability and Sustainability

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Overview

• Definition/scope of topic area

• Importance and key issues

• Highlights from the issue papers
## Definitions and Scope

- **Affordability** - Ability to survive in the current economy
- **Sustainability** - Capacity to endure (survival in a different future)

### Mass Customization

- Complexity at low cost
  - casting and lithography
  - additive manufacturing
  - configurable materials

### Innovation Networks

- Robust Design Infrastructure
  - Rules and Tools
  - accepted limitations

### Sustainability

- Highly Adaptable Products
- Highly Adaptable, Reconfigurable Firms

### Materials, Technologies, and Enabling Approaches
Why is this important?

• “A manufacturing plant that develops and applies manufacturing intelligence will be able to dramatically reduce costs and drive higher U.S. exports. The widespread application of virtual plant enterprise tools will produce at least a 10x improvement in time to commercialization.”

• “Sophisticated tools that have traditionally been available only to engineers in industrial settings are now becoming accessible to individuals without formal training in engineering.”

• “If (high performance computing is) shared throughout the entire manufacturing base, America’s global competitiveness will be greatly enhanced, particularly in desirable areas such as high-tech R&D manufacturing and modeling/simulation tools development.”
Issues and Concerns

• “Data needs to be more easily obtained via low cost sensors, more easily collected, consistently defined, managed as an operating asset, shared within companies, and selectively shared among companies.”

• “Producibility issues can have significant long term impacts on manufacturing enterprise operating costs due to the ‘hidden factory’ rework, process inefficiencies, and overhead they introduce into the day to day production operations.”

• “Some of the most pressing challenges in manufacturing arise from the need to cost-effectively produce low-cost, high-performance, reliable, and long-life energy technologies at high throughput rates.”
Highlights of the Issue Papers

- “Recently, a new **materials platform** has been discovered that could take **mass customization to the extreme**. This new approach enables fabrication of unique open-cellular materials with micro-scale truss, or lattice features ranging from tens to hundreds of microns.”

- **Knowledge Infrastructure** for Innovation and Efficiency
  - “...creating an infrastructure that can give...teams of citizen-designers full access to the means...for designing, prototyping, testing, financing, manufacturing, promoting and marketing their inventions is extreme.”
  - “...establishment of a new community source data analytics, modeling and simulation platform that will function as a clearinghouse and gateway for **core, pre-competitive tools and practices** which small, medium and large enterprises can readily access and contribute.”
  - “...define a roadmap for the development of advanced **simulation-based producibility and supply chain analysis** capabilities and frameworks that will enable true concurrent engineering and virtual prototyping of both product, manufacturing, and industrial base design concepts...”
Breakout 2
Efficient & Effective
Affordable & Sustainable

• What does this topic area mean to you and how would you define it?

• What aspects of this topic area might be especially important, and why?

• What is the current state of the art and what extreme realms do you foresee in the future, and when?

• What are some of the compelling technology questions and concerns about these particular extreme realms in manufacturing?