

Advanced Manufacturing: An Innovation Strategy for the 21st Century

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Premise:

- Economic growth depends on sustained innovation.

What is required?

- Steady flow of new ideas from research
- Human Capital: highly skilled people
- Technological Infrastructure (e.g. testing)
- Knowledgeable investors
- Appropriate government policies

National Competitiveness and Innovation

- U.S. must remain innovation leader
- Federal government cannot pick winners and losers
- Federal government can/should create fertile ground for innovation

Advanced Manufacturing within an Innovation Ecosystem

Why Manufacturing?

- U.S. leads world in production of manufactured goods
- \$1.6 trillion in GDP in 2006 (12.2% of total U.S. GDP)
- \$923 billion of manufactured goods shipped in 2006: 64% of all U.S. Exports in 2006
- Manufacturing strongly linked to national R&D: 2/3 of private R&D

What has happened? Is Happening?

- Relative manufacturing strength of U.S. has declined:
 - From 27% of GDP (1957) to 12% of GDP (2007).
 - From 17.6 million jobs in 1998 to 11.7 million jobs in 2009.
 - Large part of current U.S. unemployment in manufacturing.
 - Trade balance in high tech manufactured goods has moved from surplus to deficit: deficit in 2000 was \$32 billion; \$80 billion in 2008.
- China's trade surplus in high tech goods form \$13 billion in 2003 to \$130 billion in 2008 (information/communications).
- Underlying technologies continue to evolve rapidly.

From Manufacturing to Advanced Manufacturing: *What is Advanced Manufacturing?*

- Definition:
 - 1) Depends upon use and coordination of information, automation, computation, software, sensing, networking, and interoperability.
 - 2) Involves cutting edge materials science, physical science, biological science/biotechnology (e.g. self-assembly).
- New Ways to manufacture existing products.
- New ways to manufacture new products.
- Much of foundational research occurs in U.S.: computing and simulation, nanomaterials, AI, robotics.

Global View

- Other nations are investing in advanced manufacturing through partnerships, physical structures, incentives, policies to stimulate innovation and removing barriers to technology commercialization.
- Nature of high technology is such that, once nations establish leadership, there is sustainable first-mover advantage and industry leadership, with long term consequences for innovation.
- Other nations: technology clusters, educational investments, policies to attract talent, investment, development of “champions.”

Ideas from Workshop on the Federal Government Role:

- R&D that falls in gap between basic research and focused private development: generic or pre-competitive research.
- Large-scale infrastructure not accessible to, or affordable by SMEs.
- Public/private partnerships; High-technology clusters.
- Large scale educational efforts to produce skilled workers, STEM education.
- Remove barriers for innovators: regulations, tax structures or fiscal policies.
- Innovation through procurement.
- Expand support for best existing programs: MEP, TIP, SBIR

Report Structure

Part 1: Policy Issues

Part 2: Specific Examples: Scientific and Technological Opportunities in Advanced Manufacturing

Part 3: Recommendations:

- Key Question: Appropriate Federal Government Role?

- The Economic Argument

- The Business View

Biotechnology/Nanotechnology/ Information Technology Workshop

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Participants:

- PCAST: S. Jackson, E. Schmidt, C. Mirkin, C. Mundie
- OSTP: A. Chopra, T. Kalil, Debbie Stine, M. Maxon, G. Jochum, T. Augustine, M. Shankar
- See Participant List
- Review/Presentation of unique new technologies in nano, bio or in “golden triangle”, and opportunities from those technologies.

Barriers to Innovation:

- Lack of funding for new/complex ideas
- Research funding
- “Valley of Death”
- Infrastructure
- Human Resources