Defense Nanotechnology Research and Development

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Outline

- Department of Defense perspective
- Budget history and distribution
- Upcoming conferences
- Summary

DoD Nanotechnology Defined

Simultaneous focus on scientific merit and relevance to DoD:

Scientific Merit: to develop understanding and control of matter at dimensions of approximately 1 to 100 nanometers, where the physical, chemical, and biological properties *differ* in fundamental and valuable ways from those of individual atoms, molecules, or bulk matter

Relevance to DoD: to discover and exploit unique phenomena at these dimensions to enable novel applications enhancing warfighter and weapon systems capabilities

DoD Perspective and Nanotechnology

- **Nanotechnology investments are broadly spread across 6.1, 6.2, and 6.3 programs**
  - **Integrated into vast array of science and technology programs**
  - **Provides opportunistic view of potential applications**

- **OSD oversight and guidance for programs**
  - **Executed by Army, Navy, Air Force, DARPA, DDR&E and CBDP**
  - **~50% in 6.1**
    ~35% in 6.2
    ~15% in 6.3
  - **Additional $12M to $15M in SBIR/STTR**

- **No DoD appropriations specifically for nanotechnology**

DoD Perspective and Nanotechnology

- **History of support for pre-“nano” nanoscience research**
- **Increasing emphasis on manufacturing technology, producibility, sustainability**
- **Increasing emphasis on Environment, Health, and Safety aspects**
  - **Research, Acquisition, ESOH communities collectively engaged**
- **NNI accelerates high-potential nanotechnology-based capabilities**
- **For details see “Defense Nanotechnology Research and Development Program”**

  www.nano.gov/html/res/pdf/DefenseNano2007.pdf

Examples of Potential DoD Applications of Nanotechnology

- **Electronics and Sensing**
- **Power and Energy**
- **Structural Materials**
- **Coatings**
- **Multifunctional Materials and Devices**
- **Materials and Systems Prognosis**
- **Energetics**

Nanotechnology Program Component Areas (PCAs)

The updated National Nanotechnology Initiative (NNI) Strategic Plan, published in December 2007, identifies and defines eight major subject categories of investment:

1. Fundamental Nanoscale Phenomena and Processes
2. Nanomaterials
3. Nanoscale Devices and Systems
4. Instrumentation Research, Metrology, and Standards
5. Nanomanufacturing
6. Major Research Facilities and Instrumentation Acquisition
7. Environment, Health, and Safety
8. Education and Societal Dimensions

These PCAs constitute a taxonomy for the DoD investment

S&T Budget Requests Supporting Nanotechnology

(*All numbers rounded to nearest $M)

Program Component Area (PCA)	FY2007	FY2008	FY2009
1. Fundamental Nanoscale Phenomena and Processes	$126M	$ 179M	$ 228M
2. Nanomaterials	$100M	$ 92M	$ 55M
3. Nanoscale Devices and Systems	$ 83M	$ 71M	$ 108M
4. Instrumentation Research, Metrology, and Standards	$ 10M	$ 8M	$ 4M
5. Nanomanufacturing	$ 0M	$ 1M	$ 13M
6. Major Research Facilities and Instrumentation Acquisition	$ 23M	$ 23M	$ 22M
7. Environment, Health, and Safety	$ 1M	$ 1M	$ 2M
8. Education and Societal Dimensions			
TOTAL	**$345M**	**$375M**	**$431M**

S&T Budget Estimates

(Includes Congressional Adds for FY07 and FY08)

(*All numbers rounded to nearest $M)

Program Component Area (PCA)	**FY2007**	**FY2008**	**FY2009**
1. Fundamental Nanoscale Phenomena and Processes	$210M	$ 259M	$ 228M
2. Nanomaterials	$ 86M	$ 69M	$ 55M
3. Nanoscale Devices and Systems	$120M	$ 120M	$ 108M
4. Instrumentation Research, Metrology, and Standards	$ 4M	$ 8M	$ 4M
5. Nanomanufacturing	$ 8M	$ 5M	$ 13M
6. Major Research Facilities and Instrumentation Acquisition	$ 22M	$ 25M	$ 22M
7. Environment, Health, and Safety		$ 2M	$ 2M
8. Education and Societal Dimensions			
TOTAL	**$450M**	**$487M**	**$431M**

NanoTechnology for Defense Conference

- Premier event for Defense Nanotechnology Research and Development

- 7th Annual Conference
  - Burlinghame CA
  - April 6-9, 2009
  - www.usasymposium.com/nano
  - US citizens or Green Card holders only
  - Submission of DD2345 certification number required for academia and industry

- Previously “Nanomaterials for Defense Applications Symposium” (2003-2007) and “Nanomaterials for Defense Conference” (2008)

Foundations of Nanoscience: Self-Assembled Architectures and Devices

- Sponsored by the International Society For Nananoscale Science, Computation and Engineering
  - Supported by the Air Force Office of Scientific Research (AFOSR)

- 5th Annual Conference
  - Snowbird UT
  - April 20-24, 2009
  - **www.cs.duke.edu/~reif/FNANO/**

Defense Nanotechnology Summary

- DoD nanotechnology broadly supports Service/Agency program activities
  - DoD mission-driven goals and objectives
  - Opportunistic approach to applications
- More emphasis is being placed on nanomanufacturing and barriers to transition/commercialization
- More emphasis is being placed on environment, health and safety aspects of nanotechnology
- DoD values the NNI collaboration and leverages participating agencies' programs