Nanotechnology
Materials/Electronics/Photonics:
*Summary of TAG Survey*

a presentation to the
President’s Council of Advisors on
Science and Technology

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Opportunities for Near Term Breakthroughs

- Low cost photovoltaics with 10-yr life
- High intensity lighting and displays
- Advanced biotech “system-on-a-chip” sensors
- Ultra-high-density memory devices
- Advanced materials, customized properties
- Antimicrobial, self-cleaning surfaces
- New filtration systems for viruses and microbes
- Guided self-assembly technology
- High-speed photonic circuits
Opportunities for Long Term Breakthroughs (with High Probability of Success)

- Custom designed “super” materials
- Nano-energetic materials and fuels
- Moore’s Law driven beyond terabit densities
- Improved efficiency of motors of all types
- New very small high power portable systems
- Quantum information processing
- Low-cost nano-manufacturing
- Reduction of power dissipation
- Low-cost water production
- Small olfactory arrays that exceed sensitivity of dog’s nose
- New classes of biomachines
- Adaptive optics
- Self-healing assemblies and materials
- Smart coatings
Potential Negative Societal Implications

- Undetectable contamination of human systems
- Issues related to re-use and disposal
- Unreasonable expectations
- Public backlash against imagined consequences
- Miniaturized weapons that cannot be detected
- “Creative destruction” of traditional economic sectors
- Divide between “haves” and “have nots”
What Do We Need to Know More About?

- Effect of environment on nanosystem behavior
- Manufacturing techniques
- Measurement of properties at nanoscale
- System robustness
- Bulk processes: friction, viscosity, magnetism
- Bonding of building blocks at nanoscale
- Experimental techniques
- Durability
Major Points or Issues for Future Consideration

- Electronic platforms for solution phase
- Educational initiatives
- Consequences of system behavior
- Robust manufacturing processes
- Long term stability
- Standards
Federal Funding

- Adequacy: 14 no, 2 yes
- Poor linkage with national scientific and technology objectives
- More funding needed for multi-investigator, center type funding
- Need goals and deadlines – “If U.S. had told scientists to build the atomic bomb without a deadline or appropriate funding, we would still be working on it.”
Federal Funding (cont.)

- Funding needed to encourage industry participation
- Need balanced funding for fundamental and short term
- Be very careful not to over-emphasize short term research goals over long term ones
- Need attention to technology transfer issues
Federal Funding (cont.)

- Far too few excellent proposals being funded – too many turned down for lack of funding
- Funding too many diverse programs, not focused
- Competing nations more focused on commercialization; waiting to capitalize on our developments
- President Bush should announce a bold new $10B initiative with clear goals and expectations