

Nanosystems Modeling and Nanoelectronic Computers

James C. Ellenbogen, Ph.D.

703-983-5930 • ellenbgn@mitre.org

MITRE Sponsored Research



MITRE
Technology
Program

Problem

What should future, nanotechnology-enabled systems “look” like?

Background

- **Great progress has been made in nanotechnology over the past decade, esp.**
 - **Techniques for nanofabrication**
 - **Novel nanostructured materials**
- **Makes possible development of nano-enabled application *systems***
 - **Smaller, with ultra-dense functionality**
 - **Novel materials properties**

Objectives

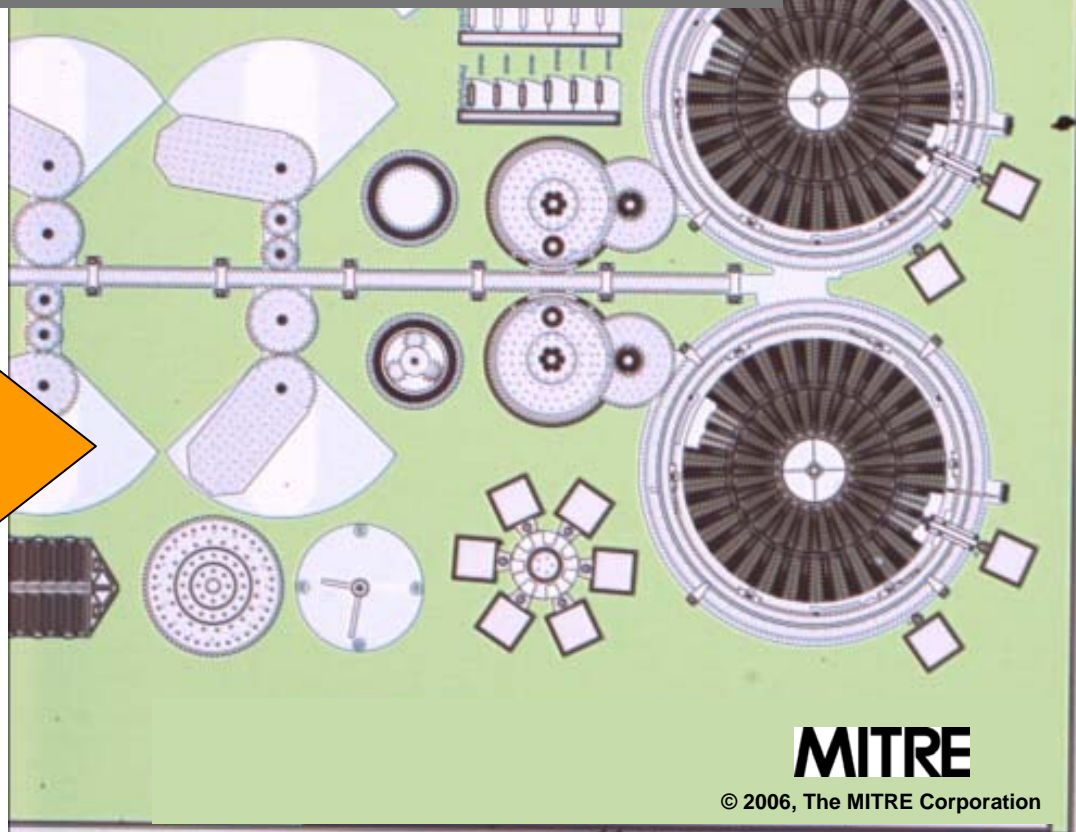
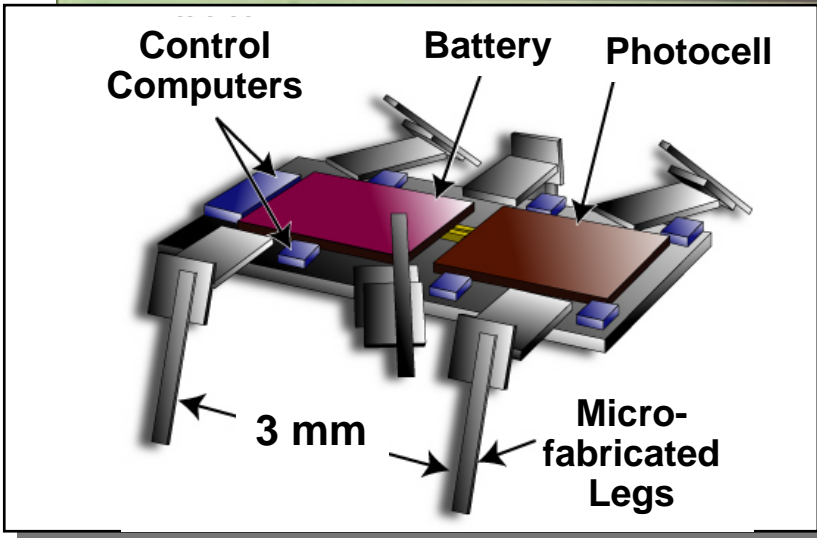
- **Assume technical leadership, worldwide, in developing, applying, and disseminating new design concepts for next-generation computers and systems integrated on the nanometer scale**
- **Develop techniques for more rapidly and accurately modeling such “nanosystems”**

Activities

- **Nanoelectronic systems design**
--esp., tiny control computers for tiny systems
- **Nano-/molecular device modeling**
- **Millimeter-scale robot design and fabrication**
- **Innovations in carbon nanomaterials technology**
- **Planning for new nanotech physical laboratory and initiating experimentation:**
 - **Millirobot testing**
 - **Carbon nanomaterial processing**

Highlight

- Microfabrication and testing are proceeding for an insect-like millimeter-scale prototype walking robot
- Recently, began testing new chips having much more complex micro-machinery

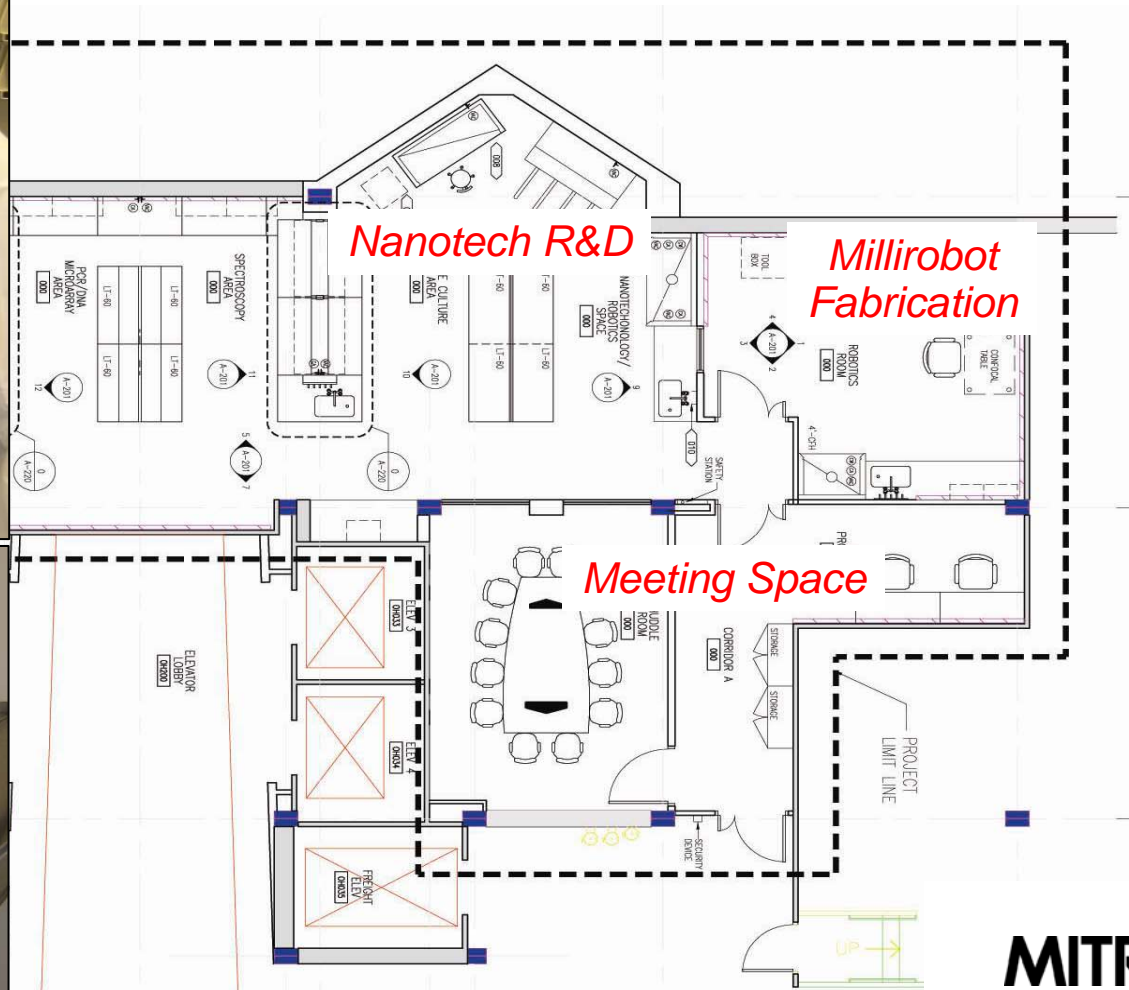
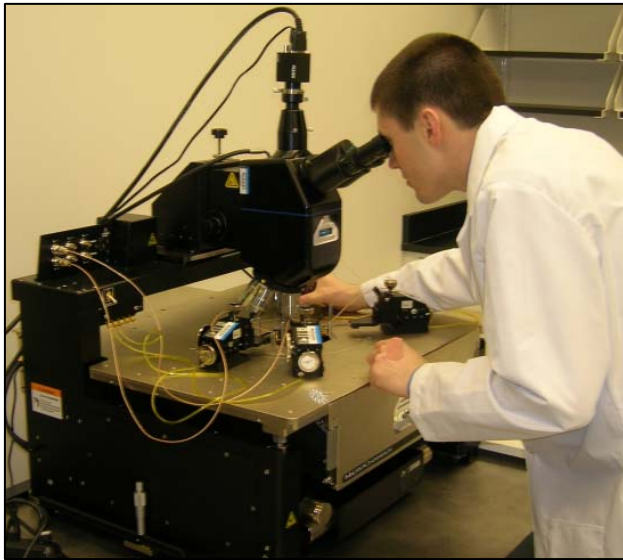


MITRE

© 2006, The MITRE Corporation

Highlight

Recently-opened lab adds capability for physical prototyping & testing of nano-enabled systems



Impacts

- **MITRE nanotech concepts, innovations, publications, and presentations have assisted in**
 - **Starting, planning and conducting several world-leading Govt. nanotech R&D programs**
 - **Starting U.S. nanotechnology companies, and**
 - **Educating the next generation of U.S. scientists and engineers.**
- **MITRE has invented new approaches for design, fabrication, and application of next-generation nanocomputers: e.g., 7 patents in past 5 years.**
- **MITRE is recognized worldwide as being among the leaders in nanotechnology R&D and its applications.**

Future Plans

- Exploit new physical lab, --esp. for R&D in:
 - Carbon nanotechnology
 - Millirobotics
 - Nanosensing
- Continue device & systems R&D
- Conduct robust student mentorship and research effort during coming summer
 - Achieve project goals
 - Assist in achieving U.S. work force development goals

