HDR

nano frontier

Pioneering Design for the Nano World

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Right: About 120 attendees represented academia, science and industry at the second annual BAT Workshop.

BAT II Workshop Reviews Hot News

Government Steps Up to the Nanoplate

Nanotechnology is second only to terrorism on the Bush administration's list of top priorities for 2005. As nanoscale science, engineering and technology advance and discoveries are woven into everyday life, the potential contributions of nanotechnology to future economic growth have brought increasing government attention.

Last December, President Bush signed into law the 21st Century Nanotechnology Research and Development Act. The new law lays out $3.7 billion for nanoscale science, engineering, and technology research and development in fiscal years 2005 through 2008.

The new act was a major topic of conversation and focus of the keynote presentation at the two-day **Buildings for Advanced Technology (BAT) Workshop II**, held in Mesa, Arizona, in January. About 120 people attended the workshop, co-sponsored by HDR. The program featured 24 prominent researchers and leaders in the field of

BAT II Keynote Speaker
Dr. Clayton Teague
Director of the National Nanotechnology Coordination Office

Dr. Teague delivered the keynote address at this year's Buildings for Advanced Technology Workshop in Mesa, Arizona. (See inside for story details.) He was appointed to his current position in the National Science and Technology Council in April 2003 as an agency representative for the National Institute of Standards and Technology (NIST), where he has been since 1972.

He has authored or coauthored 70 papers, has presented more than 50 lectures nationally and internationally and jointly with colleagues, has six patents.

nanotechnology from prestigious universities and national laboratories.

The workshop, the second annual, centered on developing a connection between emerging science and a range of technical factors to consider during design and construction of advanced technology facilities for new nano-, bio- and micro-technology research and production.

Participants included scientists, architects, engineers, end-users, facilities managers, contractors from private industry, university faculty and national laboratories representatives. Dr. Allan Chasey of Arizona State University (ASU) and Ahmad Soueid, RA, of HDR, welcomed the attendees and served as emcees.

2004 BAT II Workshop Sponsors

Arizona State University
HDR (architecture/engineering)
Create (construction research and education)
Colin Gordon & Associates (vibration/acoustics)

Essence of the Act

The new R & D act reaffirms a nanotechnology program with many of the ongoing activities supported under the National Nanotechnology Initiative (NNI) since its inception in 2001, according to Dr. Clayton Teague, Director of the National Nanotechnology Coordination Office, and keynote speaker who kicked off the three-day workshop.

"The law recognizes the need for developing networks of interdisciplinary nanotechnology research centers and advanced technology user facilities, as well as studying health and environmental implications, both of which are highly relevant to the purposes of this [BAT] workshop," Teague said.

No Nano Amount for Broad-Based Programs

The budget authorized for FY2004 nanotechnology research is $849 million, 10 percent over the 2003 budget. Of the $123 billion total allotted for all research, half goes to the Department of Defense (DOD), and half of the remainder to the National Institutes of Health, two agencies conducting key nanotechnology research for the federal government.

Teague said the U.S. government, through the National Nanotechnology Initiative, has identified five critical "investment areas." These include:

1. **Fundamental research in:**
   - Novel phenomena, materials structures, processes and properties
   - Nano-biosystems
   - Nanoscale devices and system architecture
   - Theory, modeling, and simulation

2. **NNI "grand challenge" areas:**
   - Nanostructured materials by design
   - Nanoscale manufacturing
   - Chemical-biological-radiological-explosive detection and protection
   - Nanoscale instrumentation and metrology
   - Nano-electronics, -photonics and -magnetics
   - Healthcare, therapeutics and diagnostics
   - Energy conversion and storage
   - Microcraft and robotics
   - Nanoscale processes for environmental improvement
3. **Centers of Excellence**
4. **Research infrastructure**
5. **Societal implications and workforce preparation**

Investigating the Investment Modes

The first mode under the government's plan, fundamental research, supports a balanced investment in research across all of science and engineering. This across-the-board investment is critical because research outcomes cannot always be anticipated, and discoveries in one discipline can have unexpected implications in another.

The second investment mode, the "grand challenges," focuses on nine specific R & D areas more directly related to nanotechnology applications and identified as potentially having significant economic, governmental and societal impacts.

The third mode supports "centers of excellence" at host institutions such as universities. These centers provide funding and opportunities for multidisciplinary research to scientists from varied research sectors, including academia, industry and government laboratories. Fourteen centers have been initiated in the U.S., seven funded by the National Science Foundation,

Dr. Neil Shinn, manager of the Surface and Interface Department at Sandia National Laboratories, discusses the future Sandia Center for Integrated Technologies, designed by HDR.

HDR's Ahmad Soueid, RA, greets another workshop sponsor and emcee, Dr. Allan Chasey of Arizona State University.

three by the DOD and four by the National Aeronautics and Space Administration.

Investment mode four deals with research infrastructure, for which the government will fund the often-costly development of infrastructure, instrumentation, standards, computational capabilities and other research tools. It will make Nanoscale Science Research Centers easily accessible to qualified researchers, thereby fostering innovative technology and its transition to useful applications.

Of the five such facilities under the auspices of the Department of Energy, HDR designed two: the Brookhaven National Laboratory Center for Functional Nanomaterials in Upton, New York, and the Sandia Center for Integrated Nanotechnologies in Albuquerque.

And finally, **the fifth investment mode** focuses on societal – ethical, social, legal, economic – implications of nanoscience and nanotechnology, as well as workforce preparation, education and training. This area addresses the public's concern for nanotechnology's potential effects on health and the environment.

Programming…Designing…Building the Building

Worldwide, 30 advanced technology buildings are under construction or planned, according to Teague. The BAT II Workshop focused on nanotechnology research directions, especially as architectural trends, engineering solutions and sustainable design apply to advanced technologies.

Environmental disturbances are the primary limiting factor in the design of instrumentation for nanotechnology labs, Teague said. Extremely delicate experiments are threatened by contaminants from the modern world and its machinery. Further, there is little quantitative information on how to build facilities with just the right characteristics for nanoscience research. This has caused costly mistakes, he said.

Other Hot Topics

The BAT II Workshop presented a review of project management issues and how to protect an investment in these facilities. It focused on nanotechnology and bio-nanotechnology facilities, programs and instrumentation, and covered the full spectrum of nanotechnology projects.

Also included were discussions of scientists' requirements, architectural and engineering building design approaches, information on specific laboratory equipment from both environmental and installation standpoints, and construction approaches and techniques.

Specific presentations included:

- Analytical instrumentation facility requirements
- Architectural trends, solutions and sustainable design
- Mechanical and process systems
- Electrical, EMI, grounding
- Mechanical systems noise issues - case studies
- Meeting user requirements - case studies
- Scope development, programming, cost, cost control, project control
- Project management
- The Arizona State University Bio-Design Institute

Initial planning for next year's Buildings for Advanced Technology Workshop is under way and will be announced in the next few months. Watch **www.nanobuildings.com** *for upcoming information.*

"Boutique Nanotechnology" at USF

Nano Lab on a Nano Budget

By early 2005, the doors will open on a new research building that falls under a newly coined term, "boutique nanotechnology." The University of South Florida (USF) hired HDR to provide architectural and engineering services for this highly specialized nanoscience building on its Tampa campus.

As with any boutique, the scale is smaller, but the quality high. At 15,000 gross square feet, "Nanotech I," as the new building will be called, is notably smaller than other large, high-profile complex labs designed by HDR. However, the $3 million facility will have all the bells and whistles as its more sizeable counterparts. The lab will house clean rooms, high-quality wet laboratories, metrology labs, test areas and supporting office space.

According to Alan Temple, AIA, HDR project manager, the university wanted a stand-alone facility, apart from the university's other research buildings, for the express purpose of studying nanomaterials and nanomanufacturing.

USF's First Core Facility

"This will be the first 'core facility'," said Professor Michael Kovac, director of nanotechnology and nanomanufacturing at USF. It is one of five that the university plans, aimed at bringing together multi-discipline, multi-college users, as well as outside researchers, he said, noting the burgeoning trend toward collaborative research. This side-by-side work environment for researchers of diverse backgrounds facilitates "totally unpredictable and spectacular results" through interactive knowledge-sharing, Kovac said.

"USF is firmly committed to nanotechnology research, and anticipates significant recruiting benefits from showcasing our research facilities, in terms of both students and faculty," he said.

Same Systems

According to Jim Wermes, PE, HDR mechanical/electrical and process systems engineer for the project, the lab required the same extremely tight tolerances as other similar facilities, in terms of noise, for example. With sound requirements below the threshold of human hearing, mechanical systems like air conditioning become critical concerns.
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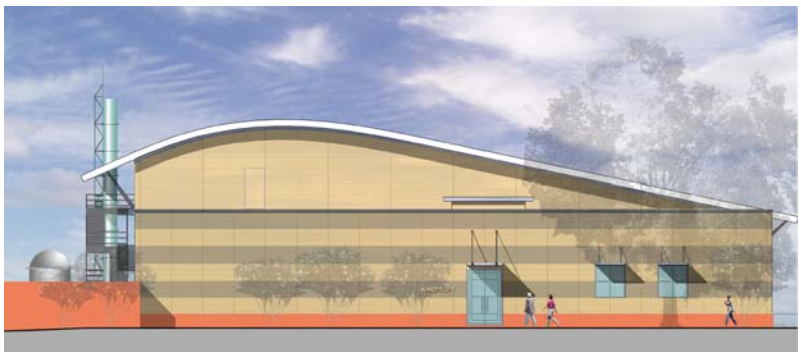

This drawing shows the south elevation of Nanotech I.

The building's design centers around flexibility, in its current layout and for expansion and future development, Temple said. The interior must be modular so that various activities can be moved around. In short, although it is a smaller lab in the overall scheme of nanotechnology labs, the same complex systems had to be considered and installed for the identical kinds of highly sensitive, highly technical research work.

"HDR will deliver the same quality building as in a much larger facility," according to Mark Jamison, HDR national director of advanced technology, "so the smaller labs that we design still realize the same 'bang for the buck'."

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