INSIGHT

Anticipating the Future... Assessing the Impact

Marta Bastrzyk, Jose Hernandez, Tae-Young Kim, Kevin Lerash, Crystal Lybolt, George Skontos, Tyge Sopko, Nir Vaks

Faculty Advisor
Prof. Janet Staker Woerner

In Collaboration with Ball State University
Faculty Advisor Prof. George Elvin

December 1, 2006

Agenda

- Background
- Introduction
- Collaboration Process
- Technical Evaluations
- Societal Issues
- Conclusions

History of Insight

- Fall 2005
  - Researched emerging technologies
    - Video Games, Internet, Optical Drives, Cell Phones
- Spring 2006
  - Focused on nanotechnology
  - Perceptions of Society
    - Stakeholder Bias
  - Major products currently on market

Objectives of IPRO 341

- Identify nanotechnology concepts and properties (self-study).
- Detail technical obstacles with BSU designs.
- Apply various communication tools in collaborative process with BSU.
- Research, identify, and analyze selected societal issues.
- Construct recommendations pertaining to the future of nanotechnology and its integration into society.

Collaboration Process

- The beginnings…
- Working with Ball State University (BSU) Architecture – “Nanostudio”
- Communication methods:
  - Breeze Software
  - E-mail
  - Newsletters
- Face to face meetings:
  - IPRO Games
  - Visits
- Balanced conversation

Technical Research

- Nanotechnology research:
  - General overview (Self-learning)
  - Specific materials and their applications
  - Existing nano-products
  - Technical problems with materials in proposed designs
  - Recommendations to solve technical issues
- Individual groups vary by:
  - Nano-materials implemented
  - House designs and sites

INSIGHT
Anticipating the Future... Assessing the Impact

Team 3884

Marta Bastrzyk (IIT), Elizabeth Boone (BSU),
Adam Buente (BSU) , Tae Young Kim (IIT)

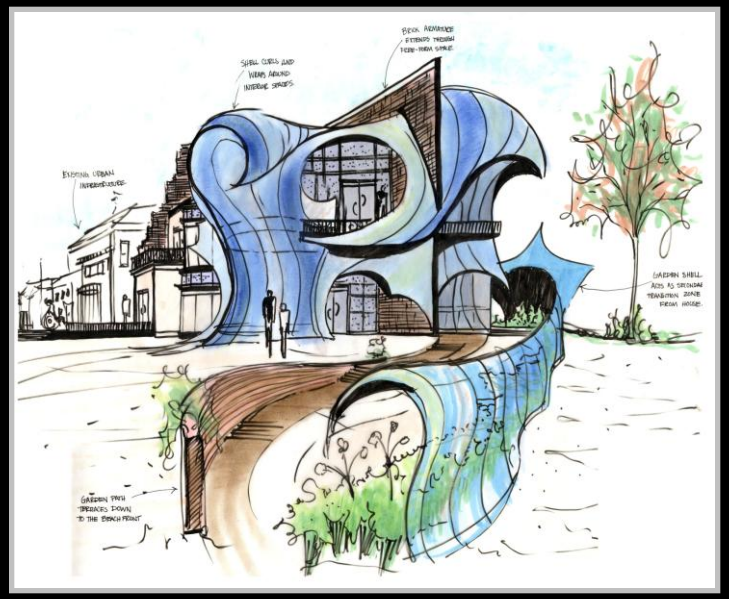
Material: Carbon Nanotube Sheets, Quantum Dots

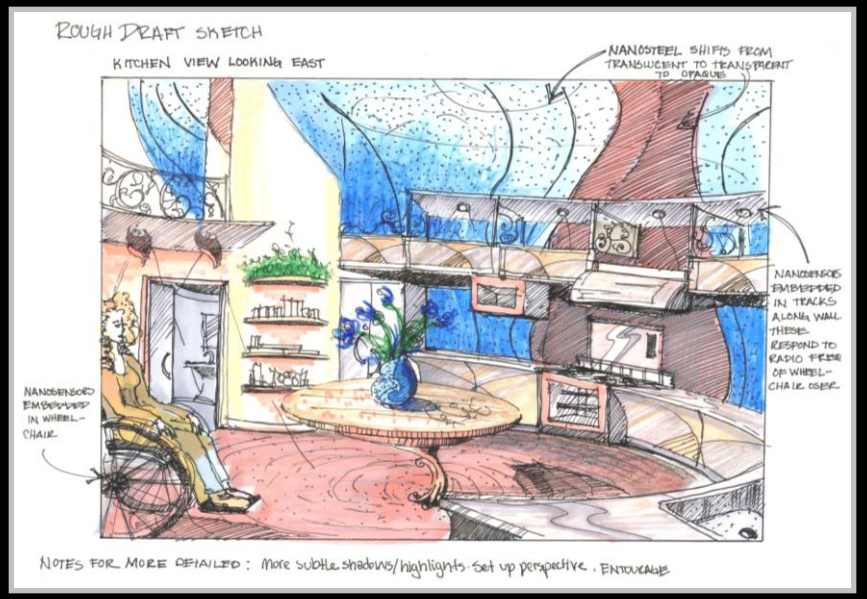
Location: Chicago, IL

INSIGHT
Anticipating the Future... Assessing the Impact

Team NanoShell

Jessica Coleman (BSU), Matt Goyak (BSU),
Nir Vaks (IIT)





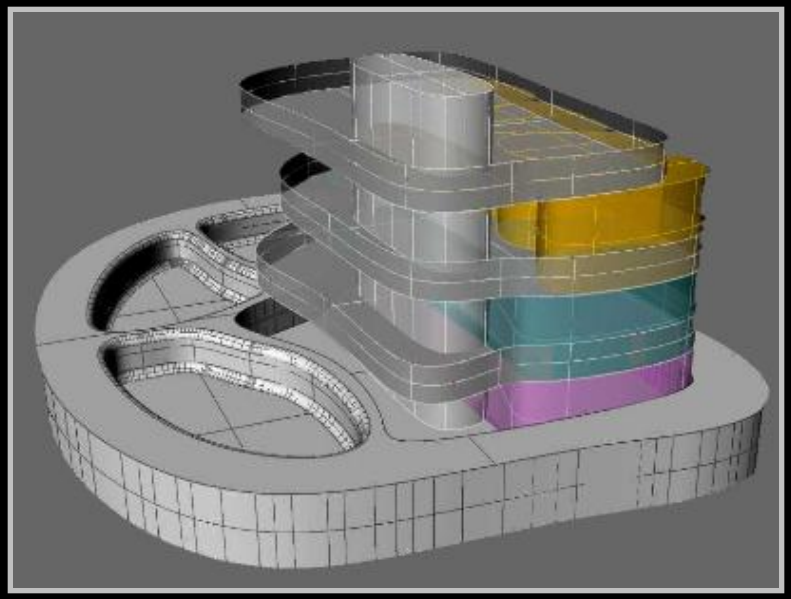
Material: Translucent Nanosteel, Carbon Nanosensors

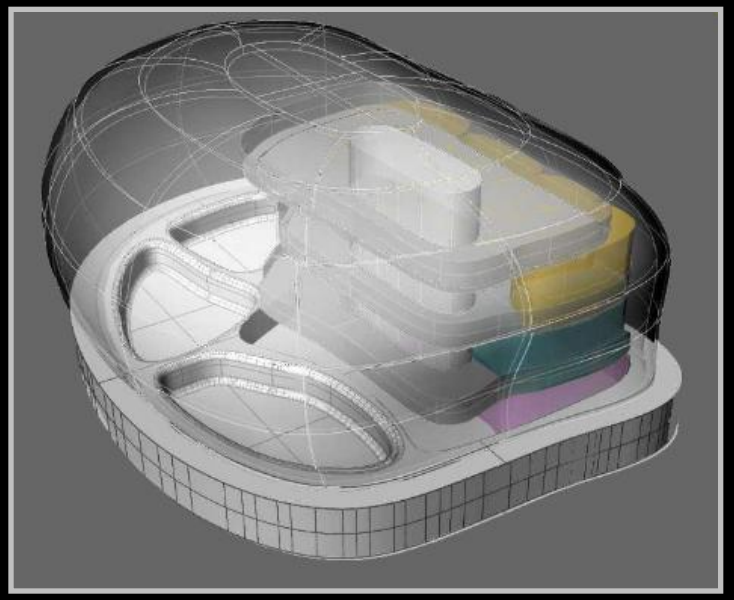
Location: San Diego, CA

INSIGHT
Anticipating the Future... Assessing the Impact

Team NanoSpa

Amber Agan (BSU), Andrew Glass (BSU),
George Skontos (IIT), Tyge Sopko (IIT)





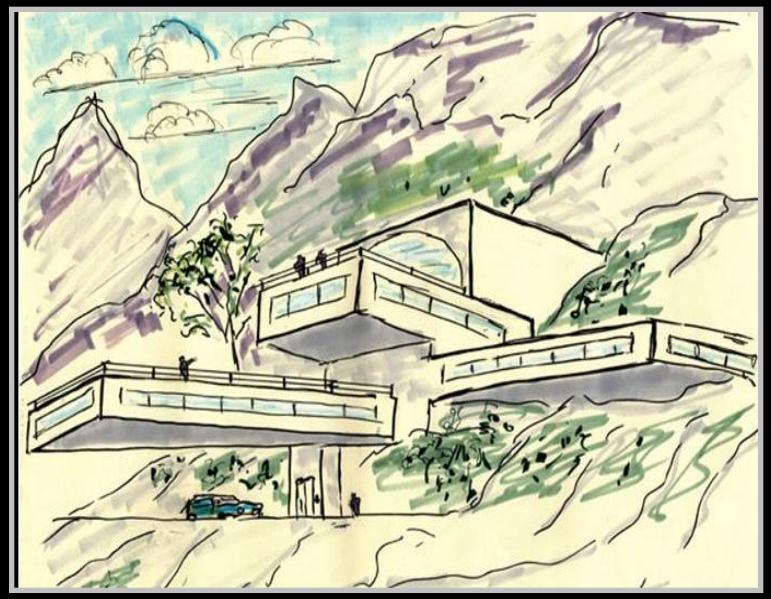
Material: Expandable Building Envelope, Nanosensors

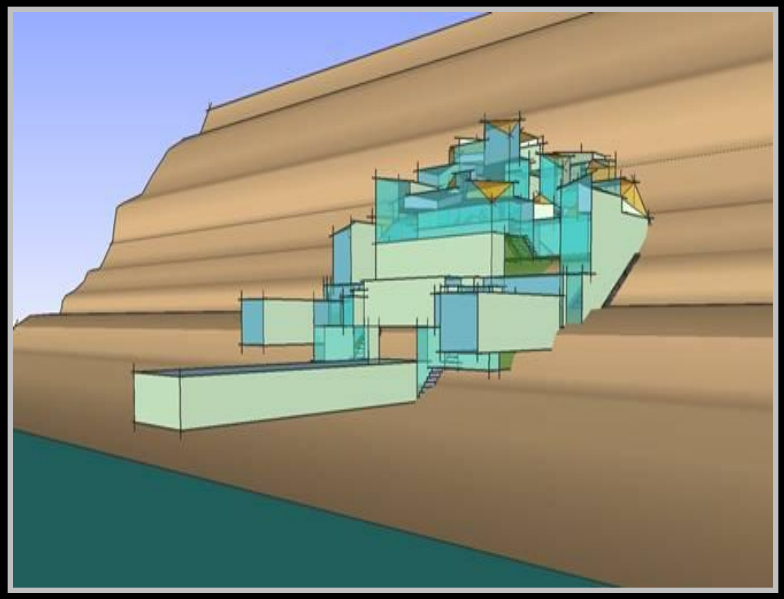
Location: Cincinnati, OH

INSIGHT
Anticipating the Future... Assessing the Impact

Team Fleischman

Eric Gerding (BSU), Kevin Lerash (IIT),
Crystal Lybolt (IIT), Paul Ripley (BSU)





Material: Carbon Nanotube Sheets, OLED Panels

Location: Anchorage, AK

INSIGHT
Anticipating the Future... Assessing the Impact

Team Natural Umbrella

Jose Hernandez (IIT), Nicole Holt (BSU),
Jessica Mullendore (BSU), Emily Perchlik (BSU)

Material: Nanowire Paper, Quantum Dots, Nanosensors

Location: Greenville, SC

Technical Evaluation Conclusions

- All designs were developed based on the assumption that they may not necessarily be applicable today, but they will be within 25 years
- BSU overall designs have questionable feasibility at this point in time
- Full potential of nanotechnology is yet to be determined
- Collaboration of technical and non-technical fields

Societal Issues

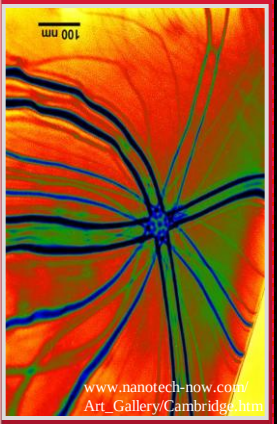
Material	Education	Society	Construction Market	Global
• Recyclability • Cost-efficiency • Toxicity • Life-expectancy • Sustainability • Durability	• User • Insurance agents • Workers • Designers / Engineers • Governing body	• Privacy / hacking • Malfunctions • Governing bodies	• Material transport • Job force / market • New hardware / machines needed	• How other nations deal with / what regulations do they have?

Societal Issues

- Toxicity Issues with CNT
- Material Handling
  - Shipping, disposal, and recycling
- Malfunctions/Emergencies
- Construction Issues
  - Site
  - Worker education/certification
- Regulatory Agencies

Conclusions

- Like any technology before, nano will have opportunities and challenges, and then one day new innovations will come to the forefront.
- Will we use this new opportunity wisely?
- May other situations arise comparable to asbestos? Teflon? Nuclear power?



Nano is coming, are we ready?

Special Thanks To:

- O'Connor Design Works
- Jannelle Ruswick
  - *Galvin Library*
- Julian Zarate
  - *Graphic Designer*
- Jay Marhoefer
  - *Attorney at Latham and Watkins, LLP*
- IPRO Offices
- Brandon Seaton
  - *IIT Student*

INSIGHT

Anticipating the Future... Assessing the Impact

Questions

December 1, 2006

INSIGHT
Anticipating the Future... Assessing the Impact

Team Members

Teams	Members	Year/Major
Team 3884	Marta Bastrzyk (IIT)	5th / Mechanical, Materials, and Aerospace Engineering & Applied Mathematics
	Tae Young Kim (IIT)	4th / Biological, Chemical, and Physical Sciences
	Adam Buente (BSU)	3rd / Architecture
	Elizabeth Boone (BSU)	3rd / Architecture
Team Natural Umbrella	Jose Hernandez (IIT)	4th / Mechanical, Materials, and Aerospace Engineering
	Nicole Holt (BSU)	3rd / Architecture
	Emily Perchlik (BSU)	3rd / Architecture
	Jessica Mullendore (BSU)	3rd / Architecture
Team NanoSpa	George Skontos (IIT)	5th / Applied Mathematics
	Tyge Sopko (IIT)	5th / Electrical and Computer Engineering
	Andrew Glass (BSU)	3rd / Architecture
	Amber Agan (BSU)	3rd / Architecture
Team Fleischman	Kevin Lerash (IIT)	4th / Political Science & Masters in Public Administration
	Crystal Lybolt (IIT)	2nd / Mechanical, Materials, and Aerospace Engineering
	Eric Gerding (BSU)	3rd / Architecture
	Paul Ripley (BSU)	3rd / Architecture
Team NanoShell	Nir Vaks (IIT)	3rd / Electrical and Computer Engineering
	Matt Goyak (BSU)	3rd / Architecture
	Jessica Coleman (BSU)	3rd / Architecture
Team Advisors	Professor Janet Staker Woerner (IIT)	
	Professor George Elvin (BSU)	

INSIGHT

Anticipating the Future... Assessing the Impact

BACKUP SLIDES

December 1, 2006

What should be done?

These conclusions have been drawn based on extensive research into societal implications on nanotechnology

- *Regulatory Agencies*
  - Establish and International Regulatory Agency
  - Launch tailor-made organization for nanotechnology within U.S. Government
  - Allocate more research grants into investigation of nanotechnology based materials' effect on our environment and our health

Education

- *Education of Regulatory Agency Members*
  - Require knowledge of vast number of scientific fields
  - Setup collaboration and communication skills courses
  - Require certifications in rapidly updating developing technology
- *Student Education*
  - Significantly revolutionize school curriculums with nanotechnology education and collaboration methods in mind
  - Incorporate disciplines intersecting complex problems
  - Include programs similar to our IPRO programs early on in elementary schools
- *User Education*
  - Require companies to include on their websites and all product labels'
  - Use of RFID to tag all products that are NANO enhanced so there is a national data base
  - Create more public, user friendly, reliable information sources
- *Workforce Education*
  - Require proper training by educated professionals who understand nanotechnology.
  - Set requirements that companies must legally follow pertaining to the explanation to employees of the risks involved

Society

- *Privacy/Hacking*
  - Consider establish a positions for ‘nanocops’ to track and punish dangerous hackers that specialize in interfering with the controls of nanodevices and systems
  - Encourage and use the work of all of the hackers to develop better security systems prior to full release of a product
- *Job Market/Work Force*
  - Workers will have to display diversity in scientific background incorporating chemistry, biology and engineering, to name the few.
  - Encourage workers already in a given field to expand their scopes of knowledge, possibly by undertaking more education.
  - Nano workers will need a new type of union to better represent them, a union that is themselves diverse in different educational backgrounds

Materials

- *Durability and Sustainability of Nano-Building Materials*
  - All nano-enhanced materials should be tested on a practical level
  - Through research in controlled labs it should be predicted if structures will be safe to use
  - Modeling tools should be used to project pitfalls and dangerous issues
- *Compatibility*
  - Regulatory board/organization should be created to encourage and enforce a uniform compatibility between similar technologies
  - Enforce making nanotechnology based products compatible with there old non-nano based technology to provide a smooth and gradual transformation

Malfunctions

- *Societal Reaction to Malfunction*
  - Place regulations or even prohibitions on the use of materials before extensive toxicity research has been conducted
  - This toxicity research should have quantitative requirements that must be satisfied to move progress to the next stage.
  - There should a set of stages or levels of safety confidence with respect to toxicity knowledge and prevention so that as research progresses on certain materials, they can be classified into these stages

Toxicity and Risks

- *Toxicity*
  - workers and developers should be required to wear appropriate safety gear
  - Guidelines for labs and manufacturing should be developed in order to create a ‘standard’ procedure for handling nanomaterials
  - complimentary nanomaterials and methods should be developed that actually will filter the air or water
  - Much more research need to be performed in this area
- *Recyclability*
  - Methods of reactivation or reusing nano-particles in new products must be devised
  - More research need to be performed in this area