The Joint School of Nanoscience and Nanoengineering

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Outline

• Background
• Strategy
• Status
• Summary
Background

- Nanotechnology offers “game changing” potential.
  - A convergent technology with tremendous economic growth potential
  - Lux Research estimates a $2.6T impact on the world’s economy by 2014

- The scientific meaning of “nano” is one billionth.
  - A nanometer is the dimensional scale of atomic or molecular clusters (one billionth of a meter)
  - Nanotechnology is the science & engineering know how to manipulate atoms and molecules to form systems with customized properties and functions.

- Enabling for
  - Product innovation
  - New device types
  - New fabrication techniques
What is small?

• “Nano” in Pop Culture is in the eye of the beholder

Hummer “nano” H3  iPod “nano-chromatic”  “Nanobama” (Hart, Tawfick, DeVolder & Walker, U. Michigan, 2008)

• What is considered small in science has been constantly changing

Sources: Nikon, Hitachi, Park Systems, Wikipedia, IBM, GM, Apple, J. Hart et al
Inflection Points in Technology

J. E. Kelly III – IBM adapted from Kurzweil 1999 and Moravec 1998
Strategy

“Pair up in threes”

Triad Community
• The Joint School of Nanoscience and Nanoengineering (JSNN) was created by UNCG and NC A&T with the support of the University of North Carolina system, the North Carolina General Assembly and the Greensboro/Triad community. Initial funding includes:
  – $50M for construction of the JSNN building
  – $8.0M for capital equipment

• JSNN’s goal is to be a world leader in research and nano-related education.
  – Develop research strengths in interdisciplinary areas focused on nanobio
  – Achieve economic growth for the Triad through joint investment and co-location with NC, National and International company partners
JSNN Building Blocks

Research emphasis on interdisciplinary “nano” fields

Nanobio
- Molecular Biology
- Biochemistry including drug discovery & delivery, nutrition and agriculture
- Biomedical Engineering & Bio-based devices
- Biophysics
JSNN Building Blocks

Research emphasis on interdisciplinary “nano” fields

Environmental
- Energy
- Sustainability
- Remediation

Nanobio
- Molecular Biology
- Biochemistry including drug discovery & delivery, nutrition and agriculture
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JSNN Building Blocks

Research emphasis on interdisciplinary “nano” fields

- Environmental
  - Energy
  - Sustainability
  - Remediation

- Materials
  - Biomaterials
  - Catalysis & Coatings
  - Nanocomposites
  - Characterization & Modeling

- Nanobio
  - Molecular Biology
  - Biochemistry including drug discovery & delivery, nutrition and agriculture
  - Biomedical Engineering & Bio-based devices
  - Biophysics
### JSNN Building Blocks

Research emphasis on interdisciplinary “nano” fields

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• Initial focus has been in four areas
  – Curriculum
  – JSNN Facility
  – Hiring
  – Outreach and Engagement
JSNN Status

• Curriculum
  – Two degree programs planned
    • Professional Master of Science in Nanoscience
    • Ph.D. in Nanoscience
  – Request to Establish Proposals have been reviewed and approved by UNCG and NC A&T and submitted to UNC General Administration for approval

• JSNN Facility
  – ~88,000 sq. ft. facility planned for Gateway South Campus
  – Programming activity completed, design phase initiated
  – Laboratories, specialized facilities, offices, classrooms and partner space are planned
  – Current projected completion date is mid-year 2011 (working to pull in completion date)
JSNN Research Facility

- The JSNN research facilities should be industrial quality and enable the diverse research activities of the faculty and partners. The programming plan for the facility includes:

  - Laboratories
    - Nanobiology
    - Nanobiochemistry and Nutrition
    - Nanobiophysics and Nanobiomedical Engineering

  - Facilities with specialized requirements
    - Nanoelectronic and Bioelectronic Cleanrooms
    - Materials Characterization (Microscopy Suite, NMR Room, Nanomaterials Characterization)
    - BSL3 Laboratory
    - Nanofabrication facility including (Nanoparticle Synthesis, Nanofiber Characterization, Nanocomposite Structure Fabrication Facility)

  - Options for small specialized (potentially proprietary) facilities
    - Plant research
    - Environmental
    - Energy
    - Other Engineering
Model Photographs
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- **Faculty and Staff Hiring underway**
  - Plan to hire 12 faculty for 3 departments (Nanoscience, Nanoenvironmental Science and Engineering and Nanoengineering)
  - Underway but slowed by financial crisis. Initial focus on Nanoscience hires
    - Nanoscience Department Head search underway
    - Search for Joint Appointment with NC A&T Math department underway
    - Candidate for Joint Appointment with UNCG Chemistry identified
  - 50 UNCG and NC A&T affiliated faculty with “nano” research interests
Research Interests of JSNN Affiliated Faculty

Nanobio-based energy research

Nanoelectronics
(SEM of IBM 65 nm device)

Communications

Prediction of Macromolecular Function
E.W. Taylor - UNCG

Nutritional Nanobiology

Drug Discovery & Delivery
P. Reggio - UNCG

Nanofibers & Nanocomposites
A. Kelkar – NC A&T

Nanoenvironmental

Computing & modeling

498 K
448 K
398 K

498 K
448 K
398 K

298 K
348 K
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• Outreach and Engagement
  – 5 NC business leaders - R. Markunas (DoD Consultant), R. Burns (Sr. VP, Lux Research), M. Stypa (VP, Syngenta), R. Sawafa (CEO, QuarTek), P. Clayson (CEO, nCoat) have agreed to become JSNN Industry Advisory Board Members
  – Pursuing relationships with nanobusinesses and government funding agencies
Summary

• Nanotechnology is a critical part our economy
  – Nanotechnology is revolutionizing IT, electronics, medicine, defense, entertainment, transportation, and communication

• JSNN will be a top academic institution in nanotechnology.
  – JSNN focus is on four goals: establish the curriculum, build the facility, hire the faculty and staff and begin outreach
  – Partnerships at JSNN will help build infrastructure and foster innovation.

• The JSNN model and infrastructure will grow as new educational, technological and partnership opportunities arise.

Thank you!

(S. Harris published in American Scientist)