NNCI: Southeastern Nanotechnology Infrastructure Corridor (SENIC)

2024 NNCI Annual Conference

SENIC Southeastern Nanotechnology Infrastructure Corridor

JSNN
Joint School of Nanoscience and Nanoengineering

North Carolina Agricultural and Technical State University
University of North Carolina at Greensboro

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SENIC: 3 Universities – 2 Locations – 1 Site

Partnership of two major & modern nanotechnology centers in the southeastern US:

- **Institute for Matter and Systems (IMS),** an Interdisciplinary Research Institute at the Georgia Institute of Technology (GT)
- **Joint School of Nanoscience and Nanoengineering (JSNN)**, an academic collaboration between North Carolina A&T State University (NCA&T) and University of North Carolina, Greensboro (UNCG)

GT-IMS Marcus Nanotechnology Building

JSNN Building

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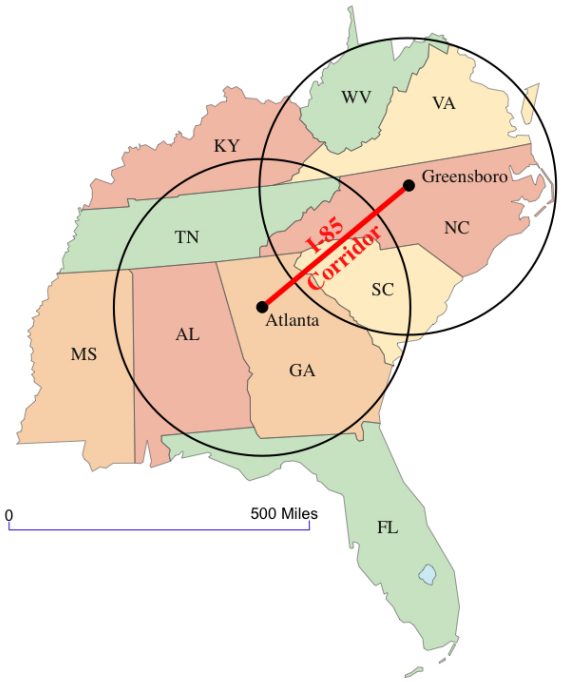
Directed Question(s)

- What are **examples of programs and activities** developed under NNCI that will be **sustainable, independent** of any continued NSF renewal funding, and what **strategies or sources** will be used to support them?
- What role do **community/technical colleges** play in your education and workforce development strategy and what role should they play in a **future infrastructure network**?

SENIC Vision & Strategic Goals (Years 6-10)

Vision Statement

*To be a **premier nano-fabrication and nano-characterization resource to southeastern US user communities** from academia, small and large companies, and government organizations, **providing tools, staff expertise, E&O activities, as well as SEI of nanotechnology programs**.*



Strategic Goals

1. **Develop and Serve Diverse User Base**
2. Develop Strong Synergies between Partners
3. Expanding Capabilities based on Future Research Trends
4. **Develop E&O and SEI Programs Targeting the SE**
5. Assist NNCI Network in Becoming More Than the Sum of its Parts

Updated strategic plan with **measurable goals**

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Plans to Achieve Diverse User Base

Programs to Develop and Serve a Diverse User Base		
Awareness	•	Webpages, newsletter, social media
	•	University/company visits facilitated by former users (SENIC Ambassadors)
	•	Seminars, workshops and short courses
	•	Outreach to local development offices
	•	Outreach/connection to business outreach org.
	•	Targeted outreach to SBIR "nano" recipients, nano PIs and SENIC alumni
	•	Partnership with Oak Ridge National Lab
Accessibility	•	Remote work services
Affordability	•	Catalyst seed grant program
All 3 "A"	•	Southeastern Nano Facility Network (SENFN)

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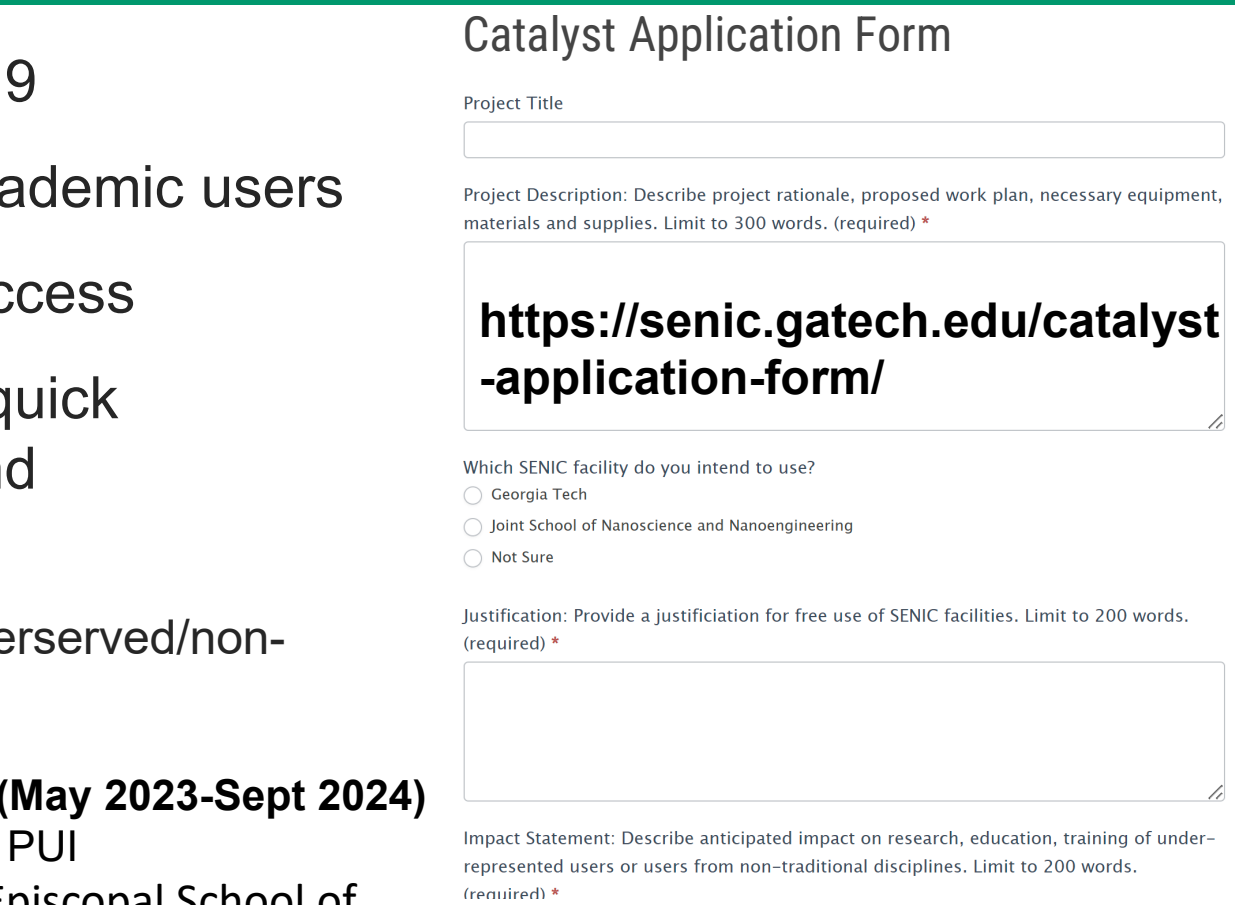
Example I - Catalyst Program

- Announced Jan 2019
- Open to external academic users
- $1000 facility/tool access
- Online application, quick screening/turnaround
- 42 awards so far
  - Most of them to underserved/non-traditional users

10 Catalyst Grants Awarded (May 2023-Sept 2024)

- 5 K-12 Schools, 3 HBCU, 2 PUI
  - North Gwinnett High, Episcopal School of Jacksonville, Gwinnett School of Mathematics, Science, and Technology, Chattahoochee High, Morrow High (K-12)
  - Morehouse, Johnson C. Smith University and Spelman Coll (HBCUs),
  - High Point University and Davidson College (PUIs)


Catalyst Application Form

Project Title

Project Description: Describe project rationale, proposed work plan, necessary equipment, materials and supplies. Limit to 300 words. (required) *

https://senic.gatech.edu/catalyst-application-form/

Which SENIC facility do you intend to use?

- Georgia Tech
- Joint School of Nanoscience and Nanoengineering
- Not Sure

Justification: Provide a justificiation for free use of SENIC facilities. Limit to 200 words. (required) *

Impact Statement: Describe anticipated impact on research, education, training of under-represented users or users from non-traditional disciplines. Limit to 200 words. (required) *

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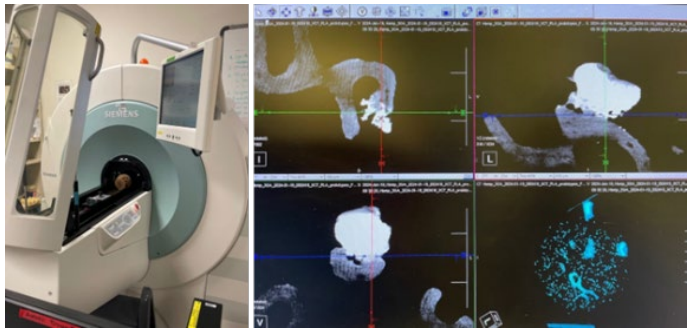
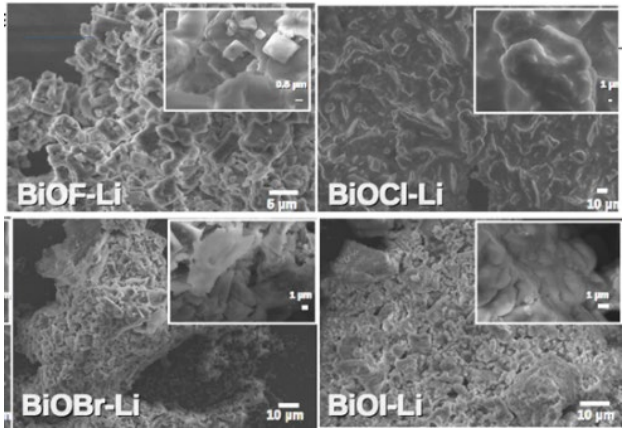
Catalyst Program - Research Highlights

3D-Printed Hemp-based Artificial Coral Reefs as Biodegradable Solution for Marine Restoration

Anabella Platt, Student, ***Episcopal School of Jacksonville***

SEM and MicroCT measurements were performed at GT





Novel Bismuth Oxyhalides (BiOX) Nanomaterials for Energy Storage Applications

Darkeyah G. Reuven, Assistant Professor of Chemistry, NanoMaterials/SIRL Laboratory Coordinator, Natural and Behavioral Sciences Department, ***Johnson C. Smith University -*** FESEM at JSNN for imaging/characterization.

Phage Discovery and Genomics

James T. Melton III, Senior Lecturer, ***Spelman College***

Each student imaged a soil phage sample on a transmission electron microscope (TEM) at GT

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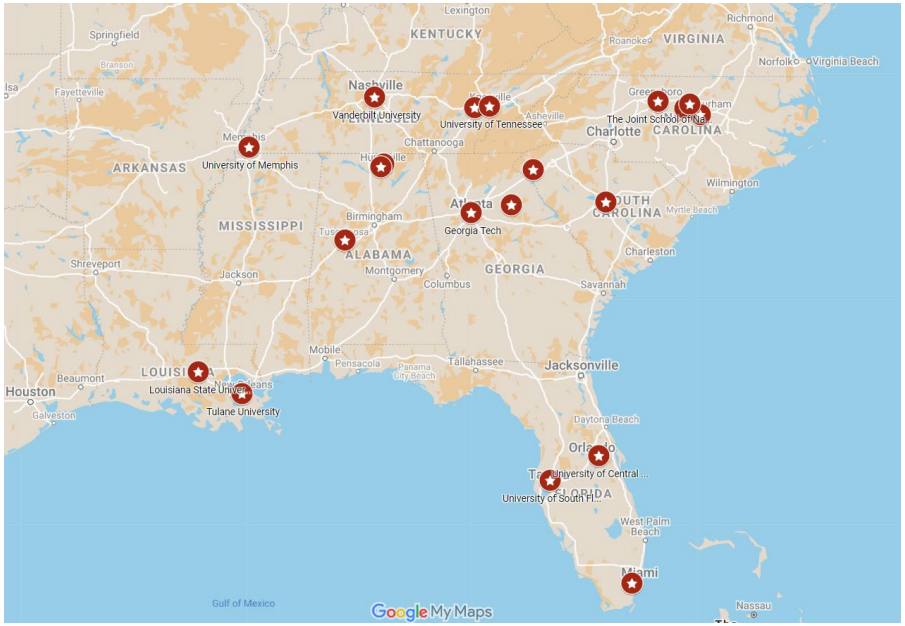
Example II - Southeastern Nano Facility Network (SENFN)

Regional network of nanoscale S&E user facilities located in southeastern USA

- To share information on capabilities and challenges at each facility, discuss best-practice solutions to common challenges, and allow for informal staff-level technical exchanges, and networking



- 20 institutions from 8 states (including RTNN)
- Annual Meeting – 2018 (GT), 2019 (ORNL), 2020 (virtual)
- Post-pandemic, SENFN has (re)organized meeting format; We now meets virtually monthly – new topic every month, share capabilities, best practices etc.
- Sponsors and Vendor support (for in-person meeting)

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Example III – DOE National Lab Engagement

- **Enhanced Relationship with Oak Ridge National Lab**
  - Member of SENIC EAB (since 2015)
  - Southeastern Nano Facility Network (SENFN) meeting
  - Cross promotion of capabilities
- **Joint user project support**
  - Umbrella SENIC user proposal with CNMS at ORNL
  - SENIC users get easy access to ONRL tools/resources that are not available at SENIC
- Joint staff exchanges and training efforts (in works)
  - Reciprocal visits/trainings
  - Reciprocal tool backup

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SG4a: Develop & Execute E&O Programs targeting the SE

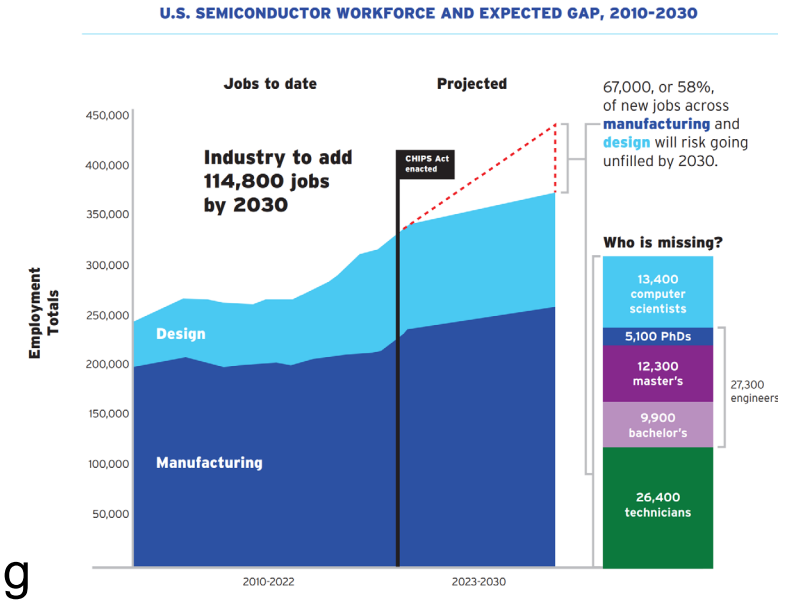
SENIC will focus on the most effective E&O (**particularly workforce development at the undergraduate, graduate and community college level**) for southeastern US and develop quantitative metrics for these programs.

Measurable Goals

- Reach 1,000 students through classroom visits (incl. remote SEM) per year.
- Emphasize outreach to districts that serve underrepresented minorities in STEM, rural districts, low-income families; make programs known to 40 districts/year.
- Connect with 200 educators in GA & NC (RET, SIMST, Conf, Prof. Dev.) /year.
- **Study career path of REU students, student assistants, and community college students involved in educational activities.**
- **Increase the number of annual participants in workforce development activities (currently 500 per year) by 50% by the end of the program.**

Community/Technical Colleges and Workforce Development

- Leading role in training of workforce e.g., technicians, and other skill trades
  - Particularly in response to workforce needs of local and regional economy
- Provide affordable education and training for skilled jobs
- For specialized fields e.g. semiconductors, insufficient or outdated facilities, lack or under-prepared instructors, courses and curriculum may be not aligned to industry needs, among others
- Partnership with 4-year colleges can be a value add in terms of resource sharing, pathways (internships), access to facilities, transferrable skills, instructor training/sharing



SIA State of U.S. Semiconductor Industry (2024)

NSF/MNT-EC Semiconductor Education and Workforce Convening (Oct 2023); Community Colleges and the Semiconductor Workforce, Harvard Kennedy School (June 2023)

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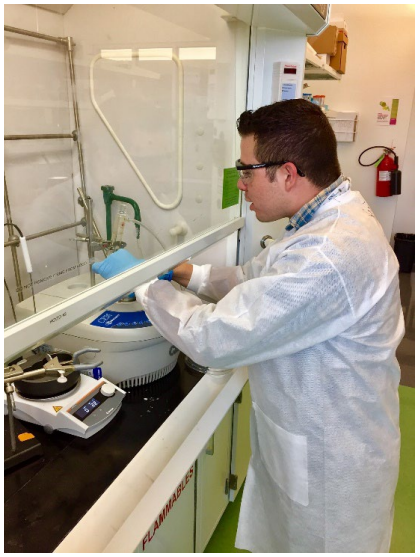
Internship Program for CC/TC Students

- **At SENIC@JSNN (since 2015)**
  - 4-8 students/year from the Forsyth Tech, Guilford Tech and Alamance CCs (extending relationship to Central Carolina CC and AdvanceNC initiative)
  - Promotion, formal application, interview and matching
  - ~45 CC students trained in the last 9 years
    - Individualized measurable learning outcomes
  - Supported using SENIC/NNCI, industry and other federal funds – Advanced Materials, Manufacturing, Biotechnology etc.
  - In the last two years, with funding from Intel and DOD ME Commons/CLAWS (NC State-led), the focus on providing hands-on, experiential training in semiconductor fabrication and characterization



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Programs for Community/Technical College

- **At SENIC@GT**
  - **Working with TC System of Georgia**
    - Internships/Apprenticeships/Co-ops
      - Students partner with IEN staff
      - Hiring of co-ops/student assistants to work in the cleanroom,
  - **Nanomanufacturing Certificate Program**
    - In partnership with Georgia Piedmont TC and Center for Nanotechnology Education and Utilization at Penn State
      - 12-week program to train veterans in microelectronics and nanomanufacturing
      - Program in partnership with Absolics, Inc.

  - Other workforce training activities/programs – TC days at GT, short courses, boot camps, mini-mesters

Thank You!

http://www.nnci.net
http://senic.gatech.edu
https://matter-systems.gatech.edu/
http://jsnn.ncat.uncg.edu

facebook.com/senic4nano

@senicnanotech

linkedin.com/company/senic/

User Support

- Usage mechanisms
  - On-site
  - Remote
  - Collaborative
  - Sponsored research
  - Special projects space
- IEN/JSNN reciprocal agreements
- Support for multiple theory/lab courses (in GT (9), JSNN (10 lab courses + multiple theory/w lab modules) and other institutions) – 163 at GT, 170 at JSNN and at least 15 external
- Support for research in non-traditional areas
  - IEN organic cleanroom and soft lithography lab
  - JSNN analytical, soft materials, composites, biology, computational modeling, and ASTM standard material testing

User Support

- SENIC Catalyst Grants
  - External academic or non-profit
- IEN Seed Grants
  - Georgia Tech or external academic users in SE US
- Student and professional education (seminars, conferences)
- Advanced training modules
  - Microfabrication course
  - Soft Lithography course
  - Imaging and materials analysis courses

Primarily Undergraduate Nanomaterials Cooperative (PUNC)

- PUNC is an organization for research-active faculty studying nanomaterials at Primarily Undergraduate Institutions (PUIs)
  - 37 PUIs
  - Community building, info sharing, and new collaborations.

Hughes, S.M., et al., 2021. ACS Nanoscience Au, 1(1), pp.6-14.

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