Research Moving Forward

An Overview of Research at North Carolina Agricultural & Technical State University


The Joint School of Nanoscience and Nanoengineering

Our land-grant heritage positions us well for today's great research challenges – nanotechnology and biotechnology ... energy and the environment ... and many more. But our work extends beyond our traditional disciplines, into areas including biomedical research, leadership development, and the social and behavioral sciences.

National Science Foundation Engineering Research Center (ERC) for Revolutionizing Metallic Biomaterials

The ERC is conducting research in biomedical engineering and nano-bio applications. Its goal is to generate revolutionary advances in cardiovascular, orthopedic and craniofacial medicine through the development of biocompatible and biodegradable implants for reconstruction and regeneration. The award totals $18 million over five years with a possible five-year extension. North Carolina A&T is the ERC's lead institution; partners include the University of Pittsburgh, University of Cincinnati, and Hannover Medical School in Germany.

Interdisciplinary Scientific Environmental Technology (ISET) Cooperative Research and Education Center

The ISET center cooperates with the National Oceanic and Atmospheric Administration (NOAA) Earth Science Research Laboratory in Boulder, Colorado. It provides the data needed to address specific climate and weather concerns, such as hurricanes, droughts, tornadoes, global warming, and ecosystem degradation. The center is funded through a $12.5 million grant from NOAA. North Carolina A&T is the lead institution; partners include California State University, Fresno; City University of New York; Fisk University; North Carolina State University; the University of Alaska Southeast; and the University of Minnesota.

Center of Excellence for Post-Harvest Technologies

The center's research adds value to agricultural commodities by finding new ways to make food safer, extend shelf life and preserve health-promoting nutrients. It is located at the North Carolina Research Campus in Kannapolis and is working with academic partners there to expand into diverse areas such as nutrigenomics and metabolomics. A&T is one of eight universities with facilities at the NCRC, a $1 billion, 350-acre biotechnology research park.

BEACON: A National Science Foundation Science & Technology Center for the Study of Evolution in Action

BEACON's goal is to gain a better understanding of evolutionary dynamics through interdisciplinary research between evolutionary theorists, evolutionary biologists, and evolutionary practitioners (engineers and computer scientists working in the field of Genetic & Evolutionary Computing). North Carolina A&T is a member of a consortium led by Michigan State University.

Science & Technology Center of Academic Excellence in Advanced Biometrics

The Center performs research in a variety of identity security issues (biometrics, face recognition, age progression, age estimation, and ocular recognition), while increasing the pool of professionals in the biometric workforce. North Carolina A&T is the lead institution; partners are Carnegie Mellon University, Clemson University and the University of North Carolina at Wilmington. Funded by an $8.93 million, five-year grant to create the first Director of National Intelligence Science and Technology Center of Academic Excellence.

Major Research Projects

Dr. Dhananjay Kumar, left, Department of Mechanical Engineering, and students

Interdisciplinary .... multidisciplinary ... emerging and converging. Where traditional disciplines overlap and where new ones arise, N.C. A&T researchers are working to turn the scientific promise of today into the technological reality of tomorrow.

Advanced Materials and Nanotechnology

Researchers from the sciences and engineering developing breakthroughs in structural material, smart structures, and nanosensors for commercial and medical applications.

Research Thrust Areas

- Advanced and Smart Materials
- Biomaterials and Regenerative Engineering
- Nanoengineered Materials
- Nanoscience and Nanoengineering Cross-Cutting Applications
- Nanoscience Basic Research

Biotechnology and Biosciences

Research in microbial, plant, and animal systems, including genetics, for applications in agriculture, food processing, environmental remediation, and human health.

Research Thrust Areas

- Bioagriculture
- Bioengineering
- Biosciences
- Computational Science

Computational Science and Engineering

An emphasis on computational methods and information processing concepts for the discovery, design, and analysis of complex physical and non-physical systems and phenomena.

Research Thrust Areas

- Computational Modeling in Non-Physical Domains
- Computational Modeling in Physical & Engineering Sciences
- Enabling Technologies
- Modeling and Simulation

Energy and Environment

Research in alternative energy and environmental sustainability that leads to improvements in air and water quality and better human health.

Research Thrust Areas

- Bioenergy and Bioproducts
- Bioremediation and Waste Management
- Energy, Efficiency, Conservation and Control
- Hydrogen Fuel and Fuel Cells
- Solar Power
- Sustainable Agriculture and Natural Resources Management

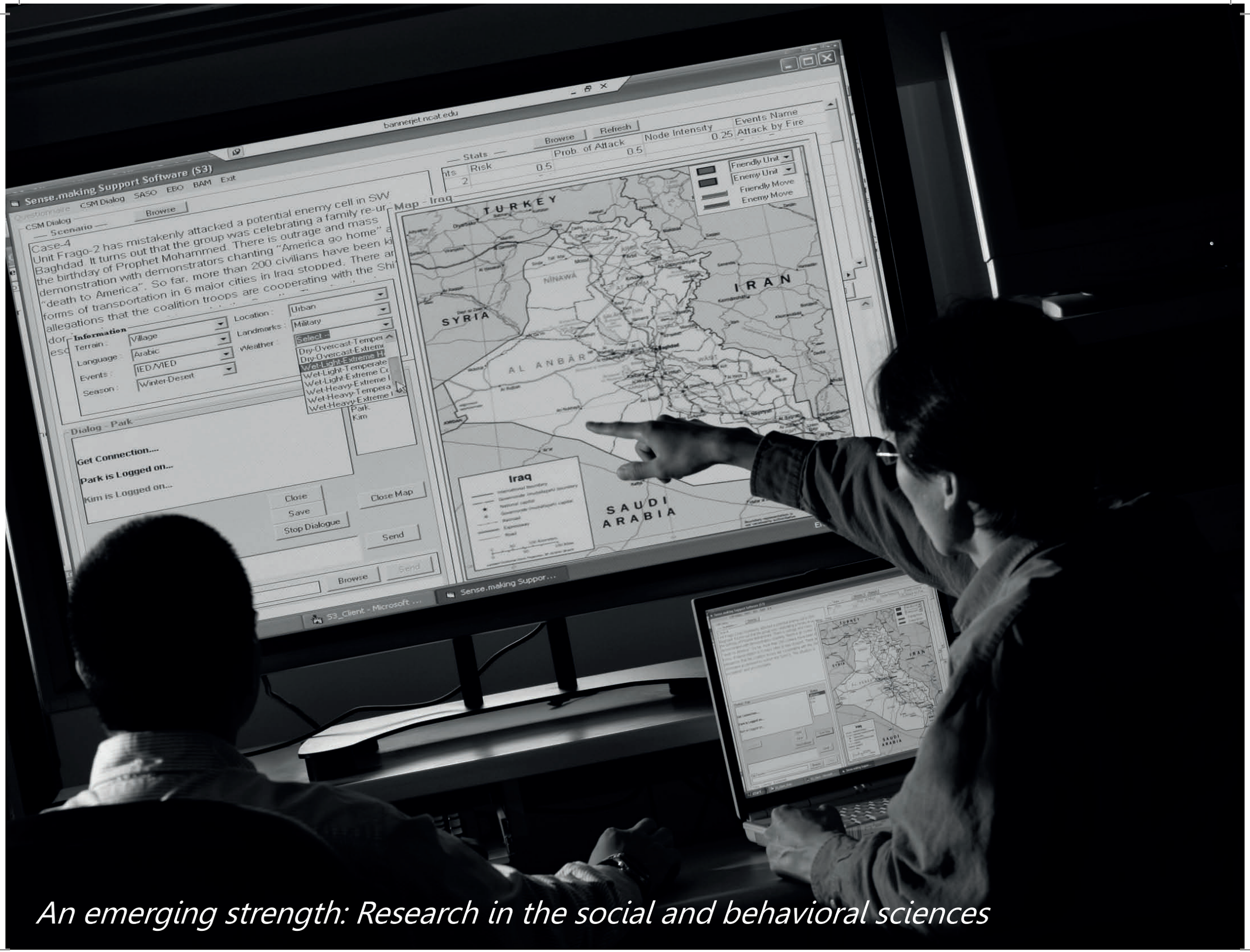
Information Systems and Technology

Facilitating the development of complex systems such as ubiquitous sensing, and artificial intelligence and thinking systems.

Research Thrust Areas

- Biometrics
- Communication, Computing, and Processing Systems
- Computational Artificial Intelligence and Thinking Systems
- Control and Decision-Making Systems
- Information Assurance
- Internet-based Applications
- Robotics
- Sensor Systems

Research Clusters



An emerging strength: Research in the social and behavioral sciences

Beyond the traditional disciplines of land grant universities lie great opportunities for research, for the creation of new knowledge and for improving the quality of life through community-based research.

Leadership and Community Development

Strengthening communities and building leadership capacity through research, educational programs and community engagement that revitalizes urban and rural communities.

Research Thrust Areas

- Economic Empowerment
- Housing and Infrastructure
- Leadership Development

Logistics and Transportation Systems

Multidimensional research capabilities for applications in defense, health care, humanitarian relief, and manufacturing.

Research Thrust Areas

- Disaster Relief
- Healthcare Logistics
- Global Transportation
- Manufacturing Logistics
- Resource Scheduling
- Supply Chain Strategy
- Warehousing & Distribution

Public Health

Strategically addressing the complex public health issues confronting local communities and communities throughout the world.

Research Thrust Areas

- Food Science and Nutrition
- Health and Education Interventions
- Health Disciplines
- Health Promotion and Disease Prevention
- Increasing the Number of Health Professionals from Underrepresented Populations
- Substance Use

Social and Behavioral Sciences

Advancing theoretical knowledge and understanding of the human condition through interdisciplinary, collaborative research in the social and behavioral sciences

Research Thrust Areas

- Cognitive Science
- Cultural Studies
- Ethics
- Interactive Research in the Arts
- Pedagogy
- Social Systems
- Socio-Economic, Cultural, and Political Disparities

Emerging Research Areas

North Carolina A&T is developing a critical mass of faculty expertise and research in these fields:

Biomedical Research

Cancer, Alzheimer's disease, arthritis, nanomedicine, drug-delivery devices, mechanical tissues, therapy, 3D culture and proteogenomics.

Defense and National Security

Cybersecurity, biometrics, food security, border security, infrastructure protection.

Rehabilitation Science and Engineering

Muscle scaffolding, prosthetics, mechanical tissues, neurophysiology/ kinesiology simulation models.

Clean room, Engineering Research Center

The foundation of N.C. A&T's research program is strong relationships with major funding agencies, including the Department of Agriculture, Department of Defense, National Institutes of Health and National Science Foundation.

Center for Advanced Materials and Smart Structures

Conducts nano-focused, basic and applied research in advanced ceramics, advanced composites, electronic ceramic devices, sensors and smart structures, III-V nitrides, ohmic contracts and devices.

Center for Autonomous Control and Information Technology

Focuses on soft computing, multiagent systems, artificial intelligence in general, control theory, genetic algorithms, and energy conservation and power electronics.

Center for Aviation Safety

Mission is to establish a strong aerospace engineering research and education program to support NASA's fundamental aeronautics and aviation safety programs.

Center for Composite Materials Research

A center of excellence in composite materials, with research in processing and fabrication of simple to complex composite components, use of textile fiber architectures in the fabrication of non-trivial lightweight composite components (braids, plain weaves, etc.), testing and characterization of composite materials, and other areas.

Center for Cyber Defense

Serves as the university's Information Assurance Center and conducts an integrated education and interdisciplinary research in information assurance. The National Security Agency has designated North Carolina A&T as a Center of Excellence in Information Assurance Education.

Center for Energy Research and Technology

A research, training and outreach provider, grounded in engineering and built-environment sciences. Works to reduce energy and water use and promote sustainable design practices.

Center for Human-Machine Studies

A multi-disciplinary program of basic and applied research and technology development in human-machine system engineering, directed toward understanding the nature of human performance while interacting with complex technology-driven systems.

Institute for Advanced Journalism Studies

Works to improve the number of blacks working in journalism and to enhance the coverage of issues important to people of African descent.

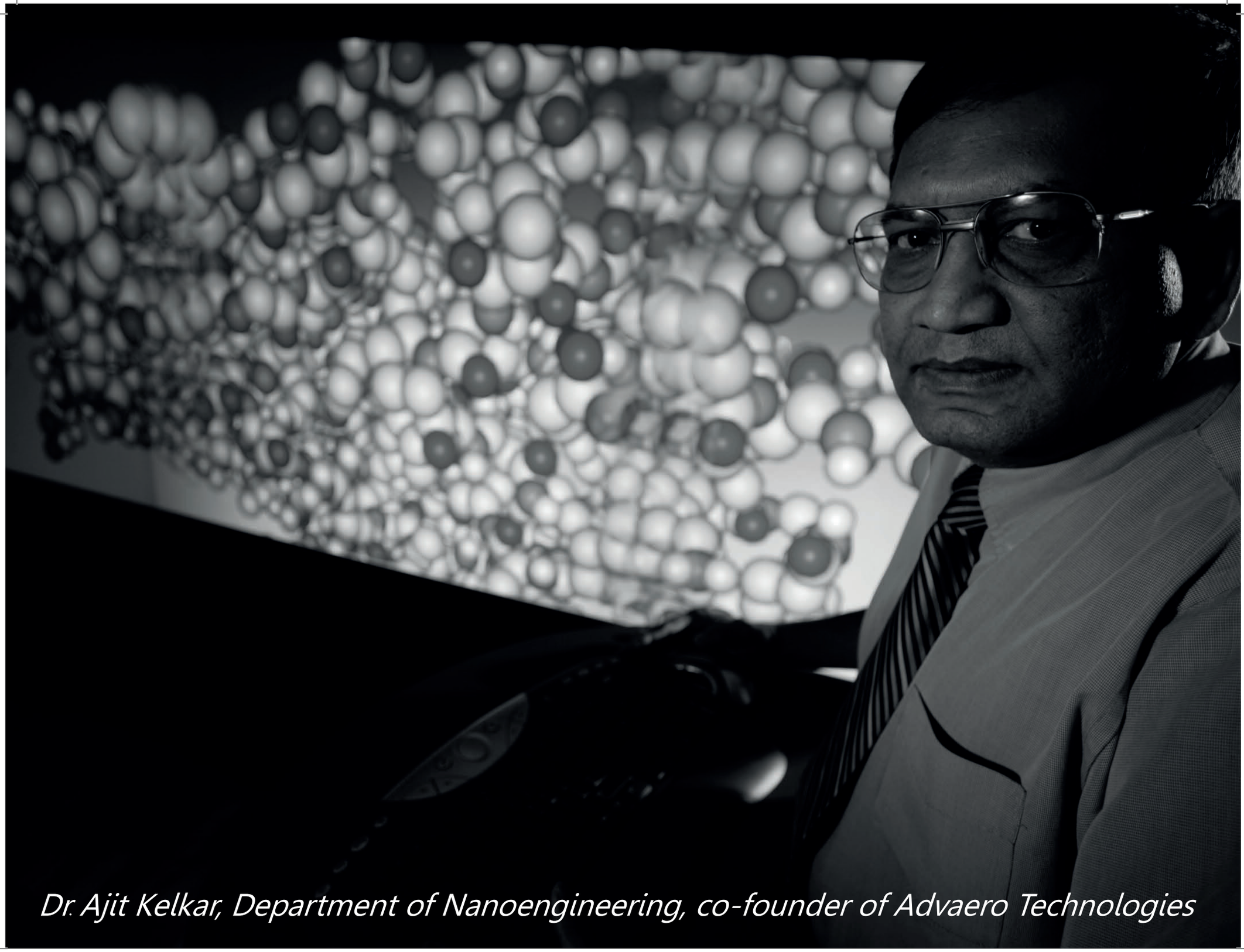
Interdisciplinary Center for Entrepreneurship and E-Business

Provides academic and experiential learning experiences for students interested in individual or corporate entrepreneurship, and for local entrepreneurs interested in improving their businesses.

International Trade Center

Provides data, technical assistance and information to agricultural businesses. Emphasis is on programs to enable farmers and processors to produce a broader range of products; identifying alternative markets; conducting research to understand factors that influence competitiveness; and developing programs for rural communities to enhance entrepreneurial skills, create jobs, and diversify their economies.

Research Centers



Dr. Ajit Kelkar, Department of Nanoengineering, co-founder of Advaero Technologies

Economic development is a core function of N.C. A&T's research enterprise.

By the Numbers

Patents: 19

Pending patent applications: 28

Invention disclosures (FY2011): 13

Total invention disclosures: 113

Memoranda of Understanding & Teaming Agreements (FY2011): 22

Spin-off companies: 4

Advaero Technologies

N.C. A&T spinoff Advaero Technologies is a full-function composites company, specializing in engineering, design, materials testing, mold development and prototyping. Its initial customers are in the aerospace industry. The company was founded by faculty members Dr. Ajit Kelkar and Dr. Ronnie Bolick. It has licensed university-owned nanotechnology.

Advaero's staff is experienced in project management from concept to completion, providing options in the design path through first part and production.

Advaero's offices and labs are located in the Gateway University Research Park, adjacent to the Joint School of NanoScience and NanoEngineering. The company operates in a collaborative university research, teaching and commercial environment on the campus.

Gateway University Research Park

Gateway consists of two 75-acre research campuses, jointly developed by N.C. A&T and the University of North Carolina at Greensboro. It is the home of the Joint School of Nanoscience and Nanoengineering, also a joint initiative of the two universities. Commercial tenants include Advaero Technologies and the U.S. Department of Agriculture Natural Resources Conservation Service. When fully built out, Gateway will have a potential $50 million impact on the local economy and employ up to 2,000 people.

Commercialization Initiatives

As part of an strategic effort by the university to foster and enhance innovation, technology transfer, and entrepreneurship, three major programs have been advanced to compliment the University's research and academic programs within the context of its history as a land-grant institution.

The new initiatives include:

PRIDE (Partnership in Research, Innovation , Discovery and Entrepreneurship): Cultivating an innovation culture at NC A&T by teaching entrepreneurship basics, building networks of entrepreneurs both within and outside the University, engaging the community and promoting best practices in the commercialization of University intellectual property.

Technology Transfer Monitoring System (T2MS): Identifying and encouraging technology transfer throughout a research project's life cycle.

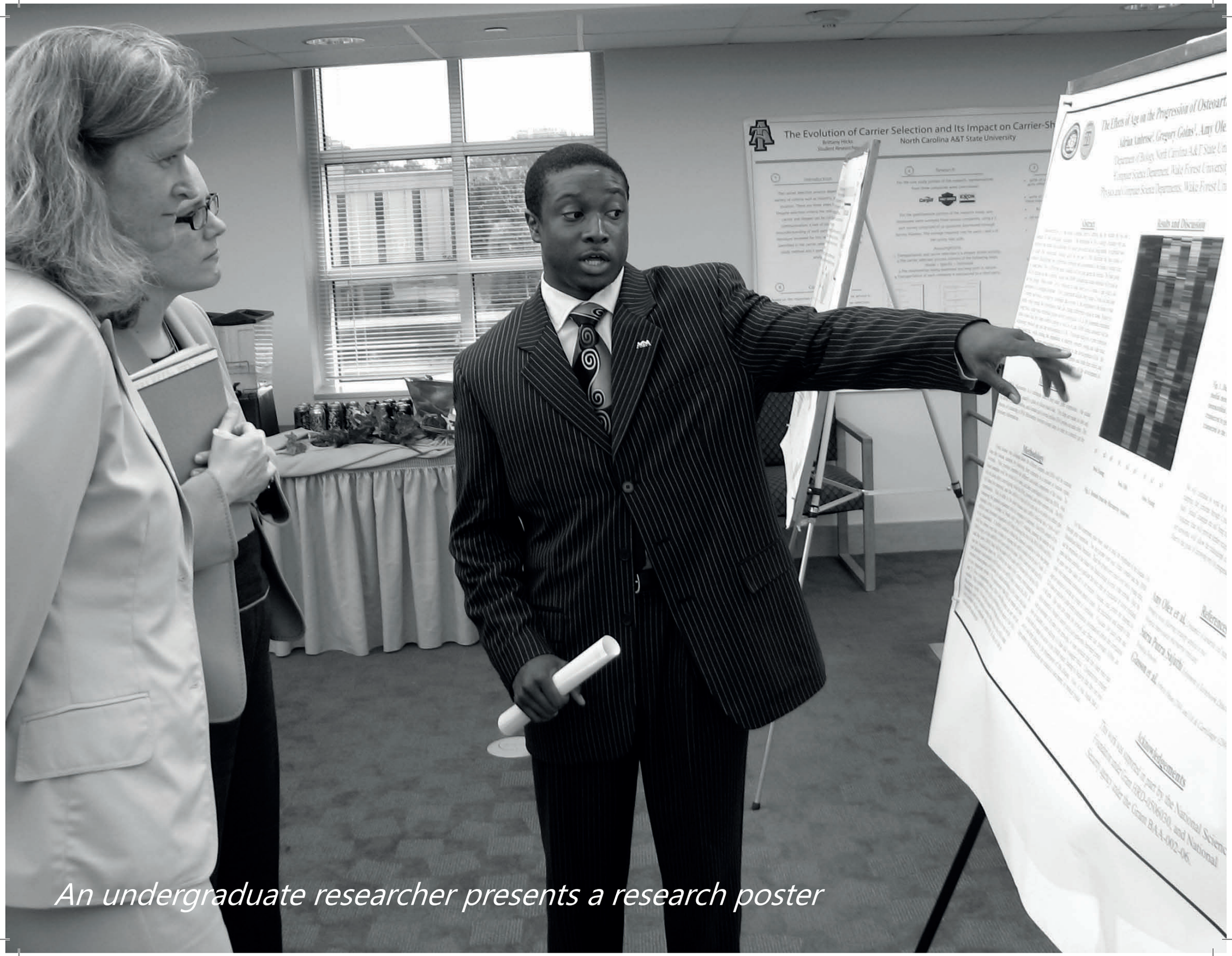
HIRED (High Impact Research for Economic Development): Identifying high-risk, high-payoff research that can be funded through federal SBIR/STTR and IDIQ programs.

The new programs complement these existing initiatives:

Colors of Innovation: Designed to engage faculty and students in innovation and discovery activities and discourse.

Community Innovation Partnership: An external advisory group focusing on improving communication, collaboration, and cooperation between academic researchers, local businesses/government, and the community.

Interdisciplinary Center for Entrepreneurship and E-Business: Located in the School of Business and Economics.



An undergraduate researcher presents a research poster

Research is an essential component of undergraduate and graduate education.

Graduate Education and Research

North Carolina A&T State University offers a range of masters and doctoral degree programs through the School of Agriculture and Environmental Sciences, College of Arts and Sciences, School of Business and Economics, School of Education, School of Technology, College of Engineering, and Joint School of Nanoscience and Nanoengineering. Major research programs include work in nanotechnology, computational science and engineering, energy and environment, food safety, health disparities, and leadership and community development.

Ph.D. Programs

Computational Science and Engineering
Electrical Engineering
Energy and Environmental Systems (three concentrations)
Industrial and Systems Engineering
Leadership Studies
Mechanical Engineering
Nanoengineering

Masters Programs

Agriculture
Agricultural Education (two concentrations)
Food and Nutritional Sciences

Arts and Sciences
Applied Mathematics
Biology
Chemistry
English and African American Literature
Physics
Social Work (offered jointly with UNCG)

Business
Management (three concentrations)
Human Resources Management

Education
Adult Education
Community Counseling (two concentrations)
Elementary Education
Physical Education
Reading Education
School Administration
School Counseling
Teaching (12 concentrations)

Engineering
Bioengineering
Chemical Engineering
Civil Engineering
Computational Science and Engineering
Computer Science
Electrical Engineering
Industrial and Systems Engineering
Mechanical Engineering
Nanoengineering

Technology
Information Technology
Instructional Technology
Technology Management

Research Experiences for Undergraduates

While research traditionally has been an integral part of graduate education, research experiences for undergraduates (REUs) evolved inconsistently across the campus, developing in some programs but not others. The School of Agriculture and Environmental Sciences and the College of Arts and Sciences both have REU programs, for example.

Now, a strategic initiative to increase such opportunities has begun with the establishment of the university's Office of Undergraduate Research. The office works with and promotes the variety of existing programs. It also is creating new opportunities, such as the Undergraduate Research Symposium, first held in September 2010, and the Undergraduate Research Day, held for the first time in April 2011.

The Patent Wall, Fort Interdisciplinary Research Center, 4th Floor

North Carolina A&T State University

Research Program

Total sponsored program funding for fiscal 2011: $60.5 million.

Current research portfolio: 228 active projects with a full value of $345 million.

Ranking in research funding within the UNC System: 3rd, behind UNC-Chapel Hill and North Carolina State University.

A public, land-grant university

Mission of education, research and extension.

Originally dedicated to education in agriculture and mechanical arts.

Academic and research strengths today in agriculture, engineering, science, and technology, particularly in interdisciplinary fields such as bioengineering, biomedical science and engineering, biotechnology, nanoengineering.

Founded: 1891

Graduate programs initiated: 1939

Location: In the city of Greensboro in the Piedmont Triad region of central North Carolina

Greensboro is 300 miles south of Washington, D.C., and 350 miles north of Atlanta.

Campus: 188 acres in east Greensboro

492-acre research farm

150-acre Gateway University Research Park, divided roughly in half between the park's South Campus, about two miles east of N.C. A&T, and North Campus, about 11 miles north of A&T in Brown Summit, North Carolina. Gateway is operated jointly by N.C. A&T and the University of North Carolina at Greensboro.

Center of Excellence in Post-Harvest Technologies, located at the North Carolina Research Campus in Kannapolis, North Carolina

A constituent institution of The University of North Carolina

Colleges and Schools

School of Agriculture and Environmental Sciences
College of Arts and Sciences
School of Business and Economics
School of Education
College of Engineering
School of Nursing
School of Technology
Joint School of Nanoscience and Nanoengineering (operated with the University of North Carolina at Greensboro)

Enrollment

10,882 students in Fall 2011
Undergraduate 9,207
Masters 1,438
Doctoral 237
Fall 2010 Enrollment by Gender: Female 54%, Male 46%
Fall 2010 Enrollment by Ethnicity: African American 85%, White 7%, Hispanic 2%, Asian 1%, Unidentified 2%, International 2%

Key Facts

Established Joint School of Nanoscience & Nanoengineering in collaboration with UNC Greensboro.

Ph.D. programs in Computational Science & Engineering and Industrial Engineering are the only such degree programs among HBCUs.

Lead institution for a National Science Foundation Engineering Research Center (ERC). Only HBCU to lead an ERC.

Host university for a NOAA Science & Technology Center.

Top producer of African-American engineers at the B.S. degree level.

Largest school of agriculture among HBCUs.

Top producer of African-American CPAs in the country.

Research @ North Carolina A&T State University

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