REQUEST FOR AUTHORIZATION TO ESTABLISH

THE

DOCTOR OF PHILOSOPHY

IN

ENERGY & ENVIRONMENTAL STUDIES PROGRAM

SUBMITTED BY

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REQUEST FOR AUTHORIZATION TO ESTABLISH THE
DOCTOR OF PHILOSOPHY IN ENERGY & ENVIRONMENTAL STUDIES

EXECUTIVE SUMMARY

The establishment of an interdisciplinary Doctor of Philosophy (Ph.D.) program in Energy & Environmental Studies is proposed. The program is a full-time program designed to prepare men and women for highly specialized positions in research and consulting in industry, government and service organizations, and teaching and research positions in colleges and universities. The interdisciplinary nature of this program will mean that students from across the Colleges and Schools of the University will be engaged in energy and environmental research. This diversity of backgrounds and preparation will contribute to a unique teaching and learning environment for students and faculty alike. While students will be permitted to pursue a plan of study individualized to their interests, all will be connected through a required group of selected core courses, common research themes, use of common research laboratories, and a program office housed within the School of Graduate Studies. The capacity of North Carolina A&T State University (NC A&T) to offer the Ph.D. in Energy and Environmental studies is excellent, and the need for the program is great. The program will uniquely prepare students to meet environmental and interrelated energy challenges that are changing rapidly because of societal expectations concerning socioeconomic status, health, and environmental quality.

The program will be built upon the strengths of existing M.S. programs related to energy and environmental research, lateral use of existing Ph.D. programs, and existing governmental and industrial partnerships in energy and environmental areas. Research programs, facilities, and courses in current NC A&T energy and environmental related M.S. programs will provide a solid foundation on which to build the proposed Ph.D. program. The program will also be supported by the current and emerging research strengths in the University’s Interdisciplinary Institutes, Centers, and Programs (Waste Management Institute, Center for Energy Research and Technology, Center for Environmental Remediation and Pollution Prevention, Transportation Institute, Center for Environmentally Responsible Solvents and Processes, Department of Energy Chair of Excellence Program, and Biotechnology Program) and Ph.D. programs in Electrical, Mechanical and Industrial Engineering. The University’s educational and research infrastructure and the energy and environmental related courses that have been developed to support existing NC A&T M.S. and Ph.D. programs will be utilized in the program.

Energy and environmental professions and issues are broad. Individuals who are committed to scholarly excellence with interests in energy and environmental issues will be attracted to the program. The students entering the program are expected to have degrees in engineering, education, agriculture, physical, biological and computational sciences, technology, or business and economics. The Ph.D. program will begin with the following research areas: Energy and Environmental Science and Engineering, Pollution Prevention and Remediation, and Energy and Environmental Education and Security. Research in these areas will be expanded in the future to include the following areas: Natural Resource Management, Nuclear and Other Alternate Energy Technologies, Energy Efficiency, Energy and Environmental Information Technology, Energy Management, Environmental Policy, and Occupational and Environmental health. Graduates of the program will be able to conceive, develop, and conduct original research
leading to useful applications in energy and environmental systems; make decisions that incorporate the scientific, technical, managerial, and social aspects of energy and environmental systems; contribute to societal understanding of global energy and environmental issues including homeland security through development of interdisciplinary educational materials and participation in international exchanges; and demonstrate written and oral communication skills related to issues in energy and environmental systems.

The energy and environmental faculty at North Carolina A&T State University have good track records of scholarly productivity. The current level of research funding for the Interdisciplinary Energy and Environmental Centers and Institutes of the University is approximately $4 million/year. Over the past 5 year period (1998-2003), the total research funding has been $20 million.

Probable student demand for this interdisciplinary program can be demonstrated by examining enrollment figures for NC A&T’s M.S. programs that would likely be a primary feeder system to the proposed program. Graduates of these programs represent a pool of potential applicants to the Energy & Environmental Studies program. For Fall 2003, approximately 650 students were enrolled in M.S. programs in engineering, agriculture and other sciences, technology, and business. The increase in graduate enrollments in the University’s Interdisciplinary Advanced Waste Management Institute Certificate Program is another indicator of student interest in advanced study in this area. The number of Advanced Waste Management Certificate recipients increased by 30% in 2003 and is expected to double in 2004. NC A&T’s program also will likely attract students from NCCU, UNC-A, UNC-W, and other UNC system undergraduate and M.S. level environmental programs who are interested in the synergies, interactions, and blended impacts of energy, environment, and policy issues. It is also expected that students from out of state and international students will interested in applying for this degree.

Some of the UNC campuses offer doctoral level environmental science and engineering programs. These related programs are UNC Chapel Hill’s Ph.D. program in environmental sciences and engineering and NC State’s Ph.D. program emphasizing water resources and environmental engineering through the Department of Civil Engineering and other Ph.D. programs in marine science, atmospheric science, and earth sciences. Duke University has Ph.D. programs in civil and environmental engineering, ecosystems science, ecology, geochemistry, and climatology. Additionally, an interdisciplinary Ph.D. in Infrastructure and Environmental Systems at UNCC has been approved for implementation. The proposed Ph.D. program in Energy and Environmental Studies at NCA&T distinguishes itself from the aforementioned Ph.D. programs in that the program will uniquely prepare students to meet environmental and interrelated energy challenges that are changing rapidly because of societal challenges concerning socioeconomic status, health, and environmental quality. All students will be required to consider economic, legal, ethical, and social considerations of the technology that they study in their dissertations as well as take a core group of required courses taught by interdisciplinary teams of faculty. These core courses will expose them to different theoretical and professional perspectives relating to environmental and energy issues. This interdisciplinary approach also will employ a variety of teaching methodologies including case studies to present science, engineering, technology, economic, and social science aspects of energy and the environment in an integrated manner. The credit hours required for the program will be 51 credit hours beyond the M.S.
degree. Of these 51 credit hours, 27 credit hours will be for course work, 3 credit hours for seminars, 3 credit hours for professional practice/development, and 18 credit hours are for dissertation research.

The proposed Ph.D. program in Energy and Environmental Studies will be managed by a Program Director (PD) who will report to the Dean of the School of Graduate Studies. The PD will be equivalent to a department chair. The PD will manage the budget, including faculty positions assigned to the program. The University has an Assessment and Program Evaluation Process in place that is used for all programs on campus. The proposed Ph.D. program will be added to the rotation schedule and be assessed and evaluated on a five year rotation beginning five years from initiation. The date of initiation of the program is the fall semester of 2005.

In summary, the proposed Ph.D. in Energy and Environmental Studies is built upon a foundation of successful master’s level programs in almost all the schools and colleges at NC A&T. The faculty has demonstrated their capacity to support the research programs required for a successful Ph.D. program. The facilities are already in place for the first group of students to enroll and plans are being developed to provide space in the future as the program grows. Everything is ready to start this interdisciplinary Ph.D. in Energy and Environmental Studies in August 2005.
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REQUEST FOR AUTHORIZATION TO ESTABLISH A NEW DEGREE PROGRAM
THE UNIVERSITY OF NORTH CAROLINA

Constituent Institution: North Carolina Agricultural and Technical State University
CIP Discipline Specialty Title: Energy and Environmental Studies (Interdisciplinary)
CIP Discipline Specialty Number: 30.9999 Level: B M 1st Prof. D X
Exact Title of the Proposed Degree: Energy and Environmental Studies (Interdisciplinary)
Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.) Ph.D.
Does this proposed program constitute a substantive change as defined by SACS? Yes No X
a) Is it at a more advanced level than those previously authorized Yes No X
b) Is the proposed program in a new discipline division: Yes No X
Proposed date to establish degree program: August, 2005
Do you plan to offer the proposed program away from campus during the first year of operation? Yes No X
I. DESCRIPTION OF THE PROGRAM

A. Describe the proposed degree program (i.e., its nature, scope, and intended audience).

Introduction
The establishment of an interdisciplinary Doctor of Philosophy (Ph.D.) program in Energy & Environmental Studies is proposed. This program is designed to prepare men and women for highly specialized positions, for research and consulting in industry, government and service organizations, and for teaching and research positions in Colleges and Universities. The interdisciplinary nature of this program will mean that students from across the Colleges and Schools of the University will be engaged in energy and environmental research. This diversity of backgrounds and training will contribute to a unique teaching and learning environment for students and faculty alike. While students will be permitted to pursue a plan of study individualized to their interests, all will be connected through a required group of selected core courses, common research themes, use of common research laboratories, and a program office housed within the School of Graduate Studies.

The capacity of North Carolina A&T State University (NC A&T) to offer the Ph.D. in Energy and Environmental Studies is excellent, and the need for the program is great. The Environmental Protection Agency (EPA) and other agencies have begun to recognize the need to embrace an interdisciplinary skill mix as well as the way work is accomplished to meet the energy and environmental challenges of this new century.

The University already awards M.S. degrees (with a focus on energy and environmental issues) in Animal Health and Science, Soil and Environmental Science, Industrial Technology (Occupational Safety and Health and Manufacturing), Physics, Chemistry, Biology, Chemical Engineering, Civil Engineering, Computer Science, Mathematics, Electronics and Computer Technology, Agricultural Education, Agricultural Economics, Mechanical Engineering, Industrial Engineering, Electrical Engineering and Management and Transportation. This is an opportunity to build upon on-going research activities in energy, pollution prevention and remediation, and environmental education and security. Several M.S. theses (see Appendix A) have been written on the above topics. Our M.S. graduates and current M.S. candidates are expressing interest in pursuing the doctoral degree in Energy and Environmental studies. NC A&T researchers and administrators are well prepared to cross disciplines, integrate diverse information, and collaborate to solve energy and environmental problems.

Elective courses and dissertation research will provide the program with depth (i.e., specialization) while the common core courses and interdisciplinary research themes will provide breadth (i.e., interdisciplinary experience). The core courses will provide the student with the opportunity to study the interactions between energy generation and use with environmental issues and concerns. Threaded throughout the core courses are economic and management issues along with data acquisition. From these core courses and the student’s previous academic experiences, the student should develop a research interest that will be supported by elective courses. Most of the elective courses are already available on campus in a
variety of business and economics, education, engineering, sciences, technology, and agricultural programs, but some new courses can be expected to be developed to reflect emerging trends in energy and environmental research.

The proposed interdisciplinary PhD in Energy and Environmental Studies supports the vision of NC A&T State University, which believes in the interaction and interdependence among energy production and consumption, environmental consequences, and economic growth (see Figure 1). To facilitate understanding of this vision, these concepts and their relationships are described below.

Energy is expressed by (a) radiation, chemical energy, atomic energy, electromagnetic energy, electrical energy, and heat energy; (b) environment is the complex set of physical, biological, chemical, social, cultural, legal, and political conditions that surround and affect an organism, community, material, or energy; and (c) economic growth is the increase in the actual value of goods and services produced by an economy.

The relationships among these concepts are that energy production and consumption are essential for economic growth. The achievement of economic growth demands investment in energy production. Energy production and consumption may have degradation consequences in the environment. These environmental consequences may dictate necessary decrease in energy production and consumption, which will also lead to a decrease in economic growth and resource management. Therefore, scientific, technological, ethical, legal, and social advances are necessary to mitigate the negative impact of energy production and consumption and economic growth on the environment.

Figure 1. Interdisciplinary Ph.D. in Energy and Environmental Studies’ Conceptual Framework
Interdisciplinary Areas of Research
The energy and environmental professions and issues are broad. Individuals who are committed to scholarly excellence with interests in energy and environmental issues will be attracted to the program because it brings together the necessary disciplines to identify and propose solutions to the challenges in meeting the energy demands while considering the environmental issues. The students entering the program are expected to have degrees in one of the following: engineering, education, agriculture, physical, biological or computational science, technology, business, or economics. These fields encompass the various levels of the waste and energy use hierarchy including pollution prevention, resource and energy conservation, renewable energy technologies, recycling/reuse, and waste treatment and disposal. Future areas of study will be identified and added according to new research initiatives and faculty qualifications.

Selected Research Areas
The Ph.D. program in Energy and Environmental Studies will begin with the following research areas and thoughtfully other areas that emphasize energy and environmental issues.

1. Energy and Environmental Science and Engineering
This interdisciplinary research area is for students who have previous undergraduate or graduate degrees in science and related engineering disciplines. It is designed to produce professionals who understand basic management skills along with interdisciplinary technical expertise in topics related to energy and complex environmental systems. The goal of this interdisciplinary area is to produce innovators in the application of renewable and non-renewable energy sources, the advancement of energy and environmental security, and the design of sustainable processes. Research topics include, but are not limited to, energy technologies (solar, wind, biomass, fuel cells, and hydrogen fuel infrastructure), energy efficiency, membrane separations, advanced research in experimental nuclear physics, catalysis, reactive separations, multiphase transport, co-generation, energy distribution, power electronics, built environments, advanced pollution control concepts, energy storage technologies, use of nanotechnology, sensors and controls, development of advanced detection systems and sensors for nuclear radiation, innovative waste heat recovery, corrosion prevention, sustainable manufacturing (environmentally benign solvents and processes, life-cycle analysis, remanufacturing, recycling, biodegradable materials, risk assessment), energy and environmental information technology, and systems science and engineering.

2. Pollution Prevention and Remediation
This interdisciplinary research area is for students who have previous undergraduate or graduate education in science and social science disciplines. It is designed to produce professionals with basic management skills along with interdisciplinary technical expertise in topics related to energy and complex environmental systems. The goal of this interdisciplinary area is to produce professionals who are innovators in the application of energy resources, the advancement of energy and environmental security, and the design of sustainable processes. Research topics include, but are not limited to, research and theory applied to supercritical carbon dioxide, separation processes, fate and transport of contaminants, bioremediation, bio-processing, quantitative risk assessments, risk management and economics, waste management, water quality, air quality, ecosystem modeling, risk assessment and economics, bio-processing, bioremediation, fate and transport of contaminants, separation processes, regulatory processes, and long term environmental
monitoring, development and application of geophysical techniques, environmental justice, and systems management and economics.

3. Energy and Environmental Education and Security
This interdisciplinary research area is for students with previous undergraduate or graduate education in education, science and social science disciplines. It is designed to produce professionals with a broad education in social and applied sciences with interdisciplinary expertise in topics related to energy and the environment. The goal of this interdisciplinary area is to produce innovators in enhancing effective communication about complex environmental security issues among the scientific community, managers, policy makers, K-12 schools, and the public. Research topics include, but are not limited to, application of technological tools for assessment and evaluation of environmental education and environmental security issues to understand waste management, water quality, air quality, ecosystem modeling, pollution prevention, risk assessment and economics, bio-processing, bioremediation, fate and transport of contaminants, separation processes, regulatory processes, and long term environmental monitoring, environmental justice, and systems education and technology.

Special Features of the Program
The special features of the Ph.D. curriculum include:

• **An** interdisciplinary approach to researching energy and environmental problems.

• **A** Ph.D. dissertation that will include the economic, legal, ethical, and social considerations of the technology that has been studied.

• Interdisciplinary teams of faculty who will teach a core group of courses using a variety of teaching methods including case studies to present science, engineering, technology, economic, and social science aspects of energy and the environment in an integrated manner.

• A research internship as part of the program curriculum. Research partnerships and internships will be arranged with state organizations such as the Department of Environment and Natural Resources, with federal organizations such as the Department of Energy (DOE), the Department of Homeland Security (DHS), the National Renewable Energy Laboratory (NREL), the Environmental Protection Agency (EPA), Central Intelligence Agency (CIA), Centers for Disease Control (CDC), and with private companies such as Ford Motor Co. and Enviro-Tech Enterprises. The University will seek funding from these agencies/companies to provide paid internships for their placements.

• Development and use of unique energy and environment related remote experiments to be shared with K-12 schools and other universities.

B. **List the educational objectives of the program.**
Graduates of the interdisciplinary Energy and Environmental Studies Ph.D. program will be able to:
1. Conceive, develop, and conduct original research leading to useful applications in energy and environmental systems.
2. Incorporate into their professional work considerations relating to scientific, technical, managerial, and social aspects of energy and environmental systems.
3. Contribute to societal understanding of global energy and environmental issues including homeland security through development of interdisciplinary educational materials and participation in international exchanges.
4. Demonstrate effective written and oral communication skills related to research issues in energy and environmental systems.

C. Describe the relationship of the program to other programs currently offered at the proposing institution, including the common use of: (1) courses, (2) faculty, (3) facilities, and (4) other resources.

(1) Courses

The program is built around the strengths of existing M.S. program related to energy and environmental research, lateral use of existing Ph.D. programs, and existing governmental and industrial partnerships in energy and environmental areas. Research programs, facilities, and courses in current NC A&T energy and environmental related M.S. programs will provide a solid foundation on which to build the proposed Ph.D. program. The program will also be supported by the current and emerging research strengths in the University’s Interdisciplinary Institutes, Centers, and Programs (Waste Management Institute, Center for Energy Research and Technology, Center for Environmental Remediation and Pollution Prevention, Transportation Institute, Center for Environmentally Responsible Solvents and Processes, DOE Chair of Excellence Program, and Biotechnology Program) and Ph.D. programs in Electrical, Mechanical and Industrial Engineering. The energy and environmental related courses that have been developed to support existing NC A&T M.S. and Ph.D. programs will be utilized in the proposed program. The existing courses that will be utilized are listed in Appendix B.

(2) Faculty

The faculty for this interdisciplinary Ph.D. program are currently teaching and conducting research in the disciplines encompassed by this program. New faculty will be hired to add expertise in key areas for program growth. Qualified adjunct faculty will also help to provide the program with strength in emerging areas of energy and environmental research.

The energy and environmental faculty at North Carolina A&T State University have substantive records of scholarly productivity. The current level of research funding for the Interdisciplinary Energy and Environmental Centers and Institutes of the University is approximately $4 million/year. Over the past 5 years period (1998-2003), the total research funding has been $20 million. The research accomplishments of the faculty are presented in Appendix C.
To effectively meet the needs of interdisciplinary research, the University enhanced its technology infrastructure by establishing an Interdisciplinary Research Center (Fort-IRC). This facility along with other centers and institutes across campus will provide the facilities and equipment needed for the faculty and students to conduct interdisciplinary research on energy and environmental issues. The list of centers, institutes and laboratories that directly relate to energy and environmental issues are listed in section VI. Facilities and Equipment.

(4) Other Resources
North Carolina A&T has ongoing partnerships with state and federal laboratories whose facilities are available for research activities.

II. JUSTIFICATION FOR THE PROGRAM – NARRATIVE STATEMENT
A. Describe the proposed program as it relates to: (1) the institutional mission and strategic plan, (2) student demand, (3) societal need, and (4) the impact on existing programs of your institution

(1) The institutional mission and strategic plan
The interdisciplinary degree programs at North Carolina A&T State University play a prominent role in the drive to fulfill the institutional mission. Through the strategic visioning process called FUTURES the University has established five goals in support of the mission and vision of an interdisciplinary North Carolina A&T State University. The program is related to the following goals:

- Establish and ensure an interdisciplinary University focus that mandates overall high quality and continued competitiveness and effectively involves global strategic partners in the marketing and delivery of programs and operations.

- Deliver visionary and distinctive interdisciplinary academic studies, research, and service and include global collaborations and partnerships as part of the learning experience.

- Enhance and diversify the University's resource base through effective fundraising and entrepreneurial initiatives.

The program will be an extension of successful existing interdisciplinary programs at the master’s levels to the doctoral level. The University's FUTURES vision states that the “creation of an interdisciplinary educational environment is a necessary response to the ever-present societal and intellectual issues that require new solutions outside of traditional disciplinary boundaries.” The Interdisciplinary University will serve the needs of both individuals and groups who seek opportunities for continuous growth.

(2) Student demand {Replace this section with the corresponding section from Executive Summary above}
The student demand for this interdisciplinary program can be demonstrated by the NC A&T enrollments in MS level programs that are basic to the proposed program. In the Fall 2003, there were approximately 650 students enrolled MS programs in engineering, agricultural and other
sciences, and technology, and business. All of these and many more at other universities will be eligible to enter the proposed program upon graduation. The student demand will grow with the increased emphasis on solving the energy and environmental issues that are already present and the issues that will arise as our population continues to grow. The increase in graduate enrollments in the University’s Interdisciplinary Waste Management Institute Certificate Program is an indicator of student interest in advanced study in this area. The advanced Waste Management Certificate recipients increased by 30% in 2003 and are expected to double in 2004.

(3) Societal need
A recent study on the number of doctoral degrees awarded in science and engineering by United States universities over the past 10 years indicates that an investment in NC A&T’s proposed program is well justified. The following facts are summarized based on data obtained from the National Science Foundation, National Council for Science and the Environment: and local newspaper reports:

- Only four percent of African-Americans received a doctoral degree in science and engineering in 2002.
- In the last 10 years, research dollars in United States have significantly increased, resulting in an increased need for environmental researchers and educators.
- United States environmental R&D allocations have steadily increased and are expected to continue to increase.
- More African-American professors are definitely needed, especially at Historically Black Colleges and Universities (HBCU). The Energy and Environmental programs among HBCUs are steadily increasing. None of the HBCUs are currently offering a Ph.D. in Pollution Prevention and Remediation, Energy and Environmental Science and Engineering and Energy and Environmental Education and Security.
- North Carolina ranks eighth in the nation in manufacturing; it is important to the state to produce more environmental educators, energy, and pollution prevention experts with Ph.D. degrees.

One of the most important technical challenges of the twenty-first century is the discovery of breakthroughs that are required to allow us to shift civilization from dependence on energy derived from fossil fuels to energy from, first, nuclear power and, ultimately, sunlight. The Environmental Protection Agency (EPA) and other agencies have begun to recognize the need to consider an interdisciplinary skill mix as well as the way work is accomplished to meet the challenges of this new century. To respond to this need an interdisciplinary Doctor of Philosophy (Ph.D.) program in Energy & Environmental Studies is proposed to produce the experts needed to meet this challenge. These experts will need to be innovators in the application of energy sources, the advancement of energy and environmental security, and the design of sustainable processes. This program is designed to prepare men and women for highly specialized positions, for research and consulting in industry, government and service organizations, and for teaching and research positions in Colleges and Universities.

The need for the proposed program that provides an integrated approach to energy and environmental systems education and research has been highlighted in recent policy statements emanating from a variety of sources. In his 2003 State of the Union address, President Bush
announced a $1.2 billion hydrogen initiative to reverse America’s growing dependence on foreign oil and reduce greenhouse gas emissions:

With a new national commitment, our scientists and engineers will overcome the obstacles … so that the first car driven by a child born today could be powered by hydrogen, and pollution-free. Join me in this important innovation to make our air significantly cleaner, and our country much less dependent on foreign sources of energy.
-President Bush, State of the Union Address, January 28, 2003

A 2004 report National Academies report on the Department of Energy’s hydrogen program concludes that:

A transition to hydrogen as a major fuel in the next 50 years could fundamentally transform the U.S. energy system, creating opportunities to increase energy security through the use of a variety of domestic energy resources for hydrogen production while reducing environmental impacts, including atmospheric CO₂ emissions and criteria pollutants.
-The National Academies, Committee on Alternatives and Strategies for Future Hydrogen Production and Use, February 2004

The importance of these policy initiatives is highlighted in a 2004 Department of Energy report:

Energy is the life-blood of our Nation. It is the mainstay of our standard of living, economy, and national security. In the United States demand for oil is projected to increase by nearly 50 percent by 2025. Petroleum imports already supply more than 55 percent of U.S. domestic needs, and those imports are projected to increase to more than 68 percent by 2025. Our growing dependence on foreign sources of energy threatens our national security. As a Nation, we must work to reduce our dependence on foreign sources of energy in a manner that is affordable and preserves environmental quality. Clean forms of energy are needed to support sustainable global economic growth while mitigating impacts on air quality and the potential effects of greenhouse gas emissions.

In the same report, the need for the broad approach to energy and environmental systems that is encompassed in the proposed Ph.D. program is highlighted:

Technical challenges to achieving a hydrogen economy include lowering the cost of hydrogen production, delivery, storage, conversion, and end-use applications. Additional needs include effective building codes and equipment standards to address safety issues as well as outreach and education campaigns to raise awareness, accelerate technology transfer, and increase public understanding of hydrogen energy systems.

Finally, this report highlighted the need for an international effort to meet these challenges. The report lists the members of the International Partnership for the Hydrogen Economy – Australia, Brazil, Canada, China, European Community, France, Germany, Iceland, India, Italy, Japan, Norway, Republic of Korea, Russia, United Kingdom, and United States. The proposed program
is designed to provide students with the kinds of skills and expertise necessary to operate in a global research effort.

(4) The impact on existing programs of your institution
The impact on the three Engineering programs currently offering a Ph.D. degree will be different than the impact on the programs only offering the M.S. degree. For the latter programs, the interdisciplinary Energy & Environmental Studies Ph.D. degree will provide a much needed vehicle to take ongoing research and study to a more advanced level. The sharing of faculty, courses, and facility resources that will be part of the interdisciplinary program, as well as access to Ph.D. quality students, will offer opportunities to both students and faculty to be more productive and part of a stimulating research environment. The management of the Energy & Environmental Studies Ph.D. program will reside in the School of Graduate Studies.

B. Discuss potential program duplication and program competitiveness
   (1) Identify similar programs offered elsewhere in North Carolina. Indicate the location and distance from the proposing institution. Include a) public and b) private institutions of higher education.

The interdisciplinary degree program will be unique in the state of North Carolina. The program will provide a basis for understanding and resolving complex environmental and interrelated energy and environmental problems facing both industrial societies and developing nations.

Some UNC campuses offer doctoral level environmental science and engineering programs. These related programs are UNC Chapel Hill’s Ph.D. program in environmental sciences and engineering and NC State’s Ph.D. program emphasizing water resources and environmental engineering through the Department of Civil Engineering and other Ph.D. programs in marine science, atmospheric science, and earth sciences. Duke University has Ph.D. programs in civil and environmental engineering, ecosystems science, ecology, geochemistry, and climatology. Additionally, an interdisciplinary Ph.D. in Infrastructure and Environmental Systems at UNCC has been approved for implementation.

The Department of Environmental Sciences and Engineering at The University of North Carolina at Chapel Hill was founded in 1921 as a program of instruction and research in sanitary and civil engineering. Since that time, it has become one of the largest graduate environmental education and research programs in the United States with a select undergraduate program as well, a department with 35 primary faculty, 36 adjunct faculty, 149 graduate students, and over 2200 graduates.

At Chapel Hill, the Ph.D. program in Environmental Science and Engineering specializes in Air Radiation and Industrial Hygiene, Aquatic and Atmospheric Sciences, Environmental Engineering, Environmental Management and Policy, and Environmental Modeling. In this program, there is an integration of engineering, science, and policy. The environmental graduate degrees are granted through the departments of anthropology, biology, business, city and regional planning, ecology, environmental sciences and engineering, geography, marine sciences and public policy. The Department of Environmental Sciences and Engineering integrates environmental science, engineering and policy analysis collaborates with units in UNC's School of Public Health; School of Medicine; Kenan-Flager School of Business; Department of Biology,
Chemistry, City and Regional Planning, Economics, Geology, Marine Sciences, Mathematics and Curricula in Ecology, Public Policy Analysis, and Toxicology.

The Department of Environmental Sciences and Engineering houses a number of research laboratories involved in important research in groundwater, wastewater, and drinking water quality, atmospheric chemistry, air pollution, industrial engineering, mutagenic effects of environmental chemicals, and occupational health and safety. In addition to more traditional analytical laboratory settings, the department also houses labs for modeling and computational analysis of environmental systems, such as atmospheric circulation and air quality models; ground and surface water flow and transport models; fluid flow and contaminant transport models for indoor air environments; exposure analysis and health effects; risk assessment; and environmental epidemiology.

At North Carolina State University (NCSU), a Ph.D. program in water resources and environmental engineering is offered through the Department of Civil Engineering, which also offers other areas of specialization including: computer-aided engineering, construction engineering and management, structural engineering and materials, coastal and ocean engineering, geotechnical and geo-environmental engineering, and transportation systems. Graduate students are encouraged to take supporting courses in a second area of specialization in civil engineering or the strong supporting programs in other departments of the University, including mathematics, statistics, computer science, operations research, business, economics, public administration, city and regional planning, marine, earth and atmospheric sciences, and others. Ph.D. candidates may designate formal minors; however, if minors are designated, they must be developed outside the Civil Engineering.

NCSU has also developed strength in industrial ecology. Additional Ph.D. programs related to environmental analysis are in marine science, atmospheric science, and earth science. These programs are operated through regular academic programs that are focused largely on those specific disciplines. A recently established Ph.D. program in environmental design is offered through the School of Design. This is neither a natural science nor an engineering-based program, but is geared towards environmental landscaping and architecture. A Ph.D. in Toxicology is offered through the College of Agriculture and Life Sciences with a concentration in Environmental Toxicology.

At Duke University, the Ph.D. program offered through the Department of Environmental and Civil Engineering is mostly focused on water quality modeling/hydrology and solid mechanics/geomechanics/structures. A separate School of the Environment operates Ph.D. programs in ecosystems science, ecology, geochemistry, and climatology.

At Charlotte, a Ph.D. program in Infrastructure and Environmental Systems has been authorized for implementation. The proposed Ph.D. program in Infrastructure and Environmental Systems (INES) provides advanced interdisciplinary studies of the relationship between infrastructure and the environment and the relationship between design, science, and management. It is through this interdisciplinary, systems-based approach that optimal solutions to infrastructure and environmental challenges will be accomplished. The program involves faculty from several academic units: Civil Engineering, Geography and Earth Sciences, Economics, Chemistry,
Biology, and Architecture. A total of 46 faculty members from these departments have agreed to be directly involved with the program.

The proposed interdisciplinary Ph.D. program in Energy and Environmental Studies at NC A&T offers no duplication of existing programs and is the only program in related areas that requires the inclusion of a discussion of the economic and social considerations of the technologies studied in the dissertation. Further, all students will take a core group of required courses taught by interdisciplinary teams of faculty using case studies to present science, engineering, technology, economic, and social science aspects of energy and the environment in an integrated manner.

(2) Indicate how the proposed new degree program differs from other programs like it in the University. If the program duplicates other UNC programs, explain a) why is it necessary or justified and b) why demand (if limited) might not be met through a collaborative arrangement (perhaps using distance education) with another UNC institution. If the program is a first professional or doctoral degree, compare it with other similar programs in public and private universities in North Carolina, in the region, and in the nation.

The focus of the proposed program is substantially different from the three engineering Ph.D. programs and that, while there may be some overlap in subject matter the multidisiplinary approach to the curriculum will be qualitatively different from the programs offered in the College of Engineering. It is expected that the University’s energy and environmental efforts that now exist in individual programs/departments will be unified under one interdisciplinary doctoral degree program in Energy and Environmental Studies. NC A&T’s program will attract students from NCCU, UNC-A, UNC-W, and other UNC undergraduate and M.S. level environmental programs who are interested in the synergies, interactions, and blended impacts of energy, environment, and policy issues.

National Comparison
Regionally, there are several respected universities outside of North Carolina and within a few hours of NC A&T that offer programs having some of the components in the proposed program:

- Clemson University offers three Ph.D programs through its School of the Environment: Environmental Engineering and Science, Geological Sciences, and Environmental Toxicology. These Ph.D. programs focus on the impacts of pollution on human health and the maintenance of a balanced and healthy ecosystem.

- At the University of South Carolina in Columbia, South Carolina, the Department of Civil Engineering offers a Ph.D. degree with focus areas in environmental, geotechnical, structural, and water resources engineering. An M.S. level interdisciplinary program attracts students interested in the management of earth and environmental resources.

- The Civil and Environmental Engineering Department at Virginia Polytechnic Institute and State University (Virginia Tech) in Blacksburg, Virginia, offers Ph.D. degrees in Civil Engineering with emphases in civil infrastructure, environmental, geo-environmental, and systems engineering. Virginia Tech also offers traditional Ph.D. degrees in Environmental Engineering and Environmental Science and Engineering.
The emerging trend in doctoral education is to remove barriers that discourage students from studying and working together in an interdisciplinary, systems-oriented setting. Notable examples of these programs in the area of Environmental Science and Engineering are listed below.

**The Environmental Sciences Institute at Florida A&M University** offers programs in environmental sciences at the bachelor’s, the Master’s and the Ph.D. degree levels. The B.S. degree program is a 120 credit hour program, the master’s program is a 36 credit-hour program including 6 thesis hours, and the Ph.D. degree program is an 80 credit-hour program including 24 dissertation credit hours. The minor in environmental sciences, available to graduate and undergraduate honors students, prepares students from diverse study areas for environmental science careers. Students add to their disciplinary strength the knowledge and skills necessary to meet present and future environmental restoration/waste management demands. The environmental science option totals 18 semester hours and may be structured from core courses.

{How will the NC A&T program will be distinctive from Florida A&M? Match format to observation re: UT at Arlington.}

**The Environmental Science and Engineering Doctoral Program at the University of Texas at Arlington** is a national model for the proposed program in its integrated multidisciplinary approach to environmental education for students who have earned science or engineering undergraduate degrees. Students develop the diverse background and broad perspective necessary for resolving environmental problems. Academic units involved in the administration of this program are: Biology, Chemistry, Biochemistry, Civil and Environmental Engineering, Geology, and Urban and Public Affairs. The program integrates earth science, engineering, mathematics, ecology, risk assessment, and public policy. The inclusion of policy and planning courses brings into a student’s program an understanding of the forces (e.g., regulatory and political) that shape implementation of alternative environmental science and engineering solutions.

The NC A&T program will be distinctive from the University of Texas program in its inclusion of chemical, electrical, industrial, and mechanical engineering to allow the energy related aspects of environmental problems to be explored.

**The Environmental Science and Engineering (ESE) Doctoral program at the Oregon Graduate Institute (OGI)** was founded more than 30 years ago, making it one of the oldest ESE programs in the country. Students enrolled in the ESE program have diverse backgrounds, but most have undergraduate majors in chemistry, physics, civil engineering, chemical engineering, geology, biology, or environmental science. Graduate courses are drawn from chemistry, hydrology, microbiology, estuarine and coastal processes, risk assessment, and environmental law. One course must be taken from 3 of the following 4 disciplines: applied mathematics, chemistry, fluid dynamics, and biology. One course must be taken from 2 of the following three media groups: surface waters, groundwater, and air. Up to 8 credits may be granted for approved participation in non-thesis research or for approved work as an intern with an environmental consulting firm, nonprofit group, research laboratory, or government agency. Most of the 53 Ph.D. graduates are faculty; scientists at laboratories of the U.S. Environmental Protection Agency, U.S. Geological...
OGI also offers an Environmental Information Technology (EIT) Doctoral program that began in Fall 2001. EIT is defined as an assembly of concepts and technologies that deliver quantifiably reliable environmental information at the right time and the right form to the right users. The goal of the EIT program is to combine a deep understanding of environmental processes with mastery of sensing, modeling, and information technology. Students recruited into the EIT program come from a variety of science and engineering backgrounds, but all have a solid calculus background and quantitative skills.

The Division of Environmental Science and Engineering (ESE) at Colorado School of Mines (CSM) was established in 1981 and began offering Master of Science degree programs in 1984. Since then, the Division has grown rapidly and now includes a Ph.D. degree program. Reflecting CSM's campus-wide commitment to the environment, the ESE Division is one of the largest graduate degree programs at the university with 62 masters’ students and 22 Ph.D. students (Fall 2003). Graduate students in the program come from diverse academic backgrounds in such fields as life sciences, earth sciences, chemistry, and most engineering disciplines. The Division's faculty are equally interdisciplinary in their research interests, and they teach basic as well as applied science and engineering. The combination of basic and applied science with engineering is blended with knowledge of public policy and environmental regulations to respond to the growing need for a new generation of environmental scientists and engineers. The ESE curriculum integrates science and engineering within existing legal, economic, and regulatory constraints and prepares students to find creative solutions to diverse environmental challenges.

Center for Energy and Environmental Policy at the University of Delaware, established in 1980, is a leading institution for interdisciplinary graduate education, research, and advocacy in energy and environmental policy. The Center is composed of an internationally diverse faculty and research staff with backgrounds in a variety of disciplines including economics, sociology, geography, political science, philosophy, engineering, urban planning and environmental studies. CEEP’s student body is likewise a diverse cultural and intellectual community. Placing a premium on critical thinking and analysis, students at CEEP are addressing a wide spectrum of issues from climate change to energy transformation, environmental justice, indigenous rights, sustainable development and water equity.

The Center for Energy and Environmental Studies at Boston University engages in education, research, and professional training in the fields of energy and environmental analysis. The perspective of the Center is multi-disciplinary and problem-oriented. The educational programs are based on the philosophy that students need a solid training in traditional disciplines, as well as a set of integrative courses that expose students to the broad and systematic nature of environmental problems. The multi-disciplinary, systems-oriented approach underlies the Center's research programs that investigate some of the planet's most challenging environmental problems. The Center is part of the College of Arts and Sciences at Boston University. Students in two Bachelor's programs and three Master's programs are part of an innovative and challenging curriculum. The faculty in the Center and affiliated departments engage in environmental research ranging from the analysis of pollution in Boston Harbor, the future of world oil supply, to the study of global climate change. The Center has close
collaborative ties with the Departments of Biology, Geography, Earth Sciences, International Relations, the Center for Remote Sensing, The Center for Transportation Studies and the Center for Ecology and Conservation Biology.

**Penn State's Department of Energy and Geo-Environmental Engineering (EGEE)** in the College of Earth and Mineral Sciences educates students to embrace the challenges of bringing natural resources into our daily lives. EGEE's team of faculty, staff, and students strive for excellence in devising ways to ensure an affordable supply of energy and minerals, while protecting the environment and the health and safety of the workforce. The program focuses on the use of fuels and minerals extracted from the earth and relating these resources to power generation. EGEE offers several Ph.D. engineering degree programs, which address the effective production, conversion, and management of energy and mineral resources:

- **Petroleum & Natural Gas Engineering** - Petroleum engineers are responsible for the effective recovery of underground resources of liquid and gaseous hydrocarbons sources.
- **Mineral Processing** - Mining engineers recover solid raw fuels and minerals from beneath the earth and mineral processing engineers purify the solid fuels and minerals for more efficient use.
- **Fuel Science** - Fuel scientists convert fuels into usable form as required for modern society. They are particularly concerned with developing novel transportation fuels, maximizing the efficiency of energy utilization and minimizing the environmental impact of fuel use.
- **Geo-Environmental Engineering** - Environmental and geo-environmental engineers prevent hazardous materials from damaging surface waterways, groundwater resources and productive land while protecting the air quality.

**C. Enrollment**

A study of the past ten-year data in terms of number of doctorate recipients from United States universities and of the future need, strongly indicates that an investment at NC A&T to produce doctorates is well-justified. The following facts are summarized based on data obtained from the American Society of Engineering Education and the National Science Foundation:

- Only three percent of United States university faculty are African-Americans, whereas, less than one percent of engineering faculty is African-American.

- North Carolina ranks eighth in the nation in manufacturing, making it important to produce more energy and environmental scientists and engineers with the terminal degree.

(1) **Headcount enrollment**

Show a five-year history of enrollments and degrees awarded in similar programs offered at other UNC institutions (using the format below for each institution with a similar program); indicate which of these institutions you consulted regarding their experience with student demand and (in the case of professional programs) job placement. Indicate how their experiences influenced your enrollment projections.
Table 1. Enrollment and Graduation Data in Ph.D. Program in Environmental Sciences and Engineering at the University of North Carolina at Chapel Hill

<table>
<thead>
<tr>
<th>Institution</th>
<th>UNC Chapel Hill</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Title</td>
<td>Ph.D. in Environmental Sciences and Engineering</td>
</tr>
<tr>
<td>Year</td>
<td>1999 2000 2001 2002 2003</td>
</tr>
<tr>
<td>Enrollment</td>
<td>67 68 60</td>
</tr>
<tr>
<td>Degrees-awarded</td>
<td>10 14 13</td>
</tr>
<tr>
<td>Comments Regarding Student Demand</td>
<td>Applicant pool for M.S. and Ph.D. degrees has averaged ~230 over the past 7 years, indicating high demand by qualified applicants.</td>
</tr>
<tr>
<td>Comments Regarding Job Placement</td>
<td></td>
</tr>
<tr>
<td>Influence on Enrollment Projections</td>
<td>An average annual enrollment of approximately 65 Ph.D. students supports the proposed steady-state enrollment projection of 20 students. The average annual graduation of 12 Ph.D. students is approximately 20% of the enrollment and 20% is used for projections in this proposal.</td>
</tr>
</tbody>
</table>

Table 2. Enrollment and Graduation Data in Ph.D. Program in Civil Engineering at North Carolina State University

<table>
<thead>
<tr>
<th>Institution</th>
<th>NC State University</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Title</td>
<td>Ph.D. in Civil Engineering</td>
</tr>
<tr>
<td>Year</td>
<td>1999 2000 2001 2002 2003</td>
</tr>
<tr>
<td>Enrollment</td>
<td>66 66 73</td>
</tr>
<tr>
<td>Degrees-awarded</td>
<td>6 16 9</td>
</tr>
<tr>
<td>Comments Regarding Student Demand</td>
<td>Steady increases in graduate program enrollment over the past 15 years are expected to continue. During this time, the student base has expanded both geographically and in terms of student backgrounds.</td>
</tr>
<tr>
<td>Comments Regarding Job Placement</td>
<td>A full array of job placements has been obtained in academia and industry by the Ph.D. graduates and no future obstacles are expected.</td>
</tr>
<tr>
<td>Influence on Enrollment Projections</td>
<td>A reasonable assumption is that approximately 33% of enrolled students and graduates were in the Environmental Area of Civil Engineering. Therefore, an average annual enrollment of 23 Ph.D. students and an average annual number of 3 Ph.D. graduates in Environmental Engineering indicates a strong demand for such a program and indicates 3 to 4 environmental Ph.D. students are graduated each year.</td>
</tr>
</tbody>
</table>
Table 3. Enrollment Projections in INES Ph.D. Program at UNC Charlotte

<table>
<thead>
<tr>
<th>Students</th>
<th>Year 1 2004-05</th>
<th>Year 2 2005-06</th>
<th>Year 3 2006-07</th>
<th>Year 4 2007-08</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>4</td>
<td>9</td>
<td>12</td>
<td>16</td>
</tr>
<tr>
<td>Part-time</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>TOTALS</td>
<td>6</td>
<td>12</td>
<td>16</td>
<td>20</td>
</tr>
</tbody>
</table>

Use the format in the chart below to project your enrollment in the proposed program for four years and explain the basis for the projections:

Table 4. Enrollment Projections in Ph.D. Program at NC A&T

<table>
<thead>
<tr>
<th>Students</th>
<th>Year 1 2005-06</th>
<th>Year 2 2006-07</th>
<th>Year 3 2007-08</th>
<th>Year 4 2008-09</th>
</tr>
</thead>
<tbody>
<tr>
<td>Full-time</td>
<td>4</td>
<td>8</td>
<td>12</td>
<td>14</td>
</tr>
<tr>
<td>Part-time</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
<tr>
<td>TOTALS</td>
<td>5</td>
<td>10</td>
<td>15</td>
<td>18</td>
</tr>
</tbody>
</table>

Please indicate the anticipated steady-state headcount enrollment after four years:

Full-time: 14  Part-time: 4  Total: 18

Based on the enrollment in Ph.D. programs in similar departments, in terms of faculty size and research record, the projected enrollment for the first five years is shown in Table 4.

(2) SCH production

Use the format in the chart below to project the SCH production for four years. Explain how SCH projections were derived from enrollment projections (see UNC website for a list of the disciplines comprising each of the four categories).

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Student Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Category</td>
<td>Doctoral</td>
</tr>
<tr>
<td>Category I</td>
<td></td>
</tr>
<tr>
<td>Category II</td>
<td></td>
</tr>
<tr>
<td>Category III</td>
<td>90</td>
</tr>
<tr>
<td>Category IV</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Year 2</th>
<th>Student Credit Hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>Program Category</td>
<td>Doctoral</td>
</tr>
<tr>
<td>Category I</td>
<td></td>
</tr>
<tr>
<td>Category II</td>
<td></td>
</tr>
<tr>
<td>Category III</td>
<td>180</td>
</tr>
<tr>
<td>Category IV</td>
<td></td>
</tr>
</tbody>
</table>
III. PROGRAM REQUIREMENTS AND CURRICULUM

A. Program Planning.

(1) List the names of institutions with similar offerings regarded as high quality programs by the developers of the proposed program.

The following programs were reviewed:

- Yale University: Ph.D. program in industrial ecology
- Florida A&M University Ph.D. program in Environmental Science
- University of California-Berkeley: Ph.D. program in engineering ecology offered by the Civil and Environmental Engineering Department
- Clarkson University: Ph.D. program in environmental manufacturing management
- University of California-Riverside: Ph.D., environmental biotechnology specialization
- Carnegie-Mellon University: Ph.D. program in engineering and public policy
- Columbia University: Earth Engineering Center and Ph.D. in earth and environmental engineering
- Johns Hopkins University: Ph.D. in geography and environmental engineering
- University of Wisconsin: several Ph.D. programs in the Nelson Institute for Environmental Studies and the Center for Sustainability and the Global Environment
- University of Illinois-Chicago: the Environmental Science and Policy Institute
- University of Massachusetts: Ph.D. emphasis on environmental technologies through the Center for Energy Efficiency and Renewable Energy
- University of California-Santa Barbara: Ph.D. program in environmental science and Management
- University of Texas at Arlington: Ph.D. program in environmental science and engineering
- Oregon Graduate Institute: Ph.D. program in environmental science and engineering
- Oregon Graduate Institute: Ph.D. program in Environmental Information Technology
• Colorado School of Mines: Ph.D. program in environmental science and Engineering
• University of Delaware: Ph.D. program in environmental and energy policy
• Penn State University: Ph.D. program in Petroleum & Natural Gas Engineering, Mining Engineering, Mineral Processing, Fuel Science, Geo-Environmental Engineering

(2) List other institutions visited or consulted in developing this proposal. Also discuss or append any consultants’ reports, committee findings, and simulations (cost, enrollment shift, induced course load matrix, etc.) generated in planning the proposed program.

The following programs were visited:
FUTURES Goal II members (Interdisciplinary Programs and Centers) visited successful interdisciplinary centers and programs at New York University, Virginia Tech, and the University of Wisconsin, Madison in 2003, in order to extract information used to attract students, faculty, staff and other stakeholders to these programs. While some information can be found via the Internet, it was the experience of team members that site visits were very helpful when establishing interdisciplinary units. Models that describe successful interdisciplinary programs were studied for possible inclusion in the A&T interdisciplinary model.

Lessons Learned from visits
• Establish interdisciplinary programs with careful planning
• Begin interdisciplinary units with conversations, seminars, colloquia, studies, programs, centers, and institutes
• Make the Director of Interdisciplinary Programs a Member of the Dean’s council
• Maintain effective communication
• Make the University community aware of works in progress
• Involve faculty in interdisciplinary committee assignments
• Start by generating interest among faculty and students through forums, seminars and lectures and not with an academic program.
• Deal with challenges and problems of uncovering information
• Use cluster hiring to fill academic positions
• Make foreign students and faculty feel welcomed and at home
• Provide excellent faculty and staff to drive interdisciplinary activities
• Invite people who are doing good work to participate in interdisciplinary activities
• Use faculty with joint appointments
• Use co-teaching of courses to enhance interdisciplinary programs
• Use faculty to lead interdisciplinary programs not administrators
• Develop a web page for information sharing
• Seek Department of Education Title VI funding.

The lessons learned from visits to successful interdisciplinary Universities have contributed to the Energy and Environmental Studies program development and overall strategic vision of the North Carolina A&T State University.
B. Admission

(1) Admissions requirements for proposed program (indicate minimum requirements and general requirements).

There are specific procedures in evaluating an applicant's potential for success in the Ph.D. program. Admissions decisions reflect an evaluation of the applicant's potential to engage in graduate coursework and independent and original investigations. Generally, requests for admission are considered by the program director. Once an application is reviewed, an admission recommendation is forwarded to the Dean of the School of Graduate Studies. Admission is granted for a specific semester or summer term, any change in the admission date must be requested in writing and approved by the School of Graduate Studies.

To be considered for admission to the Ph.D. in Energy & Environmental Studies an applicant must satisfy the following requirements:

1. Master’s degree in science, engineering, education, business, economics, technology or in a closely related to environmental or energy field with a minimum GPA of 3.25/4.0
2. GRE score of at least 1100.
3. International Students: An official score report for the Test of English as a Foreign Language (TOEFL) with the score of at least 550 (written test) or 213 (computer-based test). This requirement maybe waived if the candidate has completed a bachelors or masters degree on a full-time basis at a university in the United States or in a country in which English is recognized as the official language.

(2) Documents to be submitted for admission.

The following documents are required by the School of Graduate Studies:

1. Official transcripts of all college-level academic work.
2. Three letters of recommendation from former college professors or supervisors. Note: two of the three recommendation letters must be from a university professor.
3. Official copy of GRE score mailed directly to the university.
4. Official copy of TOEFL score mailed directly to the university (if required).
5. Completed application form and application fee stipulated by School of Graduate Studies at NC A&T.
6. Statement of Purpose in the context of pursuing the Ph.D. degree in Energy & Environmental Studies.

C. Degree requirements

(1) Total hours required. Major. Minor.

The credit hours required for the program will be 51 credit hours of core and elective courses beyond the M.S. degree. Of these 51 credit hours, 27 credit hours are for course work, 3 credit hours are for seminars, 3 credit hours are for professional practice/development, and a minimum of 18 credit hours are for dissertation research.

(2) Proportion of courses open only to graduate students to be required in program

Students must satisfy the core course requirements which are all 800-level that are open only to doctoral students. No specific minimum number of credit hours of 700-level and 800-level courses is stipulated.
(3) Grades required.
Students must obtain a cumulative Grade Point Average of 3.0 or above on a 4 point scale and meet the published academic qualifications by the School of Graduate Studies.

(4) Amount of transfer credit accepted.
Transfer credit for a maximum of 6 credit hours may be given to a student for courses completed beyond the M.S. degree. Decisions on transfer credits will be determined by the faculty with approval of the Program Director and Dean of graduate Studies.

(5) Language and/or research requirements.
There are no language requirements.

(6) Any time limits for completion.
Students must complete the requirements for the Ph.D. degree within six years from the date of first enrollment in the program.

(7) Other requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or field experience, "second major," etc.).
The requirements consist of the following elements:
1. General Core: 15 credit hours (required courses for all students in the program);
2. Doctoral Seminar: 3 credit hours (3 semesters of graded seminar required for all students in the program);
3. Elective Courses: 12 credit hours;
4. Professional development/practice requirement: 3 credit hours (required for all students in the program);
5. Dissertation Research: 18 credit hours (required for all students in the program);
6. Major Advisor: Initially the Director of the Ph.D. program will serve as an academic advisor for all new students entering the program. Each student in the Ph.D. program is expected to select a major advisor by the beginning of the second year with the approval of the Director. The major advisor must hold a tenure or tenure-track full-time faculty position at the university.
7. Composition of Ph.D. Committee: A Ph.D. Advisory Committee will consist of a minimum of five (5) graduate faculty with the major advisor as its chairperson. The Ph.D. Advisory Committee will be recommended by the major advisor, with input from the student, to the Director of the Ph.D. program, for approval by the Dean of Graduate Studies. Upon the student's selection of a research area, the Ph.D. Advisory Committee will review the student's prior transcripts, evaluate and recommend any transfer credits, and prepare a program of study for approval by the Director of the Ph.D. program before submission to the Dean of Graduate Studies. The Committee will supervise the student's program, administer dissertation review and approval, and finally recommend the awarding of the degree.
8. Comprehensive Written Examination: A Comprehensive Written examination is proposed for all accepted Ph.D. students to ensure minimum competencies and to assist the students' committee in its coursework development program. All students admitted into the Ph.D. program are subject to a Comprehensive Written
examination after the completion of Ph.D. coursework. The Comprehensive Written examination will be held once each semester focusing on the general core course work and the electives. A student failing the Comprehensive Written examination, may at the recommendation of the advisor, be given a second chance. The second Comprehensive Written examination will be given during the following semester of enrollment and the student will be limited to a maximum of six credits. Failure at the second attempt will result in permanent dismissal. The Comprehensive Examination Committee will develop the written examination. This is an ad hoc committee consisting of at least three (3) graduate faculty members in the program and is appointed by the Director of the Ph.D. Program in Energy & Environmental Studies. This committee will determine the passing performance and inform the student, the Director, and the student's major advisor of the final outcome of the examination.

9. Oral Defense of Dissertation Proposal: The dissertation proposal is submitted to the student's major advisor and the Ph.D. Advisory Committee for review. The committee will make recommendations as needed. The proposal must be orally defended by the candidate before the Advisory Committee, and it must be accepted by the committee. The signature of committee members on the dissertation proposal constitutes approval to proceed with research. After approval of the dissertation proposal, the student will register for the Energy & Environmental Studies Ph.D. Dissertation course.

10. Admission to Candidacy for Ph.D. Degree in Energy & Environmental Studies: Admission to candidacy for Ph.D. degree in Energy & Environmental Studies will require compliance with all existing Graduate School policies such as:
1. Completion of all core and elective courses approved for the student's program of study.
2. A minimum cumulative GPA of 3.0 or better,
3. Successful passing of Comprehensive Written Examination, and

11. Final Oral Examination: The final oral examination is scheduled after the dissertation is complete except for such revisions as may be necessary as a result of the examination, but not earlier than one semester or its equivalent after admission to candidacy and not before all required course work has been completed or is currently in progress. The examination consists of the candidate's defense of methodology used and the conclusions reached in the research, as reported in the dissertation. It is conducted by an examining committee, which consists of the student's advisory committee and a Graduate School representative. A unanimous vote of approval of the advisory committee is required for passing the final oral examination. Approval may be conditioned, however, on the student's meeting specific requirements described by the advisory committee. Failure of a student to pass the examination terminates one's work at this institution unless the advisory committee recommends a reexamination. No reexamination is given until one full semester has elapsed and only one reexamination is permitted.

12. Dissertation: The doctoral dissertation presents the results of the student’s original investigation in the field of major interest. It must be a contribution to
knowledge, be adequately supported by data and be written in a manner consistent with the highest standards of scholarship. Publication is expected. The dissertation will be reviewed by all members of the advisory committee and must receive their approval prior to submission to the School of Graduate Studies. Three copies of the document signed by all members of the student’s advisory committee must be submitted to the School of Graduate Studies by a specified deadline in the semester or summer session in which the degree is to be conferred. Prior to final approval, the dissertation will be reviewed by Graduate Studies to ensure that the format conforms to the specifications prescribed in the Guide for the Preparation on Theses/Dissertations. All doctoral dissertations will be microfilmed by the University Microfilms International, of Ann Arbor, Michigan, which includes publication of the abstract in Dissertation Abstracts International. The student is required to pay for the microfilming service.

13. Degree Requirements: The student must successfully complete the approved program of study with a minimum cumulative GPA of 3.0 or better.
   1. After the approval of the dissertation proposal, the student must complete dissertation research and submit a completed dissertation to the Ph.D. Advisory Committee for approval.
   2. Upon approval by the Ph.D. Advisory Committee, the student must defend the research before the Advisory Committee in a public seminar with the faculty, students, alumni and/or industrial representatives.
   3. Upon the successful defense of the research and presentation of the written dissertation, the School of Graduate Studies will initiate the recommendation for awarding of the degree.

14. Residency Requirements: For the Doctor of Philosophy degree, the student is expected to be registered for graduate work for at least four semesters beyond the master’s degree. At least two residence credits, as defined below, must be secured in continuous residence (registration in consecutive semesters) as a graduate student at the university. Failure to take work during the summer semester does not break continuity; however, summer work may be used in partial fulfillment of this requirement. Residence credit is determined by the number of semester hours of graduate work carried during a given term. During a regular semester, residence credit is calculated in the following manner:

<table>
<thead>
<tr>
<th>Semester Credits (Hours)</th>
<th>Residence Credits (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>9 or more</td>
<td>1</td>
</tr>
<tr>
<td>6-8</td>
<td>2/3</td>
</tr>
<tr>
<td>less than 6 (including registration for “Thesis Preparation”)</td>
<td>1/3</td>
</tr>
</tbody>
</table>

The residence credit for a six-week summer term is equal to one-half of the corresponding amount for a regular semester. For example, six semester hours carried during a summer session will earn one-third of a residence credit; less than six credit hours will earn one-sixth of a residence credit.
In addition to course work requirements, the exams and mileposts shown below must be completed in sequence. Written exams will be given at most once every semester, on an as-needed basis.

### Exams/ Mileposts for Ph.D. degree

<table>
<thead>
<tr>
<th>Exam/Milepost</th>
<th>Comment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Program of Study</td>
<td>In consultation with advisor and Program Director; this may be revised later.</td>
</tr>
<tr>
<td>2. Committee (milepost)</td>
<td>Committee must consist of the Advisor and four members</td>
</tr>
<tr>
<td>3. Qualifying Exam</td>
<td>Written Exam given by Committee</td>
</tr>
<tr>
<td>4. Proposal defense</td>
<td>Oral defense of proposal in the presence of Committee</td>
</tr>
<tr>
<td>5. Admission to Ph.D. candidacy (milepost)</td>
<td>On successful completion of #1, #2, #3, and #4; a maximum of two attempts on #3 and #4</td>
</tr>
<tr>
<td>6. Final defense</td>
<td>Oral defense of dissertation in the presence of Committee</td>
</tr>
</tbody>
</table>

### General Core Course Requirements

Students must complete 15 credit hours as follows:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENEV 810</td>
<td>Energy and Environmental Law</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 820</td>
<td>Economic Applications of Energy and Environmental Management</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 830</td>
<td>Acquisition and Management of Energy and Environmental Data</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 840</td>
<td>Theory and Practice of Energy and Environmental Science</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 850</td>
<td>Theory and Practice of Alternative Energy Technology</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 992</td>
<td>Doctoral Seminar</td>
<td>3</td>
</tr>
</tbody>
</table>

### Professional Practice/Development Requirements

Students must complete 3 credit hours from the following:

<table>
<thead>
<tr>
<th>Course No.</th>
<th>Course Title</th>
<th>Credit hours</th>
</tr>
</thead>
<tbody>
<tr>
<td>ENEV 990</td>
<td>Doctoral Supervised Practicum</td>
<td>3</td>
</tr>
<tr>
<td>ENEV 993</td>
<td>Doctoral Supervised Teaching</td>
<td>3</td>
</tr>
</tbody>
</table>

D. **List existing courses by title and number and indicate (*) those that are required. Include an explanation of numbering system. List (under a heading marked “new”) and describe new courses proposed**

In the course listings that follow, the following codes are used to explain the course numbering system for both new and existing courses:
• Each course listed carries a four-letter department or program prefix. The proposed program prefix is ENEV.
• Courses at the 800 and 900 levels are for doctoral students only. The designation ENEV 8XX is for ENEV-specific core courses and for other current or planned courses to be offered at the Ph.D. level as a part of the ENEV Ph.D. Program.
• All courses numbered at the 700 level are offered for graduate students only (masters and Ph.D.). Students in the ENEV Program are permitted to take courses numbered at the 700 level (masters and Ph.D. students only), but they must take the majority of their courses at the 800 level (Ph.D. students only). Existing courses along with descriptions are listed in Appendix B

General Core Courses – (All are new)
The ENEV core will focus on basic and advanced level understanding of the theory and practice of energy and environmental analysis and management. ENEV Ph.D. students will participate in interdisciplinary activities throughout their program of study. Students will begin with a set of interdisciplinary core courses. These common aspects are reflected in the six (6) core courses described below. Threaded throughout the core courses are economic and management concerns along with data acquisition and management. Most of the elective courses are already available on campus. Additional courses are under development. The elective courses can be found in almost all of the engineering, sciences, technology, and agricultural programs on campus. Throughout the program, students will participate in interdisciplinary seminar courses.

ENEV 810 Energy and Environmental Law 3(3-0)
This course covers legal, political, and regulatory systems as they relate to energy and the environment. Included will be local, state, national, and international codes and standards that govern the analysis, assessment, design, and management of energy and environmental systems. Topics to be covered include the theory and practice of energy and environmental regulation, litigation, and legislation including Superfund (CERCLA), and the Clean Water Act

ENEV 820 Economic Applications of Energy and Environmental Management 3(3-0)
This course is a study of economic concepts that affect the decision-making process in the management of energy and the environment. Topics covered include market forces, taxation, budgets, finance, and public goods and their effects on the economic sustainability of energy and the environment. This course also analyzes international aspects of energy and the environment as they interact with politics, society, economics, technology, and resources. Policy case studies covering such issues as Environmental Justice, Environment and Public Health, Trade and the Environment, Global Climate Change, and Sustainable Development are used to evaluate the current range of political-economic explanations of nature-society relations. The case studies allow a range of ethics and environmental perspectives to be examined and challenge students to develop critiques of each perspective.

ENEV 830 Acquisition and Management of Energy and Environmental Data 3(3-0)
This course is a study of theories and techniques for acquiring and managing scientific data and information related to the analysis, design, and management of energy and environmental systems. Included are pertinent aspects of information technology, such as data mining and data architecture, and applications of GIS and non-destructive assessment technologies to data
acquisition. Basic principles of energy and environmental systems analysis required in industrial and governmental projects pertaining to site characterization for natural resource evaluation, human impact on natural systems, and for developing remediation strategies are studied, including terrain analysis, and surface and subsurface characterization procedures and analysis.

**ENEV 840 Theory and Practice of Energy and Environmental Science 3(2-2)**

This course introduces both biological and chemical aspects of energy and environmental science. The biological aspects discuss the role of microbes in the environment, remediation processes, and energy production, while the chemical aspects deal with the chemistries of air at different altitudes, of water systems, and of soils. Topics include population dynamics, species interactions, community structure, biodiversity, bioenergetics, nutrient cycling, human impacts, chemical and physico-chemical processes at phase boundaries, and modeling for kinetics and mass transport. A laboratory component will be incorporated.

**ENEV 850 Theory and Practice of Alternative Energy Technologies 3(2-3)**

The course will include input-output analysis, thermodynamic availability, energy balances, economics, and environmental considerations. Conventional technologies will be discussed to address price, performance, and environmental impact benchmarking. The main focus of the course is the in-depth coverage of fuel cells, microturbines, photovoltaics, wind power, and biomass conversion technologies. A laboratory component will be incorporated on energy-related testing equipment and measurement techniques.

**ENEV 990 Doctoral Supervised Practicum 3(3-0)**

Students gain valuable experience that allows them to both apply the knowledge gained in the classroom and prepare for their future careers. Enrollment requires a faculty advisor and is limited by the number of internship opportunities available. International students need to submit appropriate paperwork for the Immigration and Naturalization Service.

Throughout the program, ENEV students will come together in interdisciplinary seminars in which they will make presentations and lead discussions on topics related to their respective concentration and critique presentations.

**ENEV 992 Doctoral Seminar 1(0-2)**

Each student will be required to participate actively in program seminars delivered by student researchers, faculty, and invited speakers. These seminars will be advertised to the campus and professional communities. Participation in these seminars will count for 3 credit hours (1 credit hour for each academic year). Prior to graduation, each student will make at least one seminar presentation and provide at least one formal critique of a presentation in this course.

**ENEV 993 Doctoral Supervised Teaching 3(3-0)**

This course is designed to introduce the doctoral student to classroom or laboratory teaching under the supervision of a faculty mentor. Doctoral students who serve as teaching assistants or as instructors are required to take this course during the first semester they teach. Others planning to undertake a teaching career are also strongly encouraged to take it. Topics covered include: course planning, classroom teaching, lecture preparation, student evaluation, and
grading. The supervisor(s) will observe and provide feedback to the student and evaluate the student’s performance. Prerequisite: Doctoral level standing.

**ENEV 994 Doctoral Supervised Research Credit 3(3-0)**
This is supervised research under the mentorship of a member of the graduate faculty. It is not intended to serve as the dissertation topic of the doctoral student. Prerequisite: Consent of instructor.

**Dissertation (18 credits minimum)**
After completion of the qualifying examination, each ENEV student will be eligible to enroll in doctoral dissertation research. The number of research credits taken each semester must be approved by the student’s doctoral program committee.

**ENEV 997 Doctoral Dissertation (1-9 credits)**
This represents the supervised research leading to the dissertation for the doctoral student. Eighteen credits of dissertation are required for graduation. Prerequisites: Doctoral standing and consent of advisor.

**ENEV 999 Continuation of Dissertation (1 credit)**
The course is for doctoral students who have completed all required credit hour requirements. Prerequisite: Completion of all Dissertation Credits.

**Elective Courses**
Potential new elective courses and existing elective courses that would be available to program students are listed in Appendix B.

A challenge in the development of the curriculum for the proposed interdisciplinary Ph.D. program is to be able to offer enough current topic specialization courses to meet the desires of students with interests in many disciplines. Therefore, the program will seek to make additional courses available to NC A&T students through innovative distance learning arrangements. The National Institute of Aerospace (NIA) at Langley Research Center (LaRC) is a world-class research and education institute created to do cutting edge aerospace and atmospheric research, develop new technologies for the nation and help inspire the next generation of scientists and engineers. NIA members include the NASA LaRC, the AIAA Foundation, and seven major research universities – Georgia Tech, Hampton University, North Carolina A&T, North Carolina State University, University of Maryland, University of Virginia, and Virginia Tech. The NIA offers each participating university a critical core curriculum (e.g., mechanical engineering) with disciplinary specializations. While NIA students will enroll in a degree program at one of the member universities and ultimately receive a degree from that institution, he or she will be able to take courses offered by all of the six universities on-site or via distance learning at the NIA headquarters.
IV. FACULTY
A. List the names of persons now on the faculty who will be directly involved in the proposed program. Provide complete information on each faculty member's education, teaching experience, research experience, publications, and experience in directing student research, including the number of theses and dissertations directed for graduate programs. The official roster forms approved by SACS can be submitted rather than actual faculty vita.

The resumes of the faculty associated with this proposed program are presented in Appendix D.

B. Estimate the need for new faculty for the proposed program over the first four years. If the teaching responsibilities for the proposed program will be absorbed in part or in whole by the present faculty, explain how this will be done without weakening existing programs.

A total of two new faculty positions will be needed for the 2005-2006 academic year. In addition, support for Ph.D. students with Graduate Teaching Assistantships (GTA) at $30,000 per year will also be needed. For the academic years, 2006-2007 and 2007-2008, the GTA student support increases to $50,000 and $72,000 respectively. Long-term needs for faculty positions will have to be met as required to sustain program quality from positions allotted to the program from enrollment increases and reallocations within the University. New faculty members will be allotted so that:

1) existing undergraduate and graduate programs are not weakened;
2) existing graduate programs can be strengthened and modified to complement the new Ph.D. program;
3) teaching loads of current faculty who will participate in the Ph.D. program can be adjusted so that they can assist with the development and teaching of new courses and so they can be relieved of a portion of their current teaching loads to guide dissertation research, and
4) Ph.D. degree enrollment and graduation projections can be met.

C. If the employment of new faculty requires additional funds, please explain the source of funding.

New faculty will be provided to the new program as part of the position structure of the University. Positions will be obtained from two sources, new positions derived from anticipated enrollment increases and transfer of positions from unproductive and underutilized programs. Funding to support the new program will come from the reallocation of existing funds and student credit hours generated. Funds that the University will receive as a result of the “new” status as a doctoral research institution will also be used to support the program. Funding from sources outside the University system is expected to be generated by this new Ph.D. program. These funds will be derived primarily from two sources. First, the existing research capabilities of the University’s Interdisciplinary Centers and Institutes will be strengthened by the addition of the proposed program. Second, the historic nature of the establishment of the first Ph.D. program in Energy and Environmental Studies at an HBCU should generate funds to assist the development of the program from professional societies, government agencies, private companies, and foundations interested in addressing this national and international challenge.
D. Explain how the program will affect faculty activity, including course load, public service activity, and scholarly research.

Faculty members who participate directly in the Ph.D. program are expected to grow to a steady-state of about six FTE faculty from those currently in tenure-track positions. Research faculty are expected to guide Ph.D. students continuously whereas other faculty will participate as their research projects may grow or recede. Virtually any of the faculty in the current eight positions can direct one or two Ph.D. students if their other duties are adjusted accordingly. Such participation and the participation of all new faculty positions will allow a total of up to twenty Ph.D. students and this level of participation will be required if graduation goals are met. The Ph.D. program will greatly enhance the ability of faculty to publish in refereed journals and to engage in other scholarly pursuits. Further, it will assist in attracting top faculty for new positions and for existing positions through normal attrition. Public service will also be impacted in a positive way because faculty are expected to move through the ranks and offices of the professional societies and to win exposure for the university and department.

V. LIBRARY

A. Provide a statement as to the adequacy of present library holdings for the proposed program.

The current library facility was occupied in June 1991. It was named for the fifth President of the institution, Ferdinand Douglass Bluford. The four level, 153,428 square feet facility will house more than 600,000 volumes. The current holdings exceed 500,000 bound volumes, over 3,000 current serial subscriptions, and, as a select depository in North Carolina for the United States government publications. Other holdings include a superior collection in films, microfilms and other audiovisuals and special collections in Archives, Black Studies, and Teacher Education Materials. The library staff consists of fifteen professional librarians plus a number of support personnel. The library is open 24 hours five days a week and offers a liberal weekend schedule for physical access to the library. During designated times of the year a 24/7 schedule is maintained.

Resources and services offered by F. D. Bluford Library support the curricular and research needs of the University from the undergraduate through the PhD level. The online catalog, INNOPAC, is accessible throughout the library and remotely from the World Wide Web. Through the catalog, users have immediate access to many electronic indexes, full-text journals and electronic books. Users may also connect to the catalogs of other libraries and, through a cooperative borrowing agreement among UNC system libraries, borrow books and other materials directly from constituent libraries. Other reciprocal agreements among libraries expand access to important reference material located globally. The library provides workstations where patrons can access research information as well as operates a laptop borrowing program, allowing in-house use of 100 wireless laptop computers.

Bluford library offers a number of core and value-added services to support research. Research consultancy and information assistance is provided by library faculty with extensive subject
knowledge. In an endeavor to enhance research within the University, the library faculty assist in the use of EndNote, establish current awareness profiles and conduct advanced database searching. By virtual interaction students can receive library instruction, research assistance, and full-text resources remotely from a librarian. Electronic books, full-text journals, virtual reference services, electronic reserves and wireless laptop computers deliver information directly and enhance research for students and faculty in a convenient and seamless manner.

**Collection and Budget**

The library’s collection is strongest in the areas of science and technology, with the bulk of the resources being spent on full-text journals. The Bluford Library annual budget for materials is approximately $2,000,000. This figure covers journal subscriptions and the purchase of new books and other media. Each department has an allocation that they can use to recommend the purchase of new books by the library. These departmental budgets do not include journal subscription charges which are born by the library’s material budget.

**Library Resources Added for the last five years**

<table>
<thead>
<tr>
<th>FISCAL YEAR</th>
<th>Books and Bound Journals</th>
<th>Microform Units</th>
<th>Audiovisual Units</th>
<th>Current Subscriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1999</td>
<td>457,326</td>
<td>981,142</td>
<td>31,587</td>
<td>3,988</td>
</tr>
<tr>
<td>2000</td>
<td>483,017</td>
<td>1,021,591</td>
<td>32,006</td>
<td>4,588</td>
</tr>
<tr>
<td>2001</td>
<td>507,036</td>
<td>1,038,474</td>
<td>34,025</td>
<td>5,466</td>
</tr>
<tr>
<td>2002</td>
<td>527,252</td>
<td>1,042,973</td>
<td>35,446</td>
<td>5,515</td>
</tr>
<tr>
<td>2003</td>
<td>541,403</td>
<td>1,052,776</td>
<td>35,735</td>
<td>6,182</td>
</tr>
</tbody>
</table>

Because of the sound disciplinary foundation provided by the existing Master’s degree programs, Bluford Library already houses a breadth of resources related to Energy and Environment. However, additional funding will be required to strengthen Bluford Library’s monographic and serials collection in this area. As the program is implemented, specific and appropriate resources will be procured by the University’s library.

**B. State how the library will be improved to meet new program requirements for the next five years. The explanation should discuss the need for books, periodicals, reference material, primary source material, etc. What additional library support must be added to areas supporting the proposed program?**

To supplement the current budget for holdings and periodicals, a supplementary budget primarily for additional periodicals, searches, and for rapid retrieval of publications and reports from other libraries will be needed. The additional annual budget needs for the next five years are shown below.
Additional Library Resource Needs

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Books</td>
<td>$2500</td>
<td>$2500</td>
<td>$2500</td>
<td>$2500</td>
<td>$2500</td>
</tr>
<tr>
<td>Journals</td>
<td>$7500</td>
<td>$7500</td>
<td>$7500</td>
<td>$7500</td>
<td>$7500</td>
</tr>
<tr>
<td>Total</td>
<td>$10000</td>
<td>$10000</td>
<td>$10000</td>
<td>$10000</td>
<td>$10000</td>
</tr>
</tbody>
</table>

The Bluford library will provide personnel and search facilities within its existing budget, which should meet the needs of the new program. This will allow the above supplement to be used exclusively for the acquisition of new periodicals and important back issues of existing periodicals of major journals.

C. **Discuss the use of other institutional libraries.**

Other libraries cooperate with North Carolina A&T State University through their interlibrary loan and shared resources programs. This gives the campus access to important reference material around the nation including the libraries at North Carolina State University, Duke University, and the University of North Carolina at Chapel Hill.

VI. **FACILITIES AND EQUIPMENT**

A. **Describe facilities available for the proposed program.**

The proposed Energy and Environmental Studies Ph.D. program will be supported by facilities and equipment in the University’s Interdisciplinary Institutes, Centers, and Programs.

**Center for Energy Research and Technology**
The mission of the Center is to enhance undergraduate and graduate education through energy-related research and to transfer this new knowledge to regional and national industries. The objective is to improve economic competitiveness while reducing the environmental impact that results from excessive energy consumption. The Center will work closely with the Waste Management Institute (WMI) to coordinate energy research and other activities associated with the proposed Ph.D. program in Energy and Environmental Studies including fellowships, internships, conferences, and workshops which will occur at various locations on and off campus.

**Center for Aerospace Research**
The primary mission of the Center of Aerospace Research is to conduct high quality research in aeronautics and astronautics. The Center will support doctoral students who are interested in NASA's exploration of space and long-term human presence in space, as well as enhancement of life of Earth.

**Center for Composite Materials Research**
Research with polymeric-based composite materials at North Carolina A&T State University was started in 1976. The present Center was established in 1988 formally as a center of

**Institute for Human-Machine Studies**
The Institute will support doctoral students in Energy and Environmental Studies who are interested in applied scientific research and technology development directed toward the understanding of the nature of human performance while interacting with complex technology-driven systems. It focuses on cognitive engineering and human-system interface sciences, aviation and transportation human factors, information and communication technology integration, and healthcare and manufacturing applications.

**Center for Autonomous Control and Information Technology**
The Center will support students who are interested in soft computing, multiagent systems, artificial intelligence in general, control theory, genetic algorithms, and energy conservation and power electronics. The Center conducts interdisciplinary research in demonstrative programs for the application of fuzzy logic-controlled power electronic building block systems in HVAC systems, nonlinear active control of dynamical systems, artificial potential field based motion planning/navigation in two- and three-dimensional dynamic environments, and other relevant topics.

**Biotechnology Program**
The biotechnology program will support doctoral students who are interested in environmental biotechnology, techniques, and applications.

**Other Facilities**
The following facilities are available to support the Ph.D. program in Energy and Environmental Studies:

**The University Farm**
The University farm, located east of the Greensboro City limits, includes approximately 600 acres of land and modern farm buildings. About 40 acres are designated as Environmental Studies Laboratory. The laboratory will be available for doctoral students who are interested in water quality, waste management, waste to energy, and air pollution research.

**Constructed Wetland Research (Partnership with USDA-ARS)**
The Constructed Wetland System will support doctoral students who are interested in wastewater (agricultural and industrial) treatment, aquatic ecology, and remediation of wastewater. This is
the only fully automated wetland system exists in Southeast of U.S. with in-situ ammonia measuring device.

**Soil and Water Quality Program**
This program will support doctoral students who are interested in soil and water quality issues. The goal of this initiative is to understand the carbon sequestration of pollutants transport mechanism in relation to physical, chemical and biological properties of soil in non-point sources and also, to develop strategies for measurement of pollutants and remediation or prevention of pollutants. Spatial watershed based studies and modeling play a major role in this program.

**High Pressure Supercritical Carbon Dioxide Equipment**
A number of labs contain experimental setups that utilize high-pressure pumps to generate carbon dioxide at supercritical conditions. One lab is a high-pressure thermophysical properties laboratory.

**Nanoengineering Laboratory**
MTS Nanoindenter XP with continuous stiffness measurements option, and WYKO RST 500 Optical Profiler

**Thin Film Processing Facility**
Polymeric thin film processing and polymer characterization facility, pulsed laser deposition facility which includes a Lambda Physik L305 laser and optics tables, a 18” dual beam chamber, a target carrousel flange assembly, a 3” Programmable substrate heater, and a TCP600 speed controlling power supply.

**Electron Microscopy / EDS Laboratory**
HITACHI S-3000N variable pressure SEM with chamberscope and backscatter detector with Oxford ISIS 310 EDS attachment, and Polaron SEM coating system

**Microscopy and Sample Preparation Laboratory**
Optical microscopes with CCD Cameras (ZEISS MC-100, Nikon epiphot inverted microscope, Meiji optical microscope) and various sample preparation equipment (LECO and Buehler)

**The Physics Laser Lab**
The Physics laser lab is located in the newly renovated Interdisciplinary Research Center, which is home for several research centers: Two 20 Hz ND: YAG Laser (Continuum Surlite II) with a double and triple output pumping two Continuum ND6000 dye lasers, a UVX: frequency doubling and tracking system. Other Accessories include a 35 cm McPherson Monochromator, a SPEX Spectrometer, a Tektronix digital oscilloscope, Le Croy 4 channel oscilloscope with 20 GS Box Car averager and gated integrator system (Stanford System), Power Supply (Stanford), Temperature controllers (Omega Engineering), PMT, PMT cooled housing, Lab-view controlled data acquisition, a chart recorder, pumps, capacitance manometer, pressure gauges, flow meters (very sensitive), several heat pipe ovens, and optical components. A Continuum Leopard pico second laser with second, third and fourth harmonic generating crystals. Reflectron Time of Flight Spectrometer: featuring photoionization source featuring delayed extraction flight tube and ion optics including integrated vertical and horizontal deflectors for guiding ions through the
spectrometer. It also features dual detection: dual micro-channel plate detectors located at the linear end of the spectrometer and at the reflectron end of the spectrometer, floating anode, allowing detection of either positive or negative ions. It has computer controlled power supplies, ion mirror and deceleration; flight tube, detectors, deflectors and ion lens. The flight chamber is horizontally mounted on metal frame with turbo molecular pump (300 l/s minimum) with controller and backing pump for main chamber, with Granville-Phillip micro-ion module ion gauge, and Pirani gauge. Under the conditions of electron impact ionization of room temperature gases, the mass resolution is about 2000 m/Dm (FWHM). When operated in linear mode, only molecular cluster ions are obtained. However, the reflectron mode, which includes reversal of ion flow direction before analysis, increases the flight path of ions allowing analysis of fragments of parent molecules. The fragmentation pattern of a single species within a mixture can be analyzed. The ion mirror has a dispersion-correcting lensing providing a nearly perfect transmission of ions.

**Computational Science Laboratory**

The computational science laboratory has the following computer hardware:

- **One (1) SUN Ultra Enterprise 450 server (Functions as a file server)**
  - Two (2) CPUs with 480 Mhz speed each
  - A total of 2GB physical memory
  - Attached a SUN StorEdge A1000 with about 600 GB storage space and a SUN StorEdge L1000 tape backup module.
- **Three (3) SUN Enterprise 420R servers (Function as application servers)**
  - Each 420R has two (2) CPUs with 450 Mhz each
  - Each 420R has 1 GB physical memory
- **An Oscar cluster (Linux) system with 3 nodes (for parallel computing)**
- **Peripherals:**
  - One (1) HP DesignJet 430 plotter
  - One (1) HP Laser Jet network printer
- **Four (4) PCs serving both as desktop workstations and X terminals**

Installed software packages include:

- Omega Seismic Processing System
- Seismic Unix
- SEP
- Matlab
- Sun Forte University Edition compiler collection
- Some other freeware

**Applied Geophysical Science Laboratories**

The Applied Geophysical Science Laboratories (AGSL) at NC A&T include the following facilities:

**Seismic Physical Modeling Laboratory**

The Allied Geophysical Laboratory (AGL) at the University of Houston built the seismic physical modeling system for NC A&T. The physical modeling system uses piezoelectric
transducers as the seismic source and receiver to record seismic data on a physical model
designed to simulate scaled versions of real-world earth systems.

The system hardware consists of the following components:
- PCI-7344 NI motion control board;
- NuDrive (multi-axis power amplifier interface);
- M063-LS09 stepping motors;
- PCI-6110 DAQ data acquisition board and BNC Adapter;
- 5660B Ultrasonic pre-amplifier;
- 5077 PR square wave pulser/receiver;
- Transducers;
- Metal frame for holding water tank and model;
- A Dell PIV workstation.

The system software is a custom designed software package in LabVIEW, consisting of signal
generation, data acquisition, and acquisition automation subsystems to simulate the general
seismic survey.

**Seismic Data Processing Laboratory**
Seismic data generated from the Seismic Physical Modeling Laboratory or gathered in the field can
be processed in the Seismic Data Processing Laboratory. The Laboratory includes the following
hardware:
- A Sun Enterprise server;
- Two SUN Ultra 60 workstations;
- Two Linux workstations;
- Six Dell Pentium III or IV workstations;
- A 6-node Linux cluster with 12 CPUs and over 500 GB hard disk storage.

The software available in the Seismic Data Processing Laboratory includes OMEGA® Seismic
Data Processing System, awarded to NC A&T by WesternGeco. Additional data processing and
visualization software packages include WinSeis® Lite, GX II, SEP, Seismic Unix, and ArcGIS.
For seismic refraction processing, we have SeisImager® software, which uses multiple methods
including GRM and tomography, as well as Rimrock Geophysics’ SIPT2-based software.

**Acoustics Sensor Testing Laboratory**
The Acoustics Sensor Testing Laboratory for theoretical and experimental physical acoustics,
recently funded by the U.S. Department of Education Minority Science and Engineering
Improvement Program (MSEIP), is currently under construction. It consists of state-of-the-art
electronic testing equipment to test, evaluate, and develop ultrasonic piezoelectric transducers for
use in the Seismic Physical Modeling Laboratory, as well as other applications.

**Geophysical Field Equipment**
Geophysical equipment currently available or soon to be available: Geometrics Geode 24-
channel seismic Data Acquisition System; AGI SuperSting R1/IP Resistively System; CS-031
ground-conductivity instrument; and GPS units. We have access to additional geophysical
equipment (including GPR and EM equipment) and other resources through our partnership with Pyramid Environmental & Engineering, PC

**Analytical Services Laboratory (ASL)**

- **UV/VIS Absorption Spectrophotometry - Ion Chromatography**
  
  **Equipment:** CARY 1E Double Beam UV/VIS Spectrophotometer with auto sampler/sample preparation station. Perkin Elmer Lambda 3B Double Beam UV/VIS Spectrophotometer. Lachat Flow Injection Analyzer/ Ion Chromatograph (FIA/IC).
  
  **Instrument Capabilities:** Any colorimetric analysis of any analyte with a derivative absorbing in the region of 200 to 900 nanometers. Any kinetic analysis of an analyte absorbing in the same region for an ambient-temperature reaction and a reactant half-life on the order of at least two minutes.

- **Gas Chromatography and Mass Spectrometry**
  
  **Equipment:** Three Hewlett Packard 5890 (II) gas chromatographs. Two Flame Ionization (FID), one Electron Capture (ECD), two Nitrogen/Phosphorus (NPD), and one HP5971A mass spectrometer detectors. TEKMAR 7000 Static Headspace Auto sampler, and model ALS2000/LCS2016 Dynamic Purge-And-Trap controller and auto sampler.

- **Volatile and Semivolatile organic molecule qualitative and quantitative analysis.**

- **Nuclear Magnetic Resonance Spectroscopy**
  
  JEOL EX-270 MHz NMR with 5 mm and 10 mm tunable broadband probes and temperature controller for sub and supra-ambient temperature sample analysis, 5 mm Carbon/Hydrogen probe, Carbon/Hydrogen solid state probe, Windows XP workstation. Compounds containing phosphorus, carbon, hydrogen, nitrogen, aluminum, and chlorine can be analyzed if sufficient concentrations of NMR-sensitive nuclear spins are present in the sample.

- **Ion Coupled Plasma/Optical Emission Spectroscopy (ICP/OES)**
  
  Perkin Elmer Optima 3300 DV with 150 place auto sampler. The spectrometer is a polychromator versus a monochromater – meaning that more than one emission wavelength can be monitored in a parallel fashion. Six thousand emission wavelength lines that include the major emission lines for 72 of the 110 elements in the periodic chart can be monitored simultaneously with triplicates done in less than five minutes.

- **High Performance Liquid Chromatograph (HPLC)**
  
  Two HPLC’s – each with three pumps and auto samplers. Both HPLC’s have Photodiode Array Detectors. “Swing” modular units that can be used on either HPLC are a Sedex 75 Evaporative Light Scattering Detector (ELSD), Hewlett Packard Refractive Index Detector (model # 1037A), and an Eldex CH-150 column heater. Volatile, Semivolatile, and Non-volatile organic molecules and ions qualitative and quantitative analysis.

- **Microwave Sample Preparation**
  
Indoor Air Quality (IAQ) and Heating, Ventilating, Air-Conditioning & Refrigeration (HVAC&R) Graduate Research Laboratory

The laboratory is specifically built to provide research facilities and equipments for the graduate students to study full-scale interactions between various systems and occupants issues. The graduate studies that have been conducted are in the areas of Demand Control Ventilation, Indoor Air Quality and Particulate Removal, Variable Speed Air handler system, Variable Speed compression system, and other related issues on thermal comfort and HVAC&R.

The Lab has the following facilities and equipment:

- Four chambers, inside of two of them are covered by stainless steel sheets to provide clean and reliable environment for different measurements. The other two chambers are equipped as typical offices.
- A Data Acquisition System (LabView software) which is able to monitor and process one hundred sensor input data.
- A DX Air-Conditioning system with Variable Frequency Drives (VFD) for Air Handler fan-motor and compressor-motor. A scroll compressor is installed in this system to study this new generation of compressors in air-conditioning system.
- Various types of sensors and meters such as different thermostats, power meter, thermometers, etc.
- A computer software (ComfortVIEW) is connected to the HVAC system and enable the students to monitor operation of the system.
- A Variable Volume (VAV) System which can be monitored.

Supporting Institutes, Centers, and Programs

The proposed Energy and Environmental Studies Ph.D. program will be supported by current and emerging strengths in the University’s Interdisciplinary Institutes, Centers, and Programs.

Waste Management Institute (WMI)

The Waste Management Institute (WMI) is an interdisciplinary academic support unit with research and public service functions. The mission of the WMI is to enhance awareness and understanding of environmental and waste management issues. The WMI administers an undergraduate and advanced certificate program. The WMI coordinates fellowships, internships, conferences, and workshops which occur at various locations on and off campus. The WMI has hosted successful national conferences and symposia on a wide range of energy and environmental topics. The most recent was the 2002 National Conference on Environmental Science and Technology (www.ncat.edu/~wmi)

Transportation Institute

The mission of the Transportation Institute is to coordinate and manage interdisciplinary research, training, and technology transfer activities involving faculty, staff and students from various departments within the University. The Institute will support doctoral students who are interested in energy and systems management and economics including but not limited to transportation of wastes and pollution issues.
Civil Infrastructure Research Institute
The Institute will support Ph.D. students who are interested in structural health and durability of bridges and highways and dredging technology, materials characterization, testing, and load modeling. The objective is to determine full-scale validation of airport pavement using field instrumentation and computer simulation, more accurate evaluation of asphalt and concrete elastic and visco-elastic properties, and more accurate simulation of the loading of new, heavier airplanes’ landing gear on airfield pavements.

North Carolina Agromedicine Institute
The NC Agromedicine Institute is a scientifically based organization whose focus is on environmental and occupational health and safety issues of agricultural, forestry, and fisheries producers, workers and their families. Its mission is to promote health and safety of agricultural, forestry, and fisheries communities through research, education, and outreach. The Institute will support doctoral students who are interested in occupational health, safety, and education issues.

DOE Chair of Excellence in Environmental Disciplines
This program will support doctoral students who are interested in the general area of environmental research and training.

External Facilities

The Thomas Jefferson National Accelerator Facility (JLab)
NC A&T students who work on research projects related to the JLab will have access to the lab facilities. The Thomas Jefferson National Accelerator Facility (JLab) is a new institution managed and operated by Southeastern Universities Research Association (SURA) for the US Department of Energy (DOE). The mission of the Laboratory is to conduct cutting-edge nuclear physics research and to provide and support research activities done by university groups. It is internationally recognized as a leading institution in the field of experimental and theoretical physics. The experimental research is based on the state-of-the-art high energy and high performance continuous electron beam accelerator (CEBAF).

The Triangle Universities Nuclear Laboratory (TUNL)
NC A&T students who work on research projects related to the TUNL will have access to the lab facilities. The Triangle Universities Nuclear Laboratory (TUNL) is a joint venture between three major universities in North Carolina: Duke University in Durham, North Carolina State University (NCSU) in Raleigh, and the University of North Carolina (UNC) at Chapel Hill. TUNL is located on the campus of Duke University. It is presently comprised of 16 faculty, 15 post doctoral research associates and research scientists, and 30 graduate students. During the last 10 years TUNL has evolved from a successful three university research institution centered around the local FN Tandem accelerator with its unique polarization capabilities into a research enterprise of tremendous breadth and diversity. Researchers at TUNL use a wide range of facilities and techniques to explore the properties of sub-atomic particles at low to medium energies. One NC A&T physics faculty member, Dr. Ron Pedroni, is a visiting senior scientist of the TUNEL for past several years, and has full access to the lab facilities.
Oak Ridge National Laboratory

Oak Ridge National Laboratory (ORNL) is an interdisciplinary research and development organization with more than 30 years of achievement in local, national, and international energy and environmental research. ORNL expand scientific knowledge and developing technological solutions to address nation’s energy and environmental problems. Many projects in ORNL are conducted with the cooperation of scientists from universities. North Carolina A&T State University had collaborative projects with ORNL in College of Arts and Sciences and College of Engineering in energy and environmental science and engineering.

US Department of Energy - Savannah River Site

On September 12, 1994, the United States Department of Energy’s Savannah River Office (USDOE-SR) and North Carolina A&T State University entered into a partnership to develop an interdisciplinary Waste Management Institute (WMI) with a $1.4 million grant. The Savannah River Site will be available to Ph.D. students who are interested in accelerated cleanup program goals including alternative subsurface sampling and monitoring approaches to environmental remediation.

B. Describe the effect of this new program on existing facilities and indicate whether they will be adequate, both at the commencement of the program and during the next decade.

The University has in place the laboratories, centers, and institutes listed above and they have space available to add research for several students. Since most of the faculty already are using this space the additional load will be small.

C. Discuss any information technology services needed and/or available.

Essential computing resources in support of the proposed program are in place at the departments, colleges, and university levels. New faculty joining the program will have to be provided with adequate computer hardware and software in their offices. This requirement is included in the budget.

D. Discuss sources of financial support for any new facilities and equipment.

The basic facilities and equipment for this proposed interdisciplinary program are in place. As the research needs grow in 5-10 years, funds will be needed to upgrade and renovate some laboratory space. The University through its on budget and research grants will be able to fund these costs.
VII. **ADMINISTRATION**

Describe how the proposed program will be administered, giving the responsibilities of each department, division, school, or college. Explain any inter-departmental or inter-unit administrative plans. Include an organizational chart showing the "location" of the proposed new program.

**Program Director**

A Program Director (PD) will be appointed to administer the program. The initial appointment will be made by the Provost in consultation with the Dean of Graduate Studies and all other academic deans with a vested interest in the program. After the initial appointment the Program Administrative Committee will handle all future appointments. The PD will be equivalent to a department chair and manage the budget, including faculty positions assigned to the program. The PD will make teaching assignments for program courses using faculty assigned to the program. If a faculty member is needed and he/she is not assigned to the program the PD must consult with the department chair of the faculty member.

**Program Administrative Advisory Committee**

The Program Administrative Advisory Committee (PAAC) will consist of the Dean of Graduate Studies and other deans, center directors, and institute directors who have an interest in the program. The initial PAAC will be appointed by the Provost in consultation with the University Dean’s Council. The Dean of Graduate Studies will be the chair of the PAAC and also act as the day-to-day supervisor of the PD. The PAAC will provide the leadership, administrative control, and financial backing for the program. Additional deans and directors may be added as new aspects of the interdisciplinary program are developed.

**Program Faculty**

The program faculty will have joint appointments with the interdisciplinary program and a home department. The home department will be the department of record for tenure, promotion, and evaluation. The PD will provide input from the interdisciplinary program for any discussions on promotion and tenure.

**Program Courses**

The curricula for the interdisciplinary program will include existing courses from established programs and new courses to be established for the interdisciplinary program. The new classes will carry a prefix consistent with the program name. Student credit hours associated with the new courses will be used to establish faculty positions and other budgets.

**Program Budget**

The budget for the first two years of the interdisciplinary program will be established by reallocating existing funds. The basic budget will include funds for a Program Director, administrative support, faculty positions, graduate teaching assistantships, office/educational supplies, and communication. (See Appendix G.) Future budgets will be based upon student credit hours generated.
Program Organizational Structure

North Carolina A&T State University
School of Graduate Studies
Organizational Chart

PROVOST AND VICE CHANCELLOR FOR ACADEMIC AFFAIRS
(Management responsibility for all academic programs)

Deans of Colleges and Schools
(College/School policies regarding student assistantships, faculty load, and facilities)

Dean of Graduate Studies
(Student record-keeping, application process, policies regarding students and graduate faculty and quality oversight)

Department Chairs
(Student assistantships, faculty load, courses offerings, recruitment, quality, and oversight)

Program Administrative Advisory Committee
(Provide support and access to chairs)

Interdisciplinary Program Director
(Manage budget, faculty positions, and liaison with deans)

Faculty
(Responsible for teaching, service, and research)

VIII. ACCREDITATION

Indicate the names of all accrediting agencies normally concerned with programs similar to the one proposed. Describe plans to request professional accreditation. If the proposed new degree program is at a more advanced level than those previously authorized or if it is in a new discipline division, was SACS notified of a potential "substantive change" during the planning process? If so, describe the response from SACS and the steps that have been taken to date with reference to the applicable procedure.

The Southern Association of Colleges and Schools (SACS), is the accrediting agency for the University as a whole. Since the university already offers two Ph.D. programs (Electrical Engineering and Mechanical Engineering), approval is in place from SACS for doctoral level programs in the university.
IX. SUPPORTING FIELDS

Are other subject-matter fields at the proposing institution necessary or valuable in support of the proposed program? Is there needed improvement or expansion of these fields? To what extent will such improvement or expansion be necessary for the proposed program?

This proposed interdisciplinary Ph.D. program has the potential to use almost all of the disciplines in the College of Arts and Sciences, College of Engineering, School of Agriculture and Environmental Sciences, School of Nursing, School of Business and Economics, and the School of Technology. The deans of each of these academic units have been part of the development of this program and understand that there may be a need to provide courses at higher levels as the proposed program grows.

X. ADDITIONAL INFORMATION

Include any additional information deemed pertinent to the review of this new degree program proposal.

XI. BUDGET

Provide estimates (using the attached form) of the additional costs required to implement the program and identify the proposed sources of the additional required funds. Use SCH projections (section II.C.) to estimate new state appropriations through enrollment increase funds. Prepare a budget schedule for each of the first three years of the program, indicating the account number and name for all additional amounts required. Identify EPA and SPA positions immediately below the account listing. New SPA positions should be listed at the first step in the salary range using the SPA classification rates currently in effect. Identify any larger or specialized equipment and any unusual supplies requirements.

For the purposes of the second and third year estimates, project faculty and SPA position rates and fringe benefits rates at first year levels. Include the continuation of previous year(s) costs in second and third year estimates.

Additional state-appropriated funds for new programs may be limited. Except in exceptional circumstances, institutions should request such funds for no more than three years (e.g., for start-up equipment, new faculty positions, etc.), at which time enrollment increase funds should be adequate to support the new program. Therefore it will be assumed that requests (in the “New Allocations” column of the following worksheet) are for one, two, or three years unless the institution indicates a continuing need and attaches a compelling justification. However, funds for new programs are more likely to be allocated for limited periods of time.
XII. EVALUATION PLANS

All new degree program proposals must include an evaluation plan which includes: (a) the criteria to be used to evaluate the quality and effectiveness of the program, (b) measures to be used to evaluate the program), (c) expected levels of productivity of the proposed program for the first four years of operation (number of graduates), (d) the names, addresses, e-mail addresses, and telephone numbers of at least three persons (six reviewers are needed for graduate programs) qualified to review this proposal and to evaluate the program once operational, and (e) the plan and schedule to evaluate the proposed new degree program prior to the completion of its fifth year of operation once fully established.

The evaluation of the proposed program began by contacting Dr. C. Russell Philbrick - Professor of Electrical Engineering, Director of Penn State University Lidar Laboratory, Senior Scientist of Applied Research Laboratory to review the proposal. Dr. Philbrick reviewed a draft of the proposal. His report and resume are presented in Appendix H.

A. Criteria to be used to evaluate the proposed program

The University has an Assessment and Program Evaluation Process in place that is used for all programs on campus. The proposed Ph.D. program will be added to the rotation schedule and be assessed and evaluated on a five year rotation beginning five years from initiation (Appendix E). During the first four years there will be annual evaluations of the progress of the program based upon the following criteria:

**Criterion 1**: Faculty involvement with students and research grants in Energy and Environmental Studies  
**Criterion 2**: Ph.D. students admitted and retained in the program  
**Criterion 3**: Intellectual capital in Energy and Environmental Studies developed by the students and faculty

B. Measure to be used to evaluate the proposed program

Each criterion will be evaluated using specific measures, as identified below.

**Criterion 1 - Faculty**
1. Number of faculty teaching courses in Energy and Environmental Studies;  
2. Number of different departments involved in teaching and research with the Energy and Environmental Studies Ph.D. students;  
3. Number of Recognized Leaders in Residence involved in the program; and  
4. Number of external researchers involved in student program committees.

**Criterion 2 - Students**
1. Number of students admitted each year;  
2. Enrollment growth considering new and continuing students;  
3. Number of students admitted to candidacy; and  
4. Diversity of academic disciplines represented by the student enrollment.
Criterion 3 – Productivity

1. Number of research articles published in Energy and Environmental Studies;
2. Number of research projects proposed and funded in Energy and Environmental Studies;
3. Number of presentations made by faculty and students on Energy and Environmental; and
4. Number of short courses developed and presented on Energy and Environmental by the faculty and students.

C. Projected productivity levels (number of graduates)

The proposed program is a full time program with no graduates expected within the first five years. The first graduates are expected at the end of five years as shown below.

Projection of number of graduates for first five years

<table>
<thead>
<tr>
<th>Year</th>
<th>No. of Full time Students</th>
<th>No. of Part-time students</th>
<th>Total No. of students</th>
<th>No. of graduates</th>
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<tbody>
<tr>
<td>2005-2006</td>
<td>4</td>
<td>1</td>
<td>5</td>
<td>-</td>
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<td>2006-2007</td>
<td>8</td>
<td>2</td>
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<td>2007-2008</td>
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<td>2008-2009</td>
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<tr>
<td>2009-2010</td>
<td>14</td>
<td>5</td>
<td>19</td>
<td>6</td>
</tr>
</tbody>
</table>

D. Recommended consultants/reviewers

Names, titles, addresses, e-mail addresses, and telephone numbers. May not be employees of the University of North Carolina.

The following consultants/reviewers are recommended:

Allen C. Basala (with EPA in NC)
1419 Brunson Court
Cary, North Carolina 27511
Basala.Allen@epamail.epa.gov

Dr. Anthony Michaels, Director,
Wrigley Institute for Environmental Studies
Los Angeles, CA 90089-0371
Phone – 213-740-6780
tony@usc.edu

Dr. James Momoh
National Science Foundation
4201 Wilson Boulevard
Arlington, Virginia 22230
jmomoh@nsf.gov
Phone: (703) 292-8339

Dr. Yogi Goswami Ph.D; P.E.
Director-Solar Energy & Energy Conversion Laboratory - 220 MEB
University of Florida
PO Box 116300
Gainesville FL 32611-6300
352-392-0812.
E. Plan for evaluation prior to fifth operational year
The Dean of Graduate Studies will meet with the Program Administrative Committee each spring semester to review the Criteria for evaluation and make any necessary adjustments for the fall semester of the next academic year. This evaluation will parallel the assessment and evaluation plan already in place at the University. In year five the program will be included in the University’s overall plan.

XIII. Reporting Requirements

Institutions will be expected to report on program productivity after one year and three years of operation. This information will be solicited as a part of the biennial long-range planning revision.

Proposed date of initiation of proposed degree program: **August 2005**

This proposal to establish a new degree program has been reviewed and approved by the appropriate campus committees and authorities.

Chancellor: __________________________________________

James C. Renick

XIV. REFERENCES AND BIBLIOGRAPHY

1. National Council for Science and the Environment
   [http://www.cnie.org/updates](http://www.cnie.org/updates)
2. National Science Foundation, Division of Science Resources Studies (NSF). 1996.
APPENDICES

APPENDIX A  Ph.D. Dissertations and Master’s Thesis 1999 – 2003 Related to Energy and Environment Areas
APPENDIX B  Courses in Energy and Environmental Studies
APPENDIX C  Past Research Projects
APPENDIX D  Faculty Resumes
APPENDIX E  Support Letters
APPENDIX F  Annual Assessment Procedures
APPENDIX G  Budget
APPENDIX H  Consultant Report
Appendix A.
Ph.D. Dissertations and Master’s Thesis 1999 – 2003
Related to Energy and Environment Areas

Dissertations


THESIS


38. Computational Fluid Dynamic Simulation Of Indoor Air Quality For Portable Air Cleaners In Indoor Environments / By Mohan Kunta, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 1999.


49. Development Of Zeolite Based Friedel-Crafts Acylation Process In Supercritical Carbon Dioxide /By Aakash S. Gupta, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2002.


<table>
<thead>
<tr>
<th>Number</th>
<th>Title</th>
<th>Author</th>
<th>Institution</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>62</td>
<td>Fate Of Atrazine And Metolachlor In Till And No-Till Soils / By Hamid Rafiee, Thesis (M.S)--North Carolina Agricultural and Technical State University, 1999.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>64</td>
<td>A Feasibility Study Of Shape Memory Alloy Control Of Thin Film Solar Arrays / By Charles Patrick Collier, Thesis (M.S)--North Carolina Agricultural and Technical State University, 1999.</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>65</td>
<td>First Order Uncertainty Analysis Of Do -Neuse River Case Study / By Hong Guan, Thesis (M.S)--North Carolina Agricultural and Technical State University, 2000.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


74. Influence Of Incubation Humidity And Breeder’s Age On Chick Hatchability And Quality / By Africa L. Joyner, North Carolina Agricultural and Technical State University, 2003.


80. Intrusion of Embedded Fiber Optic Sensor On Structural Integrity of Composite Laminate. / By Legunchim Emmanwori, Thesis (M.S.)--North Carolina Agricultural and Technical State University,


86. Isolation And Characterization Of An Fc Receptor Protein Binding IgM On Bovine Leukocytes / By Amy Michele Johnston, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2002.


90. Laboratory Scale Experiments To Determine The Effect Of Resistive Heating On Soil Microbial Communities / By Rhea Powell Jones, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 1999.


102. Nitrogen And Phosphorous Losses In Relation To Tillage And Wheel - Traffic Compaction /By Renessa C. Hardy-Brown, Thesis (M.S)--North Carolina Agricultural and Technical State University,


115. Photorelectance Study Of Te-Doped Gasb At The E0 Transition / By Baohong Gong, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 1999.


118. A Preliminary Examination Of The Dopamine Transporter And Dopamine Receptor Four Genes Expressed In Rat Strain Models Of Attention Deficit Hyperactivity Disorder / By Dawn M. Holt, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2003.

120. Quantitative Risk Analysis Of In-Service Pressure Equipment Based On Tnt Equivalencies / By Rodger V. Zawodniak, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2001.

121. Reactive And Non-Reactive Quenching Of Li(3p) By Ch4, C2h6,C3h8 - Swindell Ii, James T., Thesis (M.S.)-- North Carolina Agricultural and Technical State University, 2003.


123. Region Based Scalable Coding For The Interactive Medical Image Communication Over Networks / By Ling Cao, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2003.


135. A Study Of Mercury Ion Binding To 2-Thio And 4-Thiouridine / By Amir A. Abdalla, Thesis (M.S.)--North Carolina Agricultural and Technical State University.


147. The Treat Ability Of Poly Glycol Methyl Ether Acetate And Pre-Treated Chemical Mechanical Polish With Respirometry And Bench-Top Sequencing Batch Reactors / By Meredith Amani Watson, Thesis (M.S.)--North Carolina Agricultural and Technical State University, 2001.


APPENDIX B
Potential New Graduate Courses
And
Existing Graduate Courses

ENEV 7XX Energy and Environmental Systems - Biological Aspects 3(2-3)
The objectives of this course are to provide microbiological applications with an emphasis on the role of microbes in the environment, remediation processes, and energy production. Population dynamics, species interactions, community structure, biodiversity, bioenergetics, nutrient cycling, and human impacts are presented. A laboratory component will be incorporated.

ENEV 7XX Energy and Environmental Systems - Chemical Aspects 3(2-3)
This course provides information on chemistries of air at different altitudes, of water and soil contaminants. Chemical and physico-chemical processes at phase boundaries, modeling for kinetics and mass transport, and analytical techniques will be covered. The theory underlying vapor pressure, solubility, and Henry's Gas Law Constant will be presented. A laboratory component will be incorporated.

ENEV 7XX Smart Sensors and Fuel Cell 3(3-0)
The course will address the development of smart fuel cell technology. Utilizing advances in sensors and VLSI, smart sensors will be developed that will monitor H2, O2, and others gases, to regulate their production for optimum performance. The class will discuss signal conditioning circuits, AD/DA conversions, and decision-making circuits suitable for custom integrated circuit solutions to create a smart fuel cell. The class will include hands-on experience in creating custom analog and digital VLSI circuits using the CADENCE software package.

ENEV 7XX Introduction to Spatial Sciences 3(2-2)
Students will learn theoretical and practical applications of geo-spatial sciences within the context of energy and environmental systems. Theory of satellite-based Geographic Positioning Systems (GPS) will be studied while performing practical, hands-on laboratory experiments using the latest in GPS equipment. Classroom discussions will then focus on relating location on the Earth's surface to a common mapping grid. Non-projected and projected maps, ellipsoids and spheroids, and geoids will be discussed. Spatial relationships, or analysis, of continuous and categorical data will be addressed through the application of standard statistics and probability. ARCVIEW, a popular Geographic Information System (GIS) software tool will be stressed.

ENEV 7XX Introduction to Energy and Environmental Forecasting Systems 3(3-0)
This course addresses the composition and novel uses of observation and forecasting systems towards the enhanced understanding and management of natural resources. Students are exposed to a novel, cross-disciplinary culture for understanding and interacting with energy and environmental systems. This culture relies heavily on "real-time" generation of modeling and observational data, which are integrated and distributed through information networks designed to bring the right energy and environmental information at the right time to the right user.
ENEV 7XX Energy, Infrastructure, Management 3(3-0)
The course provides an introduction to the energy infrastructure systems and discusses in detail the historical perspectives of the natural gas and electric power industries in the U.S. The course provides a perspective of many business challenges that these industries are facing through market restructuring and convergence. Use of information technology tools in the energy industry and its impact on the energy supply chain will be discussed. The course covers both the natural gas and electric power industries in similar detail and is relevant to students wishing to be familiar with related cross-cutting issues of the industries. The objective is to provide an introduction to the basics of natural gas and electric power infrastructure economics, a review of the structural and strategic changes affecting the industries and a basic understanding of how the competitive markets for natural gas and electricity work.

ENEV 7XX Industrial Recycling and Marketing 3(3-0)
The course will illustrate process technologies converting industrial waste to marketable byproducts, with particular emphasis on locating and evaluating suitable consumers. Components of a waste are matched with operations using similar components as raw materials. This course focuses on identifying customer needs for by product materials generated by recycling processes, particularly product physical and chemical specifications. Both proven and emerging solutions to solid waste environmental problems, especially those associated with metals, will be discussed.

ENEV 7XX Fuel Cell Product Realization System: Business and Technical Integration Issues 3(3-0)
The course introduces students to the production of alternate energy systems and fuels, and demonstrates their use in vehicle design, manufacturing and service on a global level. This course provides an in-depth understanding of the product realization life cycle, and business and process issues necessary for making good business and technical decisions. A process framework begins with identifying a strategic intent for the application of technology in the marketplace, describes application development, shows integration into vehicle production, discusses concurrent engineering manufacturing issues, emphasizes the importance of quality and testing in manufacturing, and finally outlines lessons learned from the use of technology by customers in the field.

ENEV 7XX Fundamentals of Fuel Cell Systems 3(3-0)
The course addresses the process and materials aspect of fuel cell technology, and the reforming of hydrocarbon fuels to hydrogen. The course includes a review and discussion of the various types of fuel cells, materials properties of electrodes and polymeric membranes, and electrochemical mechanisms. Reforming of various types of hydrocarbon fuel to hydrogen and the application of reforming technology to stationary and vehicle fuel cells will be discussed. Safety aspects of fuel cells and the reforming of hydrocarbon fuels to hydrogen will be discussed.

ENEV 7XX Power System Planning and Policy 3(3-0)
The course focuses on the technological and policy evolution of the power industry. It also considers how technology innovations and policy/regulatory actions have guided the planning of the industry. Students investigate the range of supply and demand side resources (both existing...
and emerging) in the sector. As well, technical characteristics, utility organizational and planning structures, and emerging alternatives in utility technology, planning and policy are examined. Emphasis is placed on American experience with a comparative analysis of other national experiences. Round table discussions are used to examine the application of technologies, planning models, organizational structures and policy alternatives in developing economies.

**ENEV 7XX - Principles of Environmental Security 3(3-0)**
Scientific foundations of environmental hazards; natural and anthropogenic factors leading to environmental instability; multi-disciplinary approaches to ecosystem resilience and sustainability; engineering techniques to monitor the response of the Earth system; information synthesis; disaster preparedness and emergency response procedures; technical and political aspects of treaty monitoring; contemporary problems addressed through case studies.

**ENEV 7XX Special Topics 3(0)**
The course typically involves a scholarly and critical review of an advanced scientific topic by one or more students together with one or more faculty members. Requirements of the student typically include a written review paper and/or a seminar to be given as part of the course. Selection of this course for credit and the topic to be investigated must be approved by the Student's Program Committee.

**COURSE DESCRIPTIONS FOR CURRENT AVAILABLE ELECTIVES**

**Animal Sciences**
**ANSC-701. Environmental Topics in Animal Health Credit 3 (3-0)**
Influence of the environment upon the health status of animals within the disciplines of epidemiology, toxicology, pathobiology, reproductive physiology, nutrition, and microbiology.

**ANSC-771. Bioinformatics and Genome Analysis Credit 3 (0)**
The course will be on bioinformatics and its application to genome analysis, computational tools and methods for organizing data, as well as large scale DNA sequencing, gene expression analysis methods and algorithms for basic and advanced search techniques.

**Biology**
**BIOL-700. Environmental Biology Credit 3 (3-0)**
The scientific study of man’s living and non-living environment. The course emphasizes how our technologies and cultures impact the earth’s ability to sustain both human civilization and the earth’s biodiversity. Prerequisites: None.

**BIOL-703. Experimental Methods in Biology Credit 4 (2-4)**
An introduction to the scientific method, basic techniques, and equipment used in experimental research in Biology. The course will provide a foundation for enabling students to initiate and conduct independent research. Prerequisites: None.

**BIOL-704. Cell and Molecular Biology Credit 3 (3-0)**
A course that integrates the most recent advances in molecular biology of structure and function in cells. Prerequisite: Biology 462.
BIOL 706-Computational Biology
This course will provide detailed coverage on the theoretical and computational methods used in biology. Topics to be covered will include molecular modeling and simulations of structure and function in biological molecules, bioinformatics and computational genomics.

BIOL-739. Radio-isotope Techniques and Radiotracer Methods Credit 4 (2-4)
The techniques employed in the handling and measurement of radio-isotopes and their use as tracer agents in biological investigations.

BIOL-741. Applied Plant Ecology Credit 3 (2-2)
A study of the relations of plants to their environment with emphasis on climate and soil factors influencing their structure, behavior and distribution. Prerequisite: Biology 640, 740, or equivalent.

BIOL-749. Recent Advances in Cell Biology Credit 3 (3-0)
A course designed to present recent trends concerning functions of organized cellular and subcellular systems. Current research as it relates to the molecular and fine structure basis of cell function, replication, and differentiation will be discussed.

BIOL-750. Microscopy Technique Credit 3 (1-4)
This course is designed to develop the skills required to prepare cells, tissue, and organs for microscopic observation and study. Lectures will emphasize central concepts in microscopy. Prerequisites: Biology 201 and 462. Biology 465 is recommended.

BIOL-780. Animal Physiological Ecology Credit 3 (3-0)
An introduction to the physiological adaptations of individuals that enable them to make the internal adjustments necessary to grow and reproduce in changing environments. This course will emphasize the physiological strategies for nutrient acquisition, gaseous exchange, water and ion balance, and thermal tolerance. Prerequisites: Biology 310 and 462.

BIOL 842-Interdisciplinary Computational Science Team Project I
This course is part one of a year-long team-based definitive time scheduled project design and implementation course sequence. Students work on two to three projects each semester to develop software tools or programs for scientific tasks in a high performance computing environment. Project topics are normally chosen from industry applications and involve several disciplines. Lectures will be given on available computational environments, code development, implementation of parallel algorithms. Interpersonal interaction and people oriented management techniques are employed, along with team member measurement and assessment methods. Project reports and oral presentations are required.

BIOL 843-Interdisciplinary Computational Science Team Project II
This course is part two of a year-long team-based definitive time scheduled project design and implementation course sequence. Students work on two to three projects each semester to develop software tools or programs for scientific tasks in a high performance computing environment. Project topics are normally chosen from industry applications and involve several
disciplines. Lectures will be given on available computational environments, code development, implementation of parallel algorithms. Interpersonal interaction and people oriented management techniques are employed, along with team member measurement and assessment methods. Project reports and oral presentations are required.

Chemistry
CHEM-711. Structural Inorganic Chemistry Credit 3 (3-0)
A study of the stereochemistry and electronic properties of inorganic substances. Emphasis will be placed upon applications of group theory and upon spectroscopic and physical methods.

CHEM-721. Elements of Organic Chemistry Credit 3 (2-3)
A systematic study of the classes of aliphatic and aromatic compounds and individual examples of each. Structure, nomenclature, synthesis, and characteristic reactions will be considered. Illustration of the familiarity of organic substances in everyday life will be included. In the laboratory, preparation and characterization reactions will be performed.

CHEM-722. Advanced Organic Chemistry Credit 3 (3-0)
Recent developments in the areas of structural theory, stereochemistry, molecular rearrangement and mechanism of reactions of selected classes of organic compounds. Prerequisite: One year of Organic Chemistry or Chemistry 721.

CHEM-723. Organic Chemistry Credit 2 (2-0)
An advanced treatment of organic reactions designed to give students a working knowledge of the scope and limitations of the important synthetic methods of Organic Chemistry. Prerequisite: Chemistry 722.

CHEM-727. Organic Preparations Credit 1-2 (0-2 to 4)
An advanced laboratory course. Emphasis is placed on the preparation and purification of more complex organic compounds. Prerequisite: One year of Organic Chemistry.

CHEM-731. Modern Analytical Chemistry Credit 3 (2-3)
The theoretical bases of Analytical Chemistry are presented in detail. In the laboratory, these principles, together with a knowledge of chemical properties, are used to identify substances and estimate quantities in unknown samples.

CHEM-732. Advanced Analytical Chemistry Credit 3 (3-0)
A lecture course in which the theoretical bases of Analytical Chemistry and their application in analysis will be reviewed with greater depth than is possible in the customary undergraduate courses. Equilibrium processes, including proton and electron transfer reactions and matter-energy interactions, will be considered. Prerequisite: One year of Analytical Chemistry or Chemistry 731.

CHEM-741. Principles of Physical Chemistry I Credit 3 (3-0)
A review of the fundamental principles of Physical Chemistry, including the derivation of the more important equations and their application to the solution of problems. Prerequisite: Mathematics 606 or 622.
CHEM-742. Principles of Physical Chemistry II Credit 3 (3-0)
A continuation of Chemistry 741. May be taken concurrently with Chemistry 741.

CHEM-743. Chemical Thermodynamics Credit 3 (3-0)
An advanced course in which the laws of thermodynamics will be considered in their application to chemical processes. Prerequisite: Chemistry 442 or 742.

CHEM-744. Chemical Spectroscopy Credit 3 (2-3)
An advanced course in which the principles and applications of spectroscopy will be considered. Prerequisite: Chemistry 442 or 742.

CHEM-748. Colloid Chemistry Credit 2 (2-0)
A study of the types of colloidal systems and the fundamental principles governing their preparation and behavior. Prerequisite: Chemistry 442 or 742.

CHEM-749. Chemical Kinetics Credit 4 (4-0)
A study of the theory of rate processes; application to the study of reaction mechanisms. Prerequisites: Mathematics 222 and Chemistry 442 or 742.

Civil and Environmental Engineering
CIEN-700. Emerging Technologies in Civil Engineering Credit 3 (3-0)
Provides an overview of the applications of emerging technologies (such as decision support systems and Geographic Information Systems) in civil engineering. The students are required to complete a project which includes the design and implementation of one of the types of systems covered in the course.

CIEN-702. Civil Engineering Systems Analysis Credit 3 (3-0)
Introduces mathematical modeling techniques for the solution of civil engineering problems. These include the formulation of mathematical representation of complete civil engineering systems and their evaluation via linear programming, dynamic programming, non-linear programming and the use of formal heuristics. Multiobjective analysis, project management and civil engineering planning and design are also presented.

CIEN-710. Hazardous Waste Management Credit 3 (3-0)
Presents a study of the characteristics, treatment, and disposal of hazardous wastes. The topics include the: the generation and characteristics of hazardous waste, hazardous waste regulations, transport and fate of hazardous waste in the environment and treatment and disposal methods. (Fall)

CIEN-712. Systems Approach in Waste Management Credit 3 (3-0)
Introduces the application of systems analysis methods to the design, analysis and management of environmental systems. The topics include: characteristics of a system, problems amenable to systems analysis, optimization models, solution techniques, and case studies in solid waste management, hazardous waste management, and water quality management. (Spring)
CIEN-724. Constitutive Modeling for Geological Media Credit 3 (3-0)
Introduces the following topics: constitutive models for geological media including piecewise linear; Mohr-Coulomb: Hvorslev’s and Roscoe’s concepts; role in modeling of in-situ stress; sequential construction and stress paths; lateral pressure coefficients; dilatation and softening; arching; pore water pressure; joints and interfaces; and Darcy and non Darcy Laws.

ARCHITECTURAL ENGINEERING COURSE DESCRIPTIONS
AREN-702. Value Analysis in the Design and Construction of Buildings Credit 3 (3-0)
The students will make use of simulation and mathematical modeling as design analysis tools to minimize building life cycle costs. Structural systems, heating and air conditioning systems, lighting and power, plumbing and fire protection systems are included as part of the analysis. Value engineering principals are presented as they apply to the design of buildings. Prerequisite: Graduate standing and consent of the instructor.

AREN-742. Illuminating Engineering Credit 3 (3-0)
The course develops numerical methods and methodology for solving special problems in lighting. Topics include advanced numerical methods and lighting design for exterior applications. The application and use of lighting energy codes and standards are applied to lighting design. Prerequisite: Graduate standing and AREN 642 or consent of the instructor.

AREN-762. HVAC Systems Analysis & Simulation Credit 3 (3-0)
The course deals with the analysis of HVAC computer programs used to predict energy-use. Hour-by-hour simulation programs are compared with bin weather data programs for accuracy and care of use. Prerequisite: Graduate standing and consent of the instructor.

AREN-765. Advanced HVAC System Design Credit 3 (3-0)
This course deals with the HVAC design for complex facilities such as high rise office buildings, science laboratories, and/or hospitals. Prerequisite: Graduate standing and consent of the instructor.

AREN-770. Energy Management Planning Credit 3 (3-0)
The course presents concepts of energy management planning for multi-building complexes such as universities, hospitals, and schools. Topics include data collection and analysis, facility audits, on-site metering, and the review of maintenance records and utility bills. Prerequisite: Graduate standing and consent of the instructor.

AREN-772. Advanced Energy Conservation Systems Credit 3 (3-0)
The course includes advanced topics in energy conservation including thermal storage, district heating and cooling, waste heat recovery, and co-generation. Prerequisite: Graduate standing and consent of the instructor.

AREN-778. Energy & Maintenance Management Credit 3 (3-0)
The course deals with computerized energy accounting methodologies and computerized maintenance management methodologies. The students will apply computer programs to an actual building in order to obtain real-world experience in program application. Prerequisite: Graduate standing and consent of the instructor.
BIOENVIRONMENTAL ENGINEERING COURSE DESCRIPTIONS

AGEN-701. Soil and Water Engineering II Credit 3 (3-0)
The design of drainage and irrigation systems and their applicability to specific regions will be addressed. There will be in-depth discussion of saturated and un-saturated flow, and various equations that are used to solve soil water movement. Open channel flow, well hydraulics, and earth dams or embankments will be covered. Prerequisite: AGEN-600 or consent of the instructor.

AGEN-714. Applied Hydrogeology Credit 3 (3-0)
This course will cover basic principles of groundwater resource evaluation and the approach or techniques used to solve groundwater problems. Discussion will include methods used to quantitatively appraise hydrogeologic parameters affecting water-yielding capacity of wells and aquifers. Various types of aquifers and will be discussed under the umbrella of confined and unconfined aquifers. Ground water quality, conservation and contamination will also be covered.

COMP-715. Decision Support Systems Credit 3 (3-0)
This course examines methods of inference under uncertainty and problem-solving strategies as key components of decision support systems. Knowledge based systems, knowledge acquisition and representation, and the planning, design and implementation of computer-assisted decision systems are covered. The interactive use of software for management decision making is examined through examples drawn from decision modeling, simulations, and large-scale commercial applications. Prerequisite: Graduate standing.

COMP-740. Advanced Artificial Intelligence Credit 3 (3-0)
This course is a further study of artificial intelligence principles, with a focus on knowledge based systems. The course examines planning, belief revision, control, and system evaluation and implementation. Advanced topics include automated theorem proving, learning and robotics, neural nets, and the adequacy of existing theoretical treatments. Prerequisite: COMP-645.

COMP-741. Knowledge Representation and Acquisition Credit 3 (3-0)
The representation formalisms used in artificial intelligence are explained, along with representation selection and implementation in common Artificial Intelligence languages and shells. Formalisms include first order logic and its extensions, semantic nets, frames and scripts, and KL-ONE-like languages. Knowledge acquisition is introduced as eliciting knowledge, interpreting elicited data within a conceptual framework, and the formalizing of conceptualizations prior to software implementation. Knowledge acquisition techniques such as protocol analysis, repertory grids, and laddering are examined. Prerequisite: Graduate standing.

COMP-742. Automated Reasoning Credit 3 (3-0)
This course studies the computational aspects of logic via propositional and predicate calculi, as well as the theory underlying their automation through logic programming languages. Various forms of resolution and their soundness and completeness are examined along with unification and its properties. Proof procedures and their search characteristics, term rewriting, and techniques such as narrowing are researched as a means of theory resolution. The relationship of
formal specification techniques such as cut elimination, efficiency, and implementation issues are addressed. Prerequisite: COMP-645.

Curriculum and Instruction
CUIN-711. Research and Inquiry Credit 3 (3-0)
This course is designed to teach students to be able to locate, read, understand, critique, and use the results of research to become more effective professionals and make sound educational decisions. Students will develop an understanding of the researcher's methodologies, the procedures, and results. Students will analyze and evaluate research, judge the usefulness of the findings for educational practice, and plan research to improve educational practice.

CUIN-721. Advanced Methods and Internship Credit 3 (3-0)
This course will focus on using an understanding of child development, diversity issues and motivational strategies to plan interdisciplinary units of instruction and assessment. Candidates will create learning experiences and design a variety of modes of assessment and implement these plans. Internship is required. Prerequisites: Admission to the School of Graduate Studies.

CUIN-729. Diversity Issues in K-12 Schools Credit 3 (3-0)
This course is designed to examine issues of diversity including economic, gender, ethnic, cultural, political, physical and cognitive diversities, and how they impact classroom practices.

CUIN-746. Social Foundations of Instructional Technology Credit 3 (3-0)
This course will provide students with an opportunity to explore the philosophical, personal, and social issues underlying the universal acceptance of the technological revolution, with special emphasis on technology in education and in K-12 schools.

Electrical and Computer Engineering
ELEN-764. Power System Planning Credit 3 (3-0)
This course presents an overview of the issues and methods relevant to power systems planning. The course reviews the basics of financial analysis, regression analysis, forecasting, and reliability. Special topics relevant to power systems, such as deregulation, peak-load forecasts, load management and representation, and the loss-of-load probability (LOLP) method are also considered. Prerequisite: ELEN-661 or consent of instructor.

ELEN-861. Power System Control and Protection Credit 3 (3-0)
This course deals with power and voltage control systems, and power systems protection by relays. Related topics are also covered. Prerequisite: ELEN-661 or ELEN-668.

ELEN-862. Computer Methods in Power Systems Credit 3 (3-0)
This course deals with commercially available software for modeling and analysis of electric power systems. Prerequisite: ELEN-661 or equivalent.

Graphic Communication Systems and Technological Studies
GCS-733. Graphic Communications Organization and Management Credit 3 (3-0)
This course discusses formal and informal organizations, group dynamics, motivation, and managing conflict and change. Emphasis will be placed on different management practices and
leadership styles as they relate to satisfaction and morale, organizational effectiveness, productivity, and profitability in the graphic communications industry.

TECH-715. Advanced Research and Development Practices for Technological Education Credit 3 (3-0)
This course is concerned with research and problem-solving related to technical subsystems of technological education. Emphasis is placed on research procedure and techniques, innovations or inventions, and the results from the research.

TECH-762. Evaluation of Technological Education Programs Credit 3 (3-0)
This course examines standards, criteria, and strategies for evaluating technological education curricula, facilities, personnel, and programs. Activities include designing and conducting.

TECH-763. Technological Education for Elementary Grade Credit 3 (3-0)
This course includes the rationale, philosophy, concepts, curricula, resources, learning activities, methods, and evaluation for technological education in the elementary grades.

TECH-764. Supervision and Administration of Technological Education Credit 3 (3-0)
This course examines the relationship of technological education to the general curriculum and the administrative responsibilities involved. Courses of study, costs, coordination problems, class and laboratory organization, and the development of an effective program of supervision will be emphasized.

TECH-765. Evaluation of Training in Industrial Settings Credit 3 (3-0)
Study and application of principles of evaluation in industrial training settings. Emphasis is placed on test construction, measurement techniques, and evaluation results.

TECH-766. Curriculum Laboratories in Industrial Settings Credit 3 (3-0)
Development and preparation of instructional materials for industrial classroom use. Students select and develop significant areas of instruction for use in industrial settings. Modularized instruction that relates to industrial settings is studied for use and application in the private sector of business and industry. Opportunities are provided for review of actual industrial training materials.

TECH-767. Research and Literature in Technological Education Credit 3 (3-0)
This course studies research techniques applied to technical and educational papers and thesis classification of research. Topics include selection of subjects; delineation and planning of procedures; collection, organization and interpretation of data; and review of literature in technological education.

Industrial and Systems Engineering

INEN-731. Engineering Cost Control Credit 3 (3-0)
This course is designed to emphasize the use of cost data by engineers in support of the financial management function. Cost functions, cost behavior, cash control, budgeting, and cash flow analysis are discussed.
INEN-813. Cognitive Systems Engineering Credit 3 (3-0)
This course examines the principles, theories, and applications of the cognitive basis of system design. Topics include models of human and machine information processing, mental models, human error, human-centered design, abstraction hierarchy, ecological interface, cognitive task analysis, multi-flow models, activity-behavior models, and theories of complexity in human machine systems. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-821. Multivariate Statistics For Engineers Credit 3 (3-0)
This course focuses on methods for statistical analysis of multivariate data. Topics include: dimensionality, multidimensional classification and clustering, unstructured multi-response sampling, analysis of covariance structures, such as principal components, factor analysis and canonical correlation analysis, and multivariate normal distribution and analysis of multivariate means. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-832. Information Technology Management Credit 3 (3-0)
This course focuses on productivity measurement and improvement of information technology and information system services. Other topics covered include the planning and control of human resources and budgets, as well as the planning of innovation, entrepreneurship and research and development, and the forecasting and justification of technology. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-833. Supply Chain Systems Engineering Credit 3 (3-0)
This course addresses the analysis and design of logistics and supply chain systems. Topics covered include: logistics and supply chain characterization, site location, mode selection, distribution planning, vehicle routing, demand management, replenishment management, geographic information systems and real-time logistics control issues. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-851. Integrated Manufacturing Control Systems Credit 3 (3-0)
This course provides an advanced study of systems used for manufacturing execution and shop floor control. Traditional control and adaptive control algorithms and applications for manufacturing are explored. Integrated control system functions include scheduling, execution planning, supervisory control, human machine interface, process control, quality control, and information acquisition. Prerequisites: Graduate Standing and Consent of Instructor.

INEN-852. Integrated Product and Process Design Credit 3 (3-0)
This course provides an integrated approach to the design and manufacture of a new product. Topics include product requirements, concept generation and selection, design, product optimization, tolerances, prototype development, design for manufacturability and assembly, process optimization, and quality function deployment. Prerequisite: Graduate Standing.

ECT 785. Electric Energy and Environmental Management Credit 3 (3-0)
This course will discuss the role of electricity from fossil and nuclear fuels, and renewable resources. It will investigate the impact of high voltage transmission lines as well as the health effects of electricity generation. The course will do an assessment of cogeneration cycles and
demand side management. In addition, emission control in the US electric utility industry and an evaluation of uncertainties in quantifying emissions impacts will be studied. Prerequisites: ECT 685 or Departmental Approval

**Occupational Safety and Health**

**OSH-704. Occupational Epidemiology Credit 3 (3-0)**
The main focus of this course is on the fundamentals of occupational epidemiology, epidemiological methods used in both chronic and infectious occupational disease epidemiology, application of methods to safety and health research and practice will be stressed. Epidemiologic topics will also be related to subjects in occupational safety and health management.

**OSH-706. Noise Control Credit 3 (3-0)**
This course will cover the following topics: properties of sound, occupation damage-risk criteria, noise surveys and measuring equipment, noise control programs, and engineering controls.

**OSH-731. Toxicology for the Industrial Hygienist Credit 3 (3-0)**
This course is a basic survey of the principles of toxicology. Emphasis will be placed on the effects of common industrial toxicants; absorption, distribution, secretion, and biotransformation of toxicants; and toxicological essay methods. Prerequisite: OSH 416 or approval of instructor.

**Mathematics**

**MATH-708. Nonparametric Statistics Credit 3 (3-0)**
The following topics will be discussed in this course: Order Statistics, Run Test for Trend, Goodness of Fit Tests, Rank Tests for One and Two Populations, Linear Rank Statistics, One-Way and Two-Way Nonparametric Analysis of Variance, and applications to practical problems. Prerequisite: MATH 624.

**MATH-723. Advanced Topics in Applied Mathematics Credit 3 (3-0)**
This course is designed to cover important topics in applied mathematics that may be desired from time to time for specific students in the graduate program. It may also be used as a vehicle for development of new courses for graduate program students. Prerequisite: Consent of the instructor.

**MATH-733. Advanced Probability and Stochastic Processes Credit 3 (3-0)**
The following topics will be discussed in this course: introduction to Lebesgue integration, probability theory and random variables, laws of large numbers, central limit theorems, random walks, martingales, Markov processes and Markov chains, ergodic theorems and Brownian motion. Prerequisite: MATH 603 or permission of the instructor.

**MATH 781-Mathematical and Computational Modeling Credit 3 (2-2)**
The course will develop skills in mathematical modeling through practical experience, and explore the steps required to model and simulate a system; including discussion of generic governing equations, grid generation, basic numerical schemes, simulation strategies, and data analysis. Both discrete and continuous methods used in scientific applications will be examined; representative applications include weather prediction, molecular dynamics, scheduling problems, and engine combustion modeling. In addition to the development of mathematical
models, emphasis will be placed on the use of computational methods to investigate these models, and effective oral and written presentation of the results.

**MATH 791-Computational Science Team Project I Credit 3 (1-4)**

This course is part one of a year-long team-based definitive time scheduled project design and implementation course sequence. Students work on two to three projects each semester to develop software tools or programs for scientific tasks in a high performance computing environment. Project topics are normally chosen from industry applications and involve several disciplines. Lectures will be given on available computational environments, code development, implementation of parallel algorithms. Interpersonal interaction and people oriented management techniques are employed, along with team member measurement and assessment methods. Project reports and oral presentations are required.

**MATH 792-Computational Science Team Project II**

This course is part two of a year-long team-based definitive time scheduled project design and implementation course sequence. Students work on two to three projects each semester to develop software tools or programs for scientific tasks in a high performance computing environment. Project topics are normally chosen from industry applications and involve several disciplines. Lectures will be given on available computational environments, code development, implementation of parallel algorithms. Interpersonal interaction and people oriented management techniques are employed, along with team member measurement and assessment methods. Project reports and oral presentations are required.

**Chemical Engineering**

**CHEN-710. Transport Phenomena II Credit 3 (3-0)**

This course is an advanced treatment of the mechanisms of momentum, heat and mass transport. Emphasis is on methods of solution of transport problems for coupled systems where two or more transport processes interact. Other topics include Non-Newtonian Flow, Boundary Layer Theory, and the Analysis and solution of transport problems of significance in chemical processes. (DEMAND)

**CHEN-720. Advanced Chemical Reaction Engineering Credit 3 (3-0)**

This course includes an advanced treatment of chemical reaction engineering including the effect of non-ideal flow and fluid mixing on reactor design, as well as multi-phase reaction system and heterogeneous catalysis and catalytic kinetics. (Fall)

**CHEN-730. Advanced Biochemical Engineering Credit 3 (3-0)**

This course is the study of advanced topics in biochemical engineering and enzyme engineering, highlighting research trends. Modeling and optimization of biochemical systems are also covered, as well as the design and analysis of enzyme reactors and the use of enzymes in industrial, environmental and medical applications. (DEMAND)

**CHEN-740. Advanced Chemical Process Design Credit 3 (3-0)**

Topics in advanced conceptual process engineering such as process analysis, process synthesis and process optimization are covered. Specific topics include: flowsheeting, design variable selection, computational algorithm formulation, separation sequences, heat exchanger networks,
recycle-purge processes, process design and simulation software development, including physical and thermodynamic properties packages. (DEMAND)

**CHEN-750. Separation Processes Credit 3 (3-0)**
Differential and equilibrium stage operations involving non-isothermal and multi-component systems are covered. Other topics covered include simultaneous mass transfer and chemical reaction and dispersion effects. Applications to operations such as absorption, extraction, chromatography, distillation, ion exchange, and membrane separation are also studied. (Spring)

**CHEN-760. Advanced Chemical Engineering Thermodynamics Credit 3 (3-0)**
This is an advanced course covering topics in molecular thermodynamics of fluid phase equilibria. Statistical thermodynamics and thermodynamics of nonequilibrium processes are introduced. (Spring)

**Mechanical Engineering**

**MEEN-731. Conduction Heat Transfer Credit 3 (3-0)**
This course presents the development of the general heat conduction equation and its applications to one-, two-, and three-dimensional steady and unsteady boundary value problems. Closed form and numerical solution techniques are addressed. Prerequisite: MEEN 562 or equivalent.

**MEEN-732. Convection Heat Transfer Credit 3 (3-0)**
This course presents the analysis of heat convection in laminar and turbulent boundary layer and pipe flow. Topics include: dimensional analysis, free convection, condensation, and boiling. Prerequisite: MEEN 562 or equivalent.

**MEEN-733. Radiation Heat Transfer Credit 3 (3-0)**
A comprehensive treatment of basic theories is reviewed in this course. Topics include: radiation characteristics of surfaces, radiation properties taking account of wave length and direction, and analysis of radiation exchange between idealized and real surfaces. The course also addresses fundamentals of radiation transfer in absorbing, emitting, and scattering media. The interaction of radiation with conduction and convection is discussed. Prerequisite: MEEN 562 or equivalent.

**MEEN-808. Energy Methods in Applied Mechanics Credit 3 (3-0)**
The use of energy methods in solving applied mechanics problems is presented in this course. Applications in beams and frames, deformable bodies, plates and shells, and buckling are addressed. Variational methods are also discussed. Prerequisite: MEEN 610 or equivalent.

**MEEN-838. Solar Thermal Energy Systems Credit 3 (3-0)**
Characteristic of extraterrestrial and terrestrial solar radiation transfer are presented in this course. Topics include: analysis of thermal performance of concentrating and non-concentrating solar collectors, thermal energy storage systems and energy transport systems, and life cycle cost analysis of solar energy systems. Computer simulation software is introduced. Prerequisites: MEEN 731 and MEEN 732 or equivalent.
Natural Resources and Environmental Design
HORT-700. Plant Biotechniques Credit 3 (1-4)
Fundamentals of biotechniques in plant cell and tissue culture. These techniques are
organogenesis, somatic embryogenesis isolation of plant cellular and plasmid DNA, RNA
transformation and ELISA.

EASC-708. Conservation of Natural Resources Credit 3 (3-0)
A descriptive course dealing with conservation and development of renewable natural resources
encompassing soil, water, and air; cropland, grassland, and forests; livestock, fish, and wildlife;
and recreational, aesthetic and scenic values. Attention will be given to protection and
development of the nation’s renewable natural resources base as an essential part of the national
security, defense, and welfare.

EASC-718. Applied Environmental Microbiology Credit 3 (2-2)
Discussion of interactions between micro-organisms and their physical environment, and
significance of micro-organisms in eutrophication, mining spoils, and waste treatments.
Prerequisites: General Microbiology-221 and consent of the instructor.

SLSC-710. Soils of North Carolina Credit 3 (2-2)
A study of the factors basic to the understanding of the soils of North Carolina, their
classification, and properties as related to sound land use and management. Prerequisite:
Fundamentals of Soil Science 338.

SLSC 715 Soil Mineralogy 3 (3-0)
A study of soil minerals with regard to their composition, structure, classification, identification,
origin, and significance. Special emphasis on primary weatherable silicates, layer silicates, and
oxide minerals. Prerequisites: SLSC-634 and consent of the instructor.

SLSC-717. Methodology in Soil, Plant and Water Analysis Credit 3 (0-6)
A study of principles involved in the analysis of soils, plants and water. Emphasis on basic
instrumental and chemical methods for interpretation of soil fertility and environment.
Instruction in the use of special instruments.

SLSC-727. Soil Fertility and Plant Nutrition Credit 3 (3-0)
Fundamental and theoretical aspects of soil fertility, productivity and plant nutrients. A
discussion of important research data on soil fertility and plant nutrition. Prerequisites: SLSC-
517 and consent of the instructor.

SLSC-734. Applied Environmental Chemistry Credit 4 (3-2)
This course is an in-depth discussion of soil chemical interaction in terms of ion exchange,
solution equilibria, solubility patterns and also electrochemistry; comprehensive coverage of b
the chemistry of contaminant interactions with soil, its retention, movement and the
environmental impact; review of relevant advances in soil chemistry in the past and recent times.
Prerequisite: SLSC-634 or equivalent.
Physics

PHYS-736. Spectroscopic Techniques Credit 3 (3-0)
This course describes the methods and instrumentation of several spectroscopic techniques such as laser spectroscopy, optical resonance spectroscopy, supersonically cooled molecular spectroscopy, multiple photon spectroscopy, photoelectron spectroscopy, Raman scattering, Mössbauer spectroscopy, nuclear magnetic resonance spectroscopy, electron spin resonance spectroscopy, and mass spectroscopy. Prerequisites: Physics-465, 420 or Graduate standing.

PHYS-738. Nuclear Physics Credit 3 (3-0)
Descriptions of properties of the nuclear force and nuclear structure: nucleon-nucleon scattering, nuclear scattering theory, phenomenological potential models, the shell model, collective motion, giant resonances, direct and compound reactions, few-body systems, heavy ion physics. Prerequisite: Graduate standing or consent of the instructor.

PHYS-739. High Energy Physics Credit 3 (3-0)
Theoretical and experimental concepts in high energy physics. Topics include elementary particles; conservation laws; strong, weak, and electromagnetic interactions; particle accelerators; beams and detectors; strange particles; and quark models. Prerequisite: Physics-738 or Graduate standing.

PHYS 744-Introduction to Computational Methods in Biological and Physical Sciences
This course will offer an introduction to computational methods used in the study of computational physics, chemistry and biology. Programming skill is not required. It will survey the various methods used in the areas and give hands-on experience with some software. This may include but not limited to: quantum chemistry calculation, electronic structure, empirical force fields and molecular mechanics, energy minimization, Monte Carlo and molecular dynamics simulations, structure of proteins, RNA/DNA, sequence search and pattern recognition.

PHYS-745. Computational Physics Credit 3 (2-3)
Computational approaches to advanced physical problems. Includes ordinary differential equations, boundary value and eigenvalue problems, matrix operations, Monte Carlo Methods, nonlinear equations, curve fitting, and approximation of functions. Prerequisite: Graduate standing or consent of instructor.
APPENDIX C
Past Research Projects
<table>
<thead>
<tr>
<th>DEPT</th>
<th>TOTAL FUNDED</th>
<th>SPONSOR</th>
<th>PROPOSAL TITLE</th>
<th>Project Director</th>
</tr>
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<tbody>
<tr>
<td>AGRIB. &amp; APPLIED ECON/EDU</td>
<td>$125,000</td>
<td>VIRGINIA POLYTECH. INSTIT. &amp; STATE UNI</td>
<td>PERIUBAN HORTICULTURAL IPM RESEARCH IN THE O'HVN ZONE OF MALI: BIOCONTROL METHODS FOR GREEN BEAN SEEDBED DISEASE CONTROL AND ON-FARM MONITORING</td>
<td>YEBOAH</td>
</tr>
<tr>
<td>AGRIB. &amp; APPLIED ECON/EDU</td>
<td>$43,001</td>
<td>NC STATE UNIVERSITY</td>
<td>SUSTAINING ECOLOGICAL AND ECONOMIC DIVERSITY AMONG LIMITED RESOURCE LANDHOLDERS BY EXPANDING OPPORTUNITIES FOR MANAGEMENT OF PRODUCTIVE WOODLANDS</td>
<td>EJIMAKOR</td>
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<tr>
<td>AGRIB. &amp; APPLIED ECON/EDU</td>
<td>$46,524</td>
<td>SIGNAL CORPORATION</td>
<td>EVALUATION OF USDA RISK MANAGEMENT PECAN, PILOT PROJECT</td>
<td>THOMAS</td>
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<tr>
<td>AGRIB. &amp; APPLIED ECON/EDU</td>
<td>$80,000</td>
<td>TENNESSEE STATE UNIVERSITY</td>
<td>STRENGTHENING A COLLABORATIVE PROPOSAL ON SMALL-AND-MEDIUM-SIZED FARMS USING A BRIDGE GRANT</td>
<td>EJIMAKOR</td>
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<tr>
<td>ANIMAL SCIENCES</td>
<td>$61,728</td>
<td>NC STATE UNIVERSITY</td>
<td>DIVERSITY OF FOOD BORNE PATHOGENS ON POULTRY FARMS AND RELATIONSHIP WITH BIOSECURITY</td>
<td>WILLIS</td>
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<tr>
<td>ANIMAL SCIENCES</td>
<td>$80,000</td>
<td>EAST CAROLINA UNIVERSITY</td>
<td>PARTNERSHIP WITH THE NC INSTITUTE FOR HEALTH AND SAFETY IN AGRICULTURE, FORESTRY AND FISHERIES</td>
<td>HENSON-UPSHAW</td>
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<td>ANIMAL SCIENCES</td>
<td>$200,000</td>
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<td>$13,305</td>
<td>DOD-ARMY/Corps of Engineers/WES</td>
<td>EFFECTS OF AERIAL EXPOSURE TIMES AND TEMPERATURE ON THE BIOCHEMICAL OXYGEN DEMAND OF ZEBRA MUSSELM DEBRIS GENERATED BY DAM AND LOCK MAINTENANCE</td>
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<td>NC STATE UNIVERSITY/NC SEA GRANT</td>
<td>ISOLATION/CHARACTERIZATION OF A VIRUS PATHOGENIC FOR THE TOXIC ALGAE KARENIA</td>
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<td>CAR</td>
<td>$0</td>
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<td>DEVELOPING ULTRA-EFFICIENT ENGINE TECHNOLOGY THROUGH EDUCATION AND RESEARCH</td>
<td>FERGUSON</td>
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<td>DESIGN REFINEMENT AND COMMERCIALIZATION OF A WATER HEATING RESIDENTIAL REFRIGERATOR</td>
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<td>CHEMICAL ENGINEERING</td>
<td>$99,000</td>
<td>DOD-AIR FORCE/AIR FORCE MAT. COMMAND</td>
<td>THE EFFECT OF HEATING DURING IN SITU REMEDIATION ON THE DYNAMICS AND ACTIVITY OF SOIL MICROORGANISMS</td>
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<td>DOE-US DEPT OF ENERGY/PIITTSBURGH</td>
<td>DEVELOPMENT OF NOVEL ELECTOCATALYSTS FOR PROTON EXCHANGE MEMBRANE FUEL CELLS</td>
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<td>JET PROPULSION LABORATORY</td>
<td>HYDROGEN PRODUCTION AND SEPARATION IN A NOVEL MEMBRANE-REACTOR-SEPARATOR FOR USE IN FUEL CELL SYSTEM</td>
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<td>CHEMICAL ENGINEERING</td>
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<td>RESEARCH TRIANGLE INSTITUTE</td>
<td>RECOVERY OF CARBON DIOXIDE IN ADVANCED FOSSIL ENERGY CONVERSION PROCESSES USING A MEMBRANE REACTOR</td>
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<td>NASA George C. Marshall Space Flight Center</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$145,000</td>
<td>DOD-ARMY/CORPS OF ENGINEERS/MAES</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$230,000</td>
<td>CENTER FOR INDOOR AIR RESEARCH</td>
<td>DEVELOPING AND TESTING AN INDOOR AIR ASSESSMENT PROCEDURE FOR RESTAURANTS WHICH PERMIT SMOKING, A DEMONSTRATION PROJECT</td>
<td>ROJESKI</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$87,566</td>
<td>DOD-ARMY/ARMY RESEARCH LAB</td>
<td>HVAC RECOMMISSIONING METHODOLOGY DEVELOPMENT AND QUANTIFICATION OF BENEFITS AND COSTS AS APPLIED TO ARMY BUILDINGS</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>DOD-ARMY/CERL</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>CENTER FOR ENERGY RESEARCH AND TECHNOLOGY</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>DOD-ARMY/CERL</td>
<td>UPGRADE OF HVAC CONTROL SYSTEM FOR FAULT DIAGNOSIS AND TREND ANALYSIS IN FORT BRAGG ARMY BUILDINGS</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>UNIVERSITY OF CENTRAL FLORIDA</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>NC DEPT OF ADMIN STATE ENERGY OFFICE</td>
<td>STATE FACILITIES UTILITY SAVINGS INITIATIVE OPERATION AND MAINTENANCE CONSERVATION PROGRAM</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$13,300</td>
<td>SANDIA NATIONAL LABORATORY</td>
<td>FAILURE ANALYSIS AND SURETY DESIGN OF COMPOSITE PATCHING SYSTEMS GRADUATE FELLOWSHIP</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$200,000</td>
<td>US DEPT OF AGRICULTURE</td>
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<tr>
<td>CIVIL, ARCH, AGRI &amp; ENG</td>
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<td>GUILFORD COUNTY</td>
<td>SYNTHESIS OF UTILITIES INFRASTRUCTURE SPATIAL DATA FOR GUILFORD COUNTY: WATER SUPPLY AND SEWER SYSTEMS NETWORKS</td>
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<td>$96,810</td>
<td>NC DEPT OF ADMINISTRATION ENERGY</td>
<td>DISTRIBUTED ENERGY GENERATION: STRIPLING ENGINE DEMONSTRATION</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$40,000</td>
<td>NASA GLENN RESEARCH CENTER</td>
<td>AN INNOVATIVE MANUFACTURING OF ION THRUSTER GRIDS BY NCA&amp;T'S RTM CARBON/ CARBON COMPOSITE TECHNOLOGY</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$548,000</td>
<td>HUD-US HOUSING AND URBAN DEVELOPMENT</td>
<td>COMPOST MATERIAL RES. &amp; DECOMPOSITION AND DEMOLITION QUANTITY TAKEOFF FOR ENVIRONMENTAL RESTORATION PROJECT</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$98,900</td>
<td>CLARK ATLANTA UNIVERSITY</td>
<td>DEVELOPMENT OF D AND D QUANTITY TAKE-OFF ESTIMATES FOR ENVIRONMENTAL RESTORATION PROJECT</td>
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<td>CIVIL, ARCH, AGRI &amp; ENG</td>
<td>$48,657</td>
<td>FLORIDA DANIEL FERNALD, INC FDF</td>
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<td>COOPERATIVE EXTENSION</td>
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<td>NC STATE UNIVERSITY</td>
<td>SOUTHERN REGION SUSTAINABLE AGRICULTURE FOR NCAGT MANAGEMENT CONSORTIUM 1998-1999</td>
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<td>$10,000</td>
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<td>AGRICULTURE DEMONSTRATION FOR SMALL SCALE AND LIMITED RESOURCE FARMERS IN SELECTED COUNTIES OF NORTH CAROLINA</td>
<td>IEBRAHIM</td>
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<td>COOPERATIVE EXTENSION</td>
<td>$5,775</td>
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<td>COOPERATIVE EXTENSION</td>
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<td>UNIVERSITY OF NEBRASKA-LINCOLN</td>
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<td>$4,000</td>
<td>EVANGELICAL LUTHERAN CHURCH</td>
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<td>NC DEPT OF AGRICULTURE</td>
<td>COMPOST: AN EFFICIENT NUTRIENT MANAGEMENT TOOL FOR ANIMAL WASTE</td>
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<td>COOPERATIVE EXTENSION</td>
<td>$200,000</td>
<td>TENNESSEE STATE UNIVERSITY</td>
<td>GENETICALLY MODIFIED CROPS IN COLLABORATION WITH WOMEN IN AGRICULTURE PROGRAM</td>
<td>MAFYUA-EBNUM</td>
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<td>COOPERATIVE EXTENSION</td>
<td>$99,117</td>
<td>UNIVERSITY OF GEORGIA</td>
<td>COVER CROPPING AND RESIDUE MANAGEMENT FOR WEED SUPPRESSION SOIL FERTILITY AND ORGANIC CROP PRODUCTION</td>
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<td>DEAN AGRICULTURE</td>
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<td>UNIVERSITY OF GEORGIA</td>
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<td>DEAN AGRICULTURE</td>
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<td>DEAN ARTS &amp; SCIENCES</td>
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<td>National Science Foundation (NSF)</td>
<td>Development of A Geophysical Field Research and Training Program</td>
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<td>DEAN ARTS &amp; SCIENCES</td>
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<td>University of Georgia</td>
<td>NCAGT-UGA Bridges to the Doctorate</td>
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<td>US Department of Education</td>
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<td>DIVISION OF RESEARCH</td>
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<td>ADVANCED LOW POWER SILICON ON INSULATOR (SOI) COMPLEMENTARY METAL OXIDE SILICON (CMOS) TRANSCEIVER FOR DISTRIBUTED SENSOR NETWORKS</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>PHASE I: ELECTRONIC PROPERTIES OF VARIOUS RUBBER FORMULATIONS</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>NASA-JOHNS GLENN RESEARCH CENTER</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>MULTISPECTRAL CLASSIFICATION OF SATELLITE IMAGES USING ADAPTIVE NEURAL NETWORK</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>MATHEMATICAL FORMULATION &amp; DISTRIBUTED HYBRID-Mixed INTEGER NONLINEAR PROGRAMMING SOLVER FOR THE APPLICATION OF UAVS IN AERIAL FIREFIGHTING CAMPAIGNS</td>
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<td>ELECTRICAL &amp; COMPUTER ENG</td>
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<td>VIRGINIA POLYTECH INSTITUTE &amp; STATE UNIVERSITY</td>
<td>STUDY OF DC/DC CONVERTERS FOR PULSE POWER APPLICATIONS</td>
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<td>ELECTRICAL ENGINEERING</td>
<td>$300,000</td>
<td>NASA/Goddard Space Flight Center</td>
<td>SELF-TIMED SYNCHRONOUS DIGITAL SYSTEM DESIGN</td>
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<td>$2,220</td>
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<td>RESEARCH EXPERIENCE IN RENEWABLE POWER GENERATION AND CONTROL</td>
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<td>ELECTRICAL ENGINEERING</td>
<td>$221,755</td>
<td>UNC Charlotte</td>
<td>CHARACTERIZATION OF GIANT MAGNETORESISTIVE MULTILAYERS</td>
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<td>ELECTRONICS &amp; COMP. TECH</td>
<td>$56,966</td>
<td>National Science Foundation</td>
<td>POWER SYSTEMS STABILITY IN A DEREGULATED ENVIRONMENT</td>
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<td>ELECTRONICS &amp; COMPUTER TECH</td>
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<td>National Imagery And Mapping Agency</td>
<td>TECHNIQUES FOR HIGH PRECISION GPS POINT POSITIONING USING INERTIAL NAVIGATION AIDS (GPS-PINA)</td>
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<td>HUMAN ENVIR. &amp; FAMILY SCI</td>
<td>$269,843</td>
<td>US Dept. Of Agriculture</td>
<td>FIBER-OPTIC BIOSENSOR FOR RAPID DETECTION OF PATHOGENS IN POULTRY PRODUCTS</td>
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<td>HUMAN ENVIR. &amp; FAMILY SCI</td>
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<td>US Dept. Of Agriculture</td>
<td>GRANULAR ACTIVATED CARBON MADE FROM NORTH CAROLINA AGRICULTURAL BY PRODUCTS</td>
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<td>HUMAN ENVIR. &amp; FAMILY SCI</td>
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<td>MATHEMATICS</td>
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<td>Mathematical Methods in Nonlinear Wave Propagation</td>
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<td>National Science Foundation</td>
<td>Physical Insight and Mathematical Methods in Seismic Data Analysis</td>
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<td>MATHEMATICS</td>
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<td>Collaborative Research Enhancing Diversity in Geosciences in North Carolina</td>
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<td>MATHEMATICS</td>
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<td>MECHANICAL &amp; CHEMICAL ENG</td>
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<td>FLUX ENHANCEMENT IN CROSSFLOW MEMBRANE FILTRATION FOLLOWING AND ITS MINIMIZATION REVERSAL</td>
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<td>MECHANICAL &amp; CHEMICAL ENG</td>
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<td>SYNTHESIS AND CHARACTERIZATION OF CO2 AND H2 TOLERANT ELECTROCATALYSTS FOR PEM FUEL CELL</td>
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<td>MECHANICAL &amp; CHEMICAL ENG</td>
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<td>NASA/Marshall Space Flight Center</td>
<td>CONTINUOUS SENSOR FOR FUEL TANK HEALTH MONITORING</td>
<td>PAI</td>
</tr>
<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$0</td>
<td>NASA/CRNY Flight Research Center</td>
<td>INVESTIGATION OF HEAT TRANSFER PROPERTIES IN AEROSPACE APPLICATIONS</td>
<td>CHANDRA</td>
</tr>
<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$23,000</td>
<td>Sandia National Laboratory</td>
<td>HEALTH MONITORING OF WIND TURBINE BLADES</td>
<td>SCHULZ</td>
</tr>
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<td>MECHANICAL ENGINEERING</td>
<td>$15,000</td>
<td>Sandia National Laboratory</td>
<td>ACTIVE FIBER COMPOSITES FOR HEALTH MONITORING OF WIND TURBINE BLADES</td>
<td>SCHULZ</td>
</tr>
<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$153,000</td>
<td>NASA/AMES Research Center</td>
<td>COMBUSTION SENSORS FOR TURBINE APPLICATION</td>
<td>HUMAN</td>
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<tr>
<td>DEPT</td>
<td>TOTAL FUNDED</td>
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<td>PROPOSAL TITLE</td>
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</tr>
<tr>
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<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$8,000</td>
<td>NC STATE UNIVERSITY</td>
<td>RESEARCH FOR NASA HIGH SPEED CIVIL TRANSPORTATION PHASE I: JET NOISE REDUCTION</td>
<td>FERGUSON</td>
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<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$55,000</td>
<td>NATIONAL RENEWABLE ENERGY LAB</td>
<td>A SMART SENSOR SYSTEM FOR STRUCTURAL CONDITION MONITORING OF WIND TURBINES</td>
<td>SUNDARESAN</td>
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<tr>
<td>MECHANICAL ENGINEERING</td>
<td>$325,000</td>
<td>NAVAL UNDERSEA WARFARE CENTER</td>
<td>A SMART SENSOR SYSTEM FOR STRUCTURAL CONDITION MONITORING OF WIND TURBINES</td>
<td>SUNDARESAN</td>
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<tr>
<td>NATURAL RES. &amp; ENV. DES</td>
<td>$200,000</td>
<td>US DEPARTMENT OF AGRICULTURE</td>
<td>STRENGTHENING THE INTERDISCIPLINARY BIOTECHNOLOGY AND BIODIVERSITY PROGRAM</td>
<td>YANG</td>
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<tr>
<td>NATURAL RESOURCES</td>
<td>$132,645</td>
<td>CSREES NC</td>
<td>USE OF CONSTRUCTED WETLANDS TO TREAT SWINE WASTE AND ORGANIC POLLUTANTS FOR</td>
<td>REDDY</td>
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<td>NATURAL RESOURCES</td>
<td>$164,700</td>
<td>CSREES NC</td>
<td>SOL/WATER QUALITY MODELING AND EVALUATION OF MANAGEMENT PRACTICES FOR GRAIN AND</td>
<td>GAYLE</td>
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<td>NATURAL RESOURCES</td>
<td>$300,000</td>
<td>CSREES NC</td>
<td>TREATMENT OF SWINE WASTEWATER AND HERBICIDES IN CONSTRUCTED WETLANDS FOR WATER</td>
<td>REDDY</td>
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<td>NATURAL RESOURCES</td>
<td>$10,000</td>
<td>NC STATE UNIVERSITY</td>
<td>USING DUCKWEED AS A BIOLOGICAL TOOL TO ENHANCE SWINE WASTEWATER TREATMENT IN</td>
<td>REDDY</td>
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<tr>
<td>NATURAL RESOURCES</td>
<td>$531,021</td>
<td>CSREES NC</td>
<td>IMPROVING SOIL QUALITY THROUGH SOIL AND RESIDUE MANAGEMENT</td>
<td>RACZKOWSKI</td>
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<td>NATURAL RESOURCES</td>
<td>$18,000</td>
<td>NC STATE UNIVERSITY</td>
<td>MEASURE OF SOIL PHYSICAL PROPERTIES IN RESEARCH SYSTEMS DIRECT TOWARD</td>
<td>RACZKOWSKI</td>
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<td>NATURAL RESOURCES</td>
<td>$35,000</td>
<td>US DEPT OF AGRICULTURE</td>
<td>SWINE WASTEWATER TREATMENT IN MARSH POND MARSH WETLANDS</td>
<td>REDDY</td>
</tr>
<tr>
<td>NATURAL RESOURCES</td>
<td>$19,955</td>
<td>NC STATE UNIVERSITY</td>
<td>CHANGES IN SOIL QUALITY OF FARMING SYSTEMS DIRECTED TOWARDS AGRICULTURAL</td>
<td>RACZKOWSKI</td>
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<td>NATURAL RESOURCES</td>
<td>$18,000</td>
<td>NC STATE UNIVERSITY</td>
<td>SYSTEMS RESEARCH DIRECTED TOWARD AGRICULTURAL SUSTAINABILITY: MONITORING OF SOIL</td>
<td>RACZKOWSKI</td>
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<td>NATURAL RESOURCES</td>
<td>$50,000</td>
<td>US DEPT OF AGRICULTURE</td>
<td>ANIMAL WASTE MANAGEMENT PRACTICES &amp; ALTERNATE TECHNOLOGIES FOR LIMITED RESOURCE</td>
<td>REDDY</td>
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<td>NATURAL RESOURCES</td>
<td>$40,000</td>
<td>FORT VALLEY STATE UNIVERSITY</td>
<td>APPLICATION OF GENETIC ENGINEERING APPROACH TO ENHANCE COLD HARDINESS OF GUAVA</td>
<td>YANG</td>
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<td>NATURAL RESOURCES</td>
<td>$355,000</td>
<td>GOLDEN LEAF FOUNDATION</td>
<td>EDIBLE AND MEDICINAL MUSHROOM FARMING IN NORTH CAROLINA: A CASH CROP FOR THE</td>
<td>ISIKHEUMHEN</td>
</tr>
<tr>
<td>NATURAL RESOURCES</td>
<td>$110,076</td>
<td>NC DEPT OF ADMIN STATE ENERGY OFFICE</td>
<td>ASSESSMENT OF AGRICULTURAL CROP RESIDUES AND WOOD WASTES TO TREAT SWINE WASTE WATER</td>
<td>SHAHBAZI</td>
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<td>NATURAL RESOURCES</td>
<td>$122,255</td>
<td>US DEPT OF AGRICULTURE</td>
<td>USING ALTERNATE FLOODING AND DRAINING TO ENHANCE NUTRIFICATION IN WETLANDS TO</td>
<td>REDDY</td>
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<tr>
<td>NATURAL RESOURCES</td>
<td>$25,000</td>
<td>Z. SMITH REYNOLDS FOUNDATION, INC.</td>
<td>EDIBLE AND MEDICINAL MUSHROOM FARMING, A CASH CROP FOR THE FUTURE IN NORTH CAROLINA</td>
<td>ISIKHEUMHEN</td>
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<tr>
<td>PHYSICS</td>
<td>$211,800</td>
<td>National Science Foundation (NSF)</td>
<td>Effects of Electronic Orbital Alignment in Laser Induced Metal-H2 and Metal-CH4 Reactions</td>
<td>Billilign</td>
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<td>PHYSICS</td>
<td>$314,018</td>
<td>National Science Foundation (NSF)</td>
<td>Selected Problems in Medium Energy Physics</td>
<td>Danagoulian</td>
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<td>PHYSICS</td>
<td>$63,400</td>
<td>National Science Foundation (NSF)</td>
<td>Development of High Resolution Detection System for the Precision Measurement of the Neutral Pion Lifetime at Jefferson Laboratory</td>
<td>Danagoulian</td>
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<tr>
<td>PHYSICS</td>
<td>$317,224</td>
<td>Duke University</td>
<td>ITR/Computational Geometry for Structural Biology and Bioinformatics</td>
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<td>SPONSOR</td>
<td>PROPOSAL TITLE</td>
<td>Project Director</td>
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<td>PHYSICS</td>
<td>$285,738</td>
<td>National Science Foundation (NSF)</td>
<td>Quenching of Excited States of LiH by H$_2$, D$_2$, N$_2$ and Alkane and Alkene Hydrocarbons: Kinetics and Dynamics</td>
<td>Billigh</td>
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<td>PHYSICS</td>
<td>$267,000</td>
<td>Hampton University</td>
<td>Precision Measurement of the Neutral Pion</td>
<td>Gasparian</td>
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<td>PHYSICS</td>
<td>$68,144</td>
<td>National Science Foundation (NSF)</td>
<td>Study of Electromagnetic Structure of Light Pseudoscalar Mesons via the Primakoff Effect</td>
<td>Gasparian</td>
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<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$10,000</td>
<td>CLARK ATLANTA UNIVERSITY</td>
<td>ASSESSMENT, EVALUATION AND TESTING OF TECHNOLOGIES FOR ENVIRONMENTAL RESTORATION</td>
<td>UZOCHUKWU</td>
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<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$2,200</td>
<td>DD/ARMY</td>
<td>NATIONAL CONFERENCE ON ENVIRONMENTAL REMEDIATION SCIENCE AND TECHNOLOGY</td>
<td>UZOCHUKWU</td>
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<tr>
<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$140,588</td>
<td>EDUCATION RESEARCH &amp; DEVELOPMENT ASSOC.</td>
<td>TECHNICAL SUPPORT FOR MONITORED NATURAL ATTENUATION</td>
<td>UZOCHUKWU</td>
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<tr>
<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$1,900,000</td>
<td>EDUCATION RESEARCH &amp; DEVELOPMENT ASSOC.</td>
<td>SCIENCE AND TECHNOLOGY CENTER FOR ENVIRONMENTALLY RESPONSIBLE SOLVENTS AND PROCESSES</td>
<td>UZOCHUKWU</td>
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<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$368,986</td>
<td>UNC-CHAPEL HILL</td>
<td>TECHNICAL SUPPORT FOR MONITORED NATURAL ATTENUATION</td>
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<td>WASTE MANAGEMENT INSTITUTE</td>
<td>$40,000</td>
<td>EDUCATION RESEARCH &amp; DEVELOPMENT ASSOC.</td>
<td>NATIONAL CONFERENCE ON ENVIRONMENTAL REMEDIATION SCIENCE AND TECHNOLOGY</td>
<td>UZOCHUKWU</td>
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</table>

$20,331,638
APPENDIX D

Faculty Resumes
MOHAMED AHMEDNA
Assistant Professor
Department of Human Environment and Family Sciences
Phone/Fax: (336) 282-3574
E-mail: ahmedna@ncat.edu

Education
• Ph.D. Food Science, Department of Food Science, Louisiana State University (LSU), 1999
• M.S. Applied Statistics, Department of Experimental Statistics, LSU, 1998
• M.S. Food Science, Department of Food Science, LSU, 1995
• B.S. Fisheries Engineering, Department of Fisheries, Institut Agronomique et Veterinaire Hassan II, Rabat, Morocco, 1989

Work Experience
2000-Present: Assistant Professor, Food Science & Nutrition Program, Department of Human Environment and Family Sciences, North Carolina A&T State University, Greensboro, NC.

Current Projects
• Development of a fiber optic biosensor for detection of pathogens in poultry products.
• Development of low-cost drinking water purification materials/systems from agricultural by-products (e.g., nutshells)

Teaching Activities
• Sensory Evaluation (HEFS 638), Research Methods (HEFS 736), and Food Preservation (HEFS 643).
• Current Student Advising: 5 graduate students and 1 undergraduate student.
• Graduate thesis supervised: 4 MS theses in Food and Nutritional Sciences

Selected Research Projects

Professional Affiliation(s)
• Institute of Food Technologists (IFT)
• IFT Dogwood Section
• American Statistical Association (ASA)
• Gamma Sigma Delta, Honor Society of Agriculture
• Kappa Omicron Nu Honor Society for Family and Consumer Sciences
• Phi Tau Sigma, Honor Society of Food Science

Publications

84


Professional Presentations/Abstracts


ABDELLAH AHMIDOUCH
Associate Professor
Department of Physics
Tel. (336) 334 7646 – Fax (336) 256 0815
Email: abdellah@jlab.org

EDUCATION

- Ph.D., University of Geneva, Geneva, Switzerland, 1994
- MA, Joseph Fourier Grenoble 1 University, Grenoble, France, 1988
- Mohammed V University, Rabat, Morocco, 1987

CAREER DEVELOPMENT

2001- Associate Professor at the department of physics, present North Carolina A&T State University, Greensboro, NC, USA.

1998- Assistant Professor at the department of physics, 2001 North Carolina A&T State University, Greensboro, NC, USA.

1997 Postdoctoral research associate at the Laboratory for Nuclear Science, Massachusetts Institute of Technology, Cambridge, MA, USA.

Nov. 95 Postdoctoral research associate at the Center for Nuclear Research, Mar. 97 Kent State University, Kent, OHIO, USA.

1988- Assistant and scientific collaborator at the Department of nuclear and particle physics, 1995 University of Geneva, Geneva, Switzerland.

RESEARCH INTERESTS

Experimental Intermediate And Low Energy Nuclear Physics:
Polarization phenomena in nuclear reactions -- Electric and magnetic form factors of the neutron -- Quark-Gluon structure of the nucleon and matter -- Baryon and meson spectroscopy -- Transition from the meson-nucleon degrees of freedom to the quark-gluon degrees of freedom in the description of nuclear interactions -- Development of nuclear and particle physics instrumentation -- Polarimetry and detector techniques, electronics, data acquisition systems and analysis software – Application and exploration of nuclear physics potential in medicine

Medical Physics -- Renewable Energy Physics

GRANTS RECEIVED


Center for the Study of the Origin and Structure of Matter (COSM), Agency: National Science Foundation

Total Amount: $267,000, Duration: 6/1/03 to 5/30/04, Collaboration with Dr. S. Danagoulian and A. Gasparian.

Selected Problems in Medium Energy Physics, Agency: National Science Foundation, Total Amount: $314’019, Duration 9/1/00 to 8/31/03, Collaboration with Dr. S. Danagoulian.
“developing the online course “College Physics II – PHYS226” $4500, Spring 2003
“developing the online course “College Physics I – PHYS225” $4500, Summer 2004

GRADUATE STUDENTS SUPERVISED
Yousef Farah, MS thesis
Jarreas Underwood, MS thesis
Joe Stout
Steven Overby

SOME RELEVANT PUBLICATIONS

Near threshold electroproduction of the \( \omega \) meson at \( Q^2 = 0.5 \text{ GeV}^2 \)
P. Ambrozeewics et al.,
To be submitted to Physics Review C

Measurement of the electric form factor of the neutron at \( Q^2 = 0.5 \) and 1.0 GeV\(^2\)/c
G. Warren, et al.,
Accepted for publication in Phys. Rev. Lett.

Measurements of GEn/GMn from the \(^{2}\text{H}(e,e'n)^{1}\text{H} \) Reaction to \( Q^2 = 1.45 \text{ (GeV/c)}^2 \)
A. Semenov, et al.,
Accepted for publication in Phys. Rev. Lett. ArXiv: nucl-ex/0308007

Mesurement of the High Energy Two-Body Deuteron Photodisintegration Differential Cross Section
E.C. Schutle, A. Ahmidouch, C.S. Armstrong et al.,

A Measurement of the Electric Form Factor of the Neutron Through \( D(e,e'n)p \) at \( Q^2 = 0.5 \text{ (GeV/c)}^2 \)
H. Zhu, A. Ahmidouch, H. Anklin et al.,

Phenomenology Of The Deuteron Electromagnetic Form-Factors,
D. Abbott et al.,

Measurement Of Tensor Polarization In Elastic Electron Deuteron Scattering At Large Momentum Transfer,

A precise measurement of the deuteron elastic structure function \( A(Q) \)
PROFESSIONAL AFFILIATION
American Physical society
Jefferson lab user group
MIT-Bates Laboratory user group

SCIENTIFIC COLLABORATIONS
MIT, Duke, Hampton University, Jefferson Lab, Argonne National Lab, Rutgers University, Florida International University, CALTECH, Kent State University, Norfolk State University, Old Dominion University, Renssealaer Polytechnic Institute, CEA Saclay (France), LNS Saclay (France), IPNO Orsay (France), ISN Grenoble (France), Basel Institute for Physics (Switzerland), etc …
David W. Aldridge
Professor & Interim Chair
Department of Biology
davida@ncat.edu

Education
B.S. in Biology, University of Texas at Arlington, 1974
M.A. in Biology University of Texas at Arlington, 1976
Ph.D. in Biology, Syracuse University, 1980

Positions and Employment
Visiting Assistant Professor, Biology, North Carolina A&T State University 1980 – 82
Assistant Professor, Biology, North Carolina A&T State University 1982 – 87
Associate Professor, Biology, North Carolina A&T State University 1987 – 99
Professor, Biology, North Carolina A&T State University 1999 - current
Interim Chair, Biology, North Carolina A&T State University 2001 - current

Other Experience
1993 - Institutional Review Board (IRB) Chair

Selected Publications/Presentations


**Selected Research Projects**


AASERT Grant (DAAH04 - 95 - 0220) from the U.S. Army Research Office.  “Student Research in applied aquatic ecology.” 1995 - 98.


RIMI Grant (RII - 8912685) from the National Science Foundation.  “Improvements of cell plasma membrane research capabilities in Biology” with Dr. A. J. Hicks, Dr. T.L. Jordan and Dr. A. Goliszek (Department of Biology, North Carolina A&T State University). 1989 - 93.

RIMI Grant (RII - 8305862) from the National Science Foundation.  “Environmental Sciences and Plant Systematics Research” with Dr. A.J. Hicks and Dr. J.J. White (Department of Biology, North Carolina A&T State University). 1983 - 1986.
Education
Ph.D. Soil Science, December, 1996, North Carolina State University, Raleigh
M.Ed. Agricultural Education, June, 1981, University of California, Davis
B.S. Soil and Water Science, March, 1976, University of California, Davis

Experience
Horticulture Extension Specialist (75%) Agricultural Research (25%) 8/13/01-Present
NC A&T State University, Greensboro, NC
Small Farm Research and Extension, Coordinator-Alternative Enterprises Project, Urban Horticulture, School Gardening, Organic Farming Systems

Extension Associate, Organic Farming Systems 1997-2001
North Carolina State University, Raleigh, NC
PI/Coordinator for Sustainable Agriculture Research and Education Professional Development Program (SARE-PDP) On-farm Participatory Research grant ($107,765). PI/Summer Internship Coordinator for a Higher Education Challenge Grant on at the NCSU Center for Environmental Farming Systems (CEFS) in Goldsboro, NC ($96,605). PI/Organic Unit Coordinator for a Z. Smith Reynolds grant to develop a student farm at CEFS ($100,000). Writer/Producer of SARE PDP greenhouse tomato videos on biocontrol and organic nutrient management. Project Coordinator for a SARE PDP training for 50+ Extension agents in Organic Farming Systems. Principal Investigator for a Z. Smith Reynolds grant ($37,538) to prepare Extension publications and slide sets on organic systems and to construct an NCSU Organic Farming Systems website. Field research at the Organic Unit of the NCSU CEFS.

Graduate Research Assistant, 1993-1996
North Carolina State University, Raleigh
Conducted field research in the phytoavailability of trace metals contained in municipal composts to burley tobacco plants. Investigated N mineralization/immobilization dynamics in soils amended with composts.

Agricultural Extension Agent, 1988-1993
North Carolina Cooperative Extension Service, Raleigh
Organized and participated in Field Days and Tours demonstrating appropriate nutrient management and cover cropping strategies and technologies for farmers, public officials and the public-at-large. Conducted waste management program focusing on biosolids/wastewater management.

Publications
Grant Proposals

PI to NC Rural Center Agricultural Advancement Consortium proposal “Linking Farmers and Consumers Through Community Supported Agriculture (CSA)” ($15,683) 2002.
PI for Tobacco Trust Fund grant on “Retooling for Alternative Agricultural Enterprises” ($228,040) 2002.
PI for USDA CSREES Higher Education Challenge Grant for “Developing an Intensive Summer Internship Program in Sustainable Agricultural Systems” at the NCSU CEFS ($96,605) 1999.
PI for Z. Smith Reynolds grant “Building Capacity in Sustainable Agriculture” to develop student farm at CEFS ($100,000). 1999.
SOLOMON BILILIGN Ph.D.
Professor and Chairperson
Department of Physics
bililign@ncat.edu

Educational Background
1991 Ph.D. University of Iowa, Atomic Molecular and Laser Physics.
1987 CERTIFICATE: International Center for Theoretical Physics; Trieste, Italy.

Area of field of specialization
Experimental and Theoretical Atomic, Molecular and Optical Physics /and Chemical Physics

Teaching and other professional experience:
2003-present Professor
2003 Visiting professor, Laboratory of Theoretical Chemistry
Facultes de St-Jerome 13397 MARSEILLE
2000-2001 JILA visiting fellow
2001-Present Chair, Department of Physics
1998- present Associate Professor, Department of Physics, North Carolina A&T State University.
1993-1998 Assistant Professor: Department of Physics, North Carolina A&T State University.
1997 spring Acting Chairman: Department of Physics, North Carolina A&T State University.
1996 (summer) and NRC/HBCU Faculty Fellow: Oak Ridge National Laboratory
1997 (summer) Chemical and Biological Physics Section
1995(summer) Visiting Assistant Professor: University of Connecticut, Department of Physics, Storrs.
1995(summer) AWU-DOE Faculty Fellow: Los Alamos National Lab.
1994(summer) Visiting Assistant Professor. University of Utah, Department of Chemistry,
1991-1993 Post Doctoral Fellow: University of Utah, Chemistry Department, Salt Lake City, Utah
1988-1991 Research Assistant: University of Iowa, Department of Physics, and Iowa City, Iowa.
1983-1985 Research Assistant, Addis Ababa University, Addis Ababa, Ethiopia

Professional experience:
Photodetachment of H- (summer 1995, Los Alamos National Laboratory)
Study of the Photochemistry of Metal CVD (Photochemical Laser Deposition) precursors in cluster environment: Oak Ridge
National Laboratory, (Summer 1996, 1997)

Current Research:
Spectroscopy of Transition State Dynamics (1998-present)

Publications

S. Bililign, B Hattaway, “ Energy Transfer and Reactions In Li(np) –Ar, H2, CH4 Collisions” Recent Research Developments in Chemical Physics, 392002) 249-269 Transworld Research Network.


Funded Proposals
"Ab Initio Studies of Metal-Rare Gas and Metal-Hydrogen Interaction Potentials" NSF Program 1954: Quantum Calculations - Award Period: 09/01/96- 08/31/99 Amount: $137,628.00

Current Support
Research Grant: Current Support (last 5 years)
Project/Proposal (PI) - "Effects of Electronic Orbital Alignment in Laser Induced Metal-H2 and Metal-CH4" (3/1/98-02/28/02) Source of Support: NSF Total Award Amount: $359,465 Supplement; $14,000
Project/Proposal (PI) - "ITR/ Computational Geometry for Structural Biology and Bioinformatics" (9/15/00-8/31/05) Source of Support: NSF/Duke University Total Award Amount: $524,874.
Project/Proposal (PI) - “Quenching of excited states of lithium by H2,D2,N2 , and alkane and alkene hydrocarbons: Kinetics and Dynamics” (3/1/02-2/28/05) - Source of Support: NSF Total Award Amount: $285,738 - Supplement $6,000
Project/proposal (Co-PI) – "Interdisciplinary Fellowship Program for Graduate Training in Biotechnology, Genomics and Bioinformatics" (09/01/01-08/31/04) - Source of Support: Department of Education (GAANN) Total Award Amount: $600,000
Project/proposal (Co-PI) - “Collaborative Research: Enhancing Diversity in Geosciences in North Carolina” (03/01/02-02/28/05) - Source of Support: NSF (approved for funding) Total Award Amount: $449,988
Project/proposal (PI) - “Acquisition of a multi-source reflection time-of-flight mass spectrometer” (09/01/03-08/31/05) - Source of Support: NSF Total Award Amount: $447,635
Public lecture on Lasers for public scientific literacy (CIVITAN CLUB of GREENSBORO) 1999.

Teaching - MS Students and their research:
Past.
Ben McCarter; Currently at Corning
Thesis title: Iron Cluster reactions with Methyl Iodide
Tito Robinson, Currently at Kodak
Thesis title: Electronic Orbital Alignment Effects in the Reaction Li (2p) + H2
Current:
Barker Barker
Project: Red Wing Studies of Li(4p) + Ar, H2 and CH4 Collisions.
Bulletin of American Physical Society, DEMOP 2002
Brian Hattaway:
Thesis Title: Energy Transfer in Li(3p) + H2 and CH4 Collisions
DEWAYNE R. BROWN, Ph. D.
Department of Electronics and Computer Technology

Office: (336) 334-7718
Fax: (336) 334-7546
Email: dbrown@ncat.edu

Academic Discipline and Interests:
ECT-120 Introduction to Electronics Technology; ECT-211 Electric Circuits I; ECT-212 Electric Circuits II;
ECT-220 Electromechanical Systems Analysis; ECT-312 Active Circuits I; ECT-314 Active Circuits II; ECT-350
Communications Systems; ECT-355 Electrical Power and Machinery; ECT-360 Industrial Measurements and
Control; ECT-610 Digital Communications; ECT-650 Wireless Communications Systems; ECT-665 Wireless
Communications Systems; ECT 759 Telecommunication Policy & Regulation.

Formal Education:
BS, Electrical and Computer Engineering, University of South Carolina, Columbia SC, May 1990.
Ph.D., Electrical Engineering, Virginia Polytechnic Institute and State University, Blacksburg VA, May 1997.

Academic/Work Experience:
August 1997- Present
Associate Professor in the Department of Electronics and Computer Technology,
North Carolina A & T State University

May 20, 2002-July 26, 2002
Faculty Summer Hire, NASA Kennedy Space Center
Task: Developed a user-friendly Integrated GPS lab manual to help range engineers to estimate trajectories of future
shuttle launches.

Funded Project/Grants:
Title: Satellite Tool Kit (STK) Software
$2,370,240.00 (Analytical Graphics, Inc) 2004 Academic Year, PI

Title: Satellite Tool Kit (STK) Software
$1,817,325.00 (Analytical Graphics, Inc) 2002 Academic Year, PI

Title: Undergraduate Scholarships for Global Positioning System Research
$120,000 (Office of Naval Research) 2002/2003 to 2006/2007 Academic Year(s), Co-PI

Title: Instrumentation for a Wireless Geo-location and Global Positioning Research Laboratory
$180,000 (Air Force Office of Scientific Research) 2002/2003 to 2003/2004 Academic Year(s), Co-PI
Title: RF and Microwave (RFAM) Circuit Design Laboratory (First Installment)
$299,355.00 (Hewlett-Packard University Grants Program) 1998/1999 Academic Year, Co-PI

Title: Refurbishment of a Sound Detection and Ranging (SODAR) Instrument
$13,501.00 (Environmental Protection Agency/Penn State University) 1999/20000 Academic Year, Co-PI

Title: RF and Microwave (RFAM) Circuit Design Laboratory (Second Installment)
$237,870.00 (Agilent Technologies University Grants Program) 1999/2000 Academic Year, Co-PI

Publications:


Book Review of Math at Work, Book 1 and Math at Work, Book 2, by Angus and Clark, Prentice Hall, 2000


Conference Papers:

DeWayne Brown, Derrek B. Dunn, and Thomas Avery, "New Scheme for High Frequency Overvoltage Protection", The Thirty-Fourth Southeastern Symposium on System Theory (SSST02), March 17-19, 2002


**Memberships in Professional organizations:**

National Association of Industrial Technology (NAIT) [2000-2003]
IEEE [1997-2000]
Shou-Yuh Chang  
DOE Samuel Massie Chair of Excellence Professor in Environmental Engineering  
chang@ncat.edu

EDUCATION:
- B.S., Civil Eng., National Taiwan University, 1971
- M.S., Sanitary Eng., National Taiwan University, 1973
- M.S., Environmental Eng., University of North Carolina at Chapel Hill, 1977
- Ph.D., Environmental Eng., University of Illinois at Urbana-Champaign, 1981

ACADEMIC EXPERIENCE:
- 1995 - Pres  DOE Samuel Massie Chair of Excellence Professor in Environmental Engineering, North Carolina A&T State University
- 1992 - Pres  Professor, North Carolina A&T State University
- 1986 - 92  Associate Professor, North Carolina A&T State University
- 1989 - 90  Acting Chairman, Civil Engineering, North Carolina A&T State University
- 1988 - Pres  Interinstitutional Graduate Faculty, N. Carolina State University
- 1988 - Pres  Graduate Program Coordinator, Department of Civil Engineering, North Carolina A&T State University
- 1990-1993  University Summer Faculty, Sandia National Laboratories
- 1984 - 86  Doctoral Faculty, University of Missouri-Rolla
- 1983 - 86  Graduate Faculty, University of Missouri-Rolla
- 1981 - 86  Assistant Professor, University of Missouri-Rolla

PROFESSIONAL EXPERIENCE:
- 1995 - Pres  Member, Guilford County Advisory Board for Environmental Quality
- 1994 - Pres  Referee, Hong Kong Research Grants Council
- 2001 – Pres  Regional Editor, The Journal of Solid Waste Technology and Management
- Honorary Member of the International Advisory Committee for the Second International Seminar on Analytical Techniques in Monitoring the Environment at Sri Venkateswara University in December 2000.
- 1992 - 2000  Member, N. Carolina Water Treatment Facility Operators Certification Board
- Invited Annual Evaluator, Water Quality Division, Taiwan Environmental Protection Agency, December 26 –31, 1999, Taipei, Taiwan.
- 1994 - 97  Secretary (94-95), Vice President (95-96), President (96-97) N. Piedmont Chapter of Professional Engineers of NC (PENC)
- 1995 - 97  Secretary-Treasurer (95), Vice President (96), President (97) Overseas Chinese Environmental Engineers & Scientists Association
- 1987 - Pres  Registered Professional Engineer in North Carolina, PE No. 14041
- 1984 - Pres  Reviewer, J. Environmental Engineering, ASCE
- 1983 - Pres  Reviewer, J. Water Resources Planning and Management Div., ASCE
- 1973 - Pres  Registered Civil Engineering and Sanitary Engineer in Taiwan, ROC
PROJECTS FUNDED:

- "Use of Optimization Models to Generate Design Alternatives to Wastewater Treatment Systems", Weldon Spring Research Fund, $16,012, 6/1/82 - 5/31/83.
- "Attenuation of Pollutants by Soil Percolation", Missouri Department of Natural Resources, $34,700, 7/1/84 - 6/30/85 (Co-Investigator, J. C. Huang).
- "Development of Optimization Functions as a Decision Methodology in Support of LLWDD Strategy Implementation", Chemical Technology Division, ORNL, $15,000, 6/1/87 - 9/30/87.
- "Development of Tradeoff Analysis Methods for Assessing River Basin Level Hydroelectric Power Development" Environmental Sciences Division, ORNL, $25,000, 10/1/87 - 6/30/88.
- "Establishing an Energy Research and Training Center at NC A&T State University", Department of Energy, $193,830, 10/1/87 - 9/30/89 (responsible for the proposal development in Civil Engineering part).
- "Development of Optimization Functions As a Decision Methodology in Support of LLWDD Strategy Implementation (Phase II)", Chemical Technology Division, Oak Ridge National Laboratory (ORNL), $30,000, 7/1/88 - 3/31/89.
- "Development of the Civil Engineering Undergraduate Laboratories and Plan a Graduate Environmental Engineering Program", Title III Grant, US Department of Education, $314,058, 10/1/88 - 9/30/91 (responsible for the environmental engineering program part).
- "Minority Academic Institutions Traineeship Program in Environmental Protection and Pollution Abatement", U.S. EPA through GEM, 1/1/94 - 12/31/96, $120,000.
- "Air Force FAST Center for Environmental Remediation, Fate and Transport of Hazardous Chemicals", Air Force Office of Scientific Research, (Kabadi-PI, Schimmel & Chang -C0-PIs), 10/95 - 9/00, $3,600,000.
- "Department of Defense Environmental Fellowship Grant", subcontract from Iowa State University, 7/1/97 - 6/30/99, $48,000.
- “Protocols for Rating the Capacity of Activated Sludge Plants”, Water Environment Research Foundation, 7/00 – 6/02, $149,952, Joint proposal with the University of Tennessee, A&T’s budget, $22,500.
- "DOE Samuel Massie Chair of Excellence in Environmental Engineering" Department of Energy, 9/01 – 4/02, $168,750.
- "Interdisciplinary Environmental Engineering Fellowship Program for Agricultural, Chemical and Civil Engineering", US Department of Education GAANN Program, 8/00-8/03, $382,500.
- “Membrane Treatment of Secondary Effluent for Subsequent Use, Phase I”, UNC Water Resources Research Institute, subcontract from UNC Chapel Hill, 6/01-6/02, $11,000.
- “Recycling Climate and Markets for the Sandhills region in North Carolina”, USACERL, 5/03-12/03, $41,466.
- “Membrane Treatment of Secondary Effluent for Subsequent Use, Phase II”, Water Environment Research Foundation, subcontract from Camp, Dresser and McKee, 01/04-09/04, $32,166.

Selected Honors and Awards:

**HONORS:**

Phi Kappa Phi Honor Society; Tau Beta Pi Honor Engineering Society; Chi Epsilon Honor Civil Engineering Society; 1981 Academic Excellence Award, conferred by Central States Water Pollution Control Association, NC A&T Department of Civil Engineering Excellence in Teaching Award (May 1994), NC A&T Department of Civil Engineering Excellence in Research Award (May 1995), NC A&T College of Engineering Excellence in Research Award (May 1995), Alpha Delta Epsilon (CE Honor Society) Teacher of the Year (May 1996), ASCE Student Chapter Teacher of the Year (May 1996), International Chinese Environmental Federation Outstanding Leadership Award (July 1997), Overseas Chinese Environmental Engineers & Scientists Outstanding Environmental Service Award (May 1998), DOE Massie Chair of Excellence Program Award for Outstanding Research and Educational Accomplishments, (October, 1999). The 16th International Conference on solid Waste Technology and Management and The Journal of Solid Waste Technology and Management Iraj Zandi Award (December 2000).

**PROFESSIONAL AFFILIATIONS:**

Water Environment Federation; American Society of Civil Engineers; Association of Environmental Engineering Professors; Overseas Chinese Environmental Engineers and Scientists Association; The Association of Chinese Scholars in the Southeast United States
JIANN-LONG CHEN
Assistant Professor
Department of Civil, Architectural, Agricultural, and Environmental Engineering
chenjl@ncat.edu

Education:
- B.S. Civil Engineering, National Taiwan University, Taipei, Taiwan, June, 1987
- M.S. Environmental Engineering, Duke University, Durham, NC, May, 1993
- Ph.D. Environmental Engineering, University of Cincinnati, Cincinnati, OH, December, 1997

Academic Experience:
- 2000–current: Assistant Professor, North Carolina A&T State University, Dept. of Civil, Architectural, Agricultural, and Environmental Engineering, Greensboro, North Carolina
- 2003 Summer: Visiting Scientist, US Environmental Protection Agency, Cincinnati, Ohio
- 1993–1997: Research assistant and graduate student, Dept. of Civil and Environmental Engineering, University of Cincinnati
- 1991–1993: Graduate student, Dept. of Civil and Environmental Engineering, Duke University
- 1989–1990: Assistant Engineer, Environmental Science and Technology Center, China Technical Consultants, Inc., Taipei, Taiwan

Selected Publications/Presentations

PEER-REVIEWED PUBLICATIONS


Projects Funded:


• Feasibility of Using Compressive Strength Test Results For Acceptance testing of Concrete Pavements, Funding agent: North Carolina Department of Transportation, Amount Requested: $94,377, Duration: 7/31/03 ~ 12/31/04.


Selected Honors and Awards:

*Professional Society Memberships*
- Member, American Society of Civil Engineers
- Member, National Ground Water Association
- Member, American Chemical Society
- Member, American Geophysical Union

*Professional Registration And Training*
- Professional Engineer, State of Ohio, registration # E-63803
- OHSA 40 hours training meeting the requirements of 29 CFR 1910.120 (Hazardous Waste and Emergency Response)
Education:
- B.S. in Physics, Yerevan State University, Yerevan, Armenia, 1973.
- M.S. in Physics, Yerevan State University, Yerevan, Armenia, 1974
- Ph.D. in Experimental Nuclear Physics, Yerevan Physics Institute, Yerevan, Armenia, 1974.

Academic Experience:
- Associate Professor, Department of Physics, NCA&T State University, 2000-present
- Adjunct Associate Professor, Department of Physics, NC A & T State University, and Tomas Jefferson National Accelerator Facility (Jefferson Lab), Newport News, VA (bridge appointment), 1996-2000
- Adjunct Associate Professor, Department of Physics, NC A & T State University, 1993-1996
- Visiting Professor, Laboratoire de l'Accelerateur Lineaire, Orsay, University Paris XI, France, 1990-1993
- Staff Scientist, Yerevan Physics Institute, 1977 - 1990

Professional Experience:
- Head of the Physics Section of the Organizing Committee of the International Congress "Second Armenian Scientific World Congress", (UNESCO), September 6-9, 1993, Paris
- Reviewer of an Introductory Nuclear Physics textbook, 2000

Selected Publications/Presentations Recent Publications:
- "High resolution spectroscopy of the $^1_{\Lambda}$ hypernucleus produced by the ($e,e'_{K^+})$ reaction", Physical Review Letters volume 90, issue 23, 10 June 2003
- Measurement of the Electric Form Factor of the Neutron at $Q^2 = 0.5$ and 1.0 GeV^2/c^2. e-Print Archive: nucl-ex/0308021. Submitted to Phys.Rev.Lett.
- Authors except the first, are in alphabetical order. In total, more than 50 articles in refereed physics journals.

Selected Research Projects:

Funded Research Projects
- "Selected Problems in Medium Energy Physics" : NSF Award # PHY-0072466, $314,019. Period Covered: 09/01/00 - 08/31/03. PI.
- "Development of a High Resolution Detection System for the Precision Measurement of the Neutral Pion Lifetime at JLab" : NSF MRI award # PHY-0079840. $ 63,000. Award Period Covered: 07/01/00. PI.
- “Center for the Origin and Structure of Matter (COSM), NSF through Hampton University. 09/01/03 - 08/31/06, $462,000. Co-PI.
- “Study of Electromagnetic Structure of Light Pseudoscalar Mesons via the Primakoff Effect” : NSF award # 0245407; 09/01/03 - 08/31/06 $998,144. Co-PI
- “Investigation of the Influence of Solar Activity on the Atmospheric Conditions through Detection of Solar
Pending Research Projects:

- Student Involvement in Science, Technology and Space Exploration Projects (SI-STS-EP)


Selected Honors and Awards:

Professional Affiliation

- American Physics Society.
- Association des Anciens et des Amies du CNRS (France)
NUMAN S. DOGAN  
Associate Professor  
Department of Electrical Engineering  
dogan@ncat.edu

Education
B.S. (Electrical Eng.) Karadeniz Technical University, Trabzon-Turkey, 1975  
M.S. (Electrical Eng.) Polytechnic Institute of New York, N.Y., 1979  
Ph.D. (Electrical Eng.) University of Michigan, Ann Arbor, MI, 1986  
Thesis advisor: Professor George I. Haddad

Employment History
8/98-present Associate Professor, Department of Electrical Engineering  
North Carolina A&T State University, Greensboro, NC 27411
6/98-8/98 Visiting Research Scientist, General Electric Corporate Research & Development  
Schenectady, NY 12309
6/98-8/98 Visiting Research Scientist, Air Force Research Laboratory, Eglin AFB
10/95-8/98 Act. Head, Department of Electrical Engineering,  
Tuskegee University, Tuskegee, AL 36088
8/94-8/98 Associate Professor, Department of Electrical Engineering,  
Tuskegee University, Tuskegee, AL 36088
8/86-7/94 Assistant Professor, School of Electrical Engineering & Computer Science, Washington State University, Pullman, WA 99164

Professional Affiliations
Senior Member, Institute of Electrical and Electronics Engineers (IEEE)  
Member, International Microelectronics and Packaging Society and Educational Foundation

Funded Research Grants (Current)


Funded Research Grants (Past)
Co-Principal Investigator, NSF, Washington, DC, “REU (Research Experience for Undergraduates)”, $5,000, 5/92-8/92.
Principal Investigator, BOEING Aerospace and Electronics, “Design and Fabrication of GaAs Stacked Varactor Diodes”, $100,000, 1/89-1/991.

Funded Infrastructure Grants (Past)

Principal Investigator, Course Development Support for Undergraduate Laboratory in IC Fabrication, College of Engineering and Architecture, Washington State University, $8,000, 7/90-12/90.

Supervision of Students (North Carolina A&T State University)
graduated: May 2003.
expected graduation: May 2004

Publications (In review)


Journal Papers-Published


Proceedings Papers-Published


DERREK B. DUNN, PH. D.

Associate Professor
Department of Electronics and Computer Technology
dbdunn@ncat.edu

Education:
- Master of Science in Mathematics, The Department of Mathematics, Virginia Polytechnic Institute and State University, June 1994 - May 1995
- Master of Science in Electrical Engineering, The Bradley Department of Electrical Engineering, Virginia Polytechnic Institute and State University, August 1991 - June 1993
- Bachelor of Science in Electrical Engineering, North Carolina A&T State University, August 1986 - December 1990
  Bachelor of Science in Mathematics, North Carolina A&T State University, August 1986 - December 1989

Academic/Work Experience:
Associate Professor (July 2002 to Present), The Department of Electronics and Computer Technology, North Carolina Agricultural & Technical State University, Greensboro, NC 27411; Assistant Professor (August 1998 to June 2002), The Department of Electronics and Computer Technology, North Carolina Agricultural & Technical State University, Greensboro, NC 27411; Assistant Professor (August 1997 to May 1998), The Department of Electrical Engineering, Tuskegee University, Tuskegee, AL 36088; Instructor (August 1996 to May 1997), The Department of Mathematics and Statistics, Radford University, Radford, VA 24142;

Selected Research Projects:

Funded Project/Grants:
- Optical Communication Networking Laboratory at North Carolina A&T State University, $15,000.00 (Lucent Technologies) 2002/2003 Academic Year, PI
- Visiting Industrial Scholar Request for Dr. Ruthie D. Lyle at North Carolina A&T State University, $600.00 (Oak Ridge Associated Universities) 2002/2003 Academic Year, PI
- Undergraduate Scholarships for Global Positioning System Research, $120,000.00 (Office of Naval Research) 2002/2003 to 2006/2007 Academic Year(s), PI
- Wireless Indoor Position Location System, $298,000.00 (NASA) 2001/2002 to 2004/2005 Academic Year(s), PI
- Instrumentation for a Wireless Geo-location and Global Positioning Research Laboratory, $180,000.00 (Air Force Office of Scientific Research) 2002/2003 to 2003/2004 Academic Year(s), PI
- EPA Minority Institution Academic Undergraduate Student Fellowship (Jackie Green), $23,373.00 (EPA) 2002/2003 to 2003/2004 Academic Year(s), PI
- Distance Learning Development Laboratory at North Carolina A&T State University

Selected Honors and Awards:
- Acting Chairperson for the Electronics and Computer Technology Department, North Carolina Agricultural & Technical State University
- Associate Professor of Electronics and Computer Technology, North Carolina Agricultural & Technical State University
- Graduate Faculty, North Carolina Agricultural & Technical State University
- Associate Graduate Faculty, Indiana State University Consortium Ph.D. Degree Program in Technology Management
- Member of the International Editorial Review Board of the “21st Century Engineer”, an Online International Peer-Reviewed Journal
- Certified Industrial Technologist, National Association of Industrial Technology (NAIT)
- Engineer Class I Certification with Master Endorsement (RF), National Association of Radio and Telecommunication Engineers (NARTE)
FERESHTEH FATEHI
Elec. and Comp. Tech. Department
fatehi@ncat.edu

Education:
- Post-Doctoral Research Associate, 1996, Iowa State University
- Ph.D. in Electrical Engineering; 1995, Montana State University
- M.S. in Electrical Engineering; 1993, Montana State University
- B.S. in Electrical Engineering, Shiraz University

Academic Experience:
- August 1996 to present, Assistant/Associate Professor, North Carolina A&T State University, Greensboro, NC
- August 1995 to July 1996, Post-Doctoral Research Associate, Iowa State University, Ames, Iowa
- 1991 to July 1995, Research Assistant, Montana State University, Bozeman, Montana

Selected Publications:


Selected Honors and Awards:

Member, IEEE Engineering Society, and IEEE Power Engineering Society.
Ashot Gasparian
Associate Professor
Department of Physics NC A&T State University
Phone: (336)-256-2038  email: gasparan@jlab.org

Education:
• B.S. in Experimental Nuclear and Particle Physics, Yerevan State University, Armenia, 1974.
• M.S. in Experimental Nuclear and Particle Physics, Yerevan State University, Armenia, 1974.
• Ph.D. in Experimental Nuclear and Particle Physics, Yerevan Physics Institute, Armenia, 1987.

Positions and Academic Experience:
• Assistant Professor, Department of Physics, NC A&T SU, 2002-present
• Research Professor, Department of Physics, Hampton University, 1997-2002
• Research Scholar, Physics and Astronomy Department, University of Kentucky, 1995-1997
• Visiting Scientist, Jefferson Laboratory, Newport News, VA, USA, 1992-1995
• Senior Research Scientist, Yerevan Physics Institute, Armenia, 1974-1992

Research Interest:
Intermediate energy nuclear and particle physics; Chiral symmetry breaking effects in the quark-gluon structure of light pseudo-scalar mesons; precision measurements of the neutral mesons lifetime; parity violation effects in electron scattering and nucleon spin structure; development of nuclear and particle physics instrumentation; detector techniques; fast data acquisition systems; Monte Carlo computer simulations and analysis software.

Recent Proposals and Research Developments:
• Developed experimental proposal: “A Precision Measurement of the Neutral Pion Lifetime via the Primakoff Effect”. The proposal was approved by Jefferson Lab PAC15 with high scientific (A-) rating (E99-014), 1999.
• Developed and submitted an updated proposal: “A Precision Measurement of the Neutral Pion Lifetime via the Primakoff Effect”. The proposal was re-approved by Jefferson Lab PAC22 with highest scientific (A) rating (E02-014), July, 2002.
• Developed an experimental project for the Jefferson Lab “High Energy Upgrade” program: “Electromagnetic Properties of Pseudoscalar Mesons via the Primakoff Effect”. Submitted to JLab Pac23, January, 2003. The proposal was approved and included in the “Executive Summary” of the “Science Driving the 12 GeV JLab Upgrade”.

Recent Conferences and Talks:
• Invited talk at “X International Workshop: Chiral Dynamics 2003”, “The  Lifetime Experiment and Future Plans at JLab”, Bonn, Germany Sept. 2003
• Invited talk at South-Eastern section of APS meeting: “New Generation Precision Experiments to Test Chiral Anomaly”. SESAPS-2003, Wilmington, NC, Nov. 2003

Current Research Grants and Awards:
• NSF Major Research Instrumentation (MRI) grant (PHY-0079840), “Development of a High Resolution Detection System for the Precision Measurement of the Neutral Pion Lifetime at Jefferson Lab”, 2000-2004, for ~$1,000,000, (Principal Investigator).
• NSF research award (PHY:0245407), “Study of Electromagnetic Structure of Light Pseudoscalar Mesons Via the Primakoff Effect”, 2003-2006, for ~$1,000,000, (Principal Investigator).

Selected Recent Publications:
• “Polarization Transfer in the He\(^3\)(e, e/\( \pi^+\))H\(^3\) Reaction up to \( Q^2 = 2.6 \text{ GeV}/C^2\)”, S. Strauch et al., Phys.Rev.Lett.91:052301, 2003.
• “Measurement of Longitudinal and Transverse Cross-Sections in the He\(^3\) (e, e/ \( \pi^+\)) H\(^3\) Reaction at \( W = 1.6 \text{ GeV}\)”, D. Gaskell, et al., Phys.Rev.C65:011001,2002.

Selected Teaching in Past 2 Years:

Graduate Students advised in past 2 Years:
• Marvin Payen
• Arkadzi Talkachou
MELDON HUMAN  
Associate Professor  
Department of Chemical Engineering  
human@ncat.edu

Education

PhD; M.S. – Mechanical Engineering, Stanford University, Palo Alto, CA  
B.S. – Engineering Science, Northwestern University, Evanston, IL

Professional Experience

Associate Professor (Tenured), Department of Mechanical Engineering - North Carolina A&T State University, Greensboro, NC, January 1994 – Present  
Research Engineer (Technical Staff), AT&T – Bell Laboratories, Whippany, NJ, September 1983 – August 1993  
Research Engineer, Timken Company - Mechanical Engineering Department, Canton, OH, 1981 – 1983

External Funding

1994-1998: $310,000, NASA, Propulsion Group Coordinator in NASA Center for Aerospace Research  
1999-2001: $143,000, NASA, Combustion Sensors  
2000-2002: $44,000, Department of Education, Saturday Academy  
2002-2003: $48,000, DOE, PWR Flow Transient Simulations: Thermomechanical Stresses

Affiliations

American Society of Mechanical Engineers  
American Institute of Aeronautics & Astronautics  
Society of Industrial & Applied Mathematics  
American Energy Engineers

Graduate Students

"Design Sensitivities for an Aerovehicle Engine Box", MS Thesis, 1996, Mr. Leslie King  
"Multidisciplinary Methods in Automotive Vehicle Design", MS Project, 1999, Mr. Syed Zahir  

Undergraduate Research

"Energy System Optimization", 1996, Ms. Lois Bennett

Professional Organizations

SIAM: member since 1990  
AEE (Association of Energy Engineers) member since 2000
Education:
- B.S. Chemical Engineering, University of Engineering & Technology, Dhaka, (1974)
- M.S. Chemical Engineering, University of Petroleum & Minerals, Dhahran, (1979)
- Ph.D. Chemical Engineering, Queen’s University at Kingston, Canada, (1986)

Academic Experience:
- Professor (Promoted, July 1, 2000), Associate Professor (Promoted & Tenured, July 1, 1996; Joined as Assistant Professor in August 1990), Department of Chemical Engineering, North Carolina A&T State University, Greensboro, 1990-Present
- Research Associate, Department of Chemical Engineering, University of Cincinnati, Cincinnati, 1986-90
- Lecturer, Department of Chemical Engineering, University of Petroleum and Minerals, Dhahran, 1979 - 1986

Other Experience:
- Proposal Reviewer - Frequently reviews research proposals for National Science Foundation, U.S. Department of Energy and U.S. EPA.
- Meetings & Conferences – Organized and Co-Chaired numerous Technical Sessions at national and international meetings (AIChE, ACS, NAMS, IIChE)
- International Activities - Under the USAID IDP funded Linkage Program between NCATSU & BUET (a three year program 2001-2004), we assisting BUET ChE Department in Curriculum & Faculty Development and Research Capability in the area of Pollution Prevention
- Other Activities - President (2000) and Program Chair (1999) Sigma Xi, The Science and Engineering Research Society, Greensboro Section; President (94-95) and Secretary (93-94) AIChE Triad Section.

Selected Publications/Presentations:


Selected Research Projects:

Selected Honors and Awards:

**PROFESSIONAL AFFILIATIONS**

Member, American Institution of Chemical Engineers (AIChE)
Member, Sigma Xi Scientific Research Society
Member, American Chemical Society (ACS)
Member, Air & Waste Management Association (A&WMA)
Professional Engineer (P.E.), State of Ohio

**RESEARCH & TEACHING PERFORMANCE**

• **Grants:** Twenty-two grants (11 as PI) over the past nine years. Nine funded projects over the past five years totaling over $1.9 million in sponsored research.

• **Graduate Students:** Thesis advisor/co-advisor to twenty-five MChE graduates and currently advisor to eight MSChE students.

• **Excellence Awards:** Recipient of Chancellor’s Outstanding Senior Faculty Research Award of the University for Year 2002

**Patents**


**PUBLICATIONS, PROCEEDINGS & PRESENTATIONS**

• Twenty-five refereed journal papers and over hundred technical presentations and conference proceedings.
Education:
- B.S. Chemical Engineering, Bombay University, May, 1973
- M.S. Chemical Engineering, SUNY at Buffalo, May, 1976
- Ph.D. Chemical Engineering, Penn State University, March, 1982

Academic Experience:
- July 1996 to present: Professor of Chemical Engineering at NCA&T
- July 1990 to June 1996: Associate Professor of Chemical Engineering at NCA&T
- Aug 1985 to June 1990: Assistant Professor of Chemical Engineering at NCA&T
- Aug 1984 to Aug 1985: Assistant Professor of Chemical Engineering at Penn State University
- Jan 1982 to Aug 1984: Post-Doc in Chemistry Department at Penn State University

Other Experience:
- July 2002 to July, 2003: NRC Senior Research Associate, U.S. Army Research Laboratory, Aberdeen, Maryland

Selected Publications/Presentations:

**Research Proposals Funded**

Selected Honors and Awards:

• American Institute of Chemical Engineers (AIChE) - Member
• American Chemical Society (ACS) - Member
• Society of Petroleum Engineers (SPE) - Member
VEREDA JOHNSON KING, Ph.D.
Associate Professor
Economics and Transportation/Logistics
School of Business and Economics
Telephone: (W) (336) 334-7744 Ext. 2008 (H) (336) 288-2826
Fax: (336) 334-7093 E-mail: vkncat@aol.com

EDUCATION:

Ph.D. Economics, Duke University, May 1984
Durham, North Carolina, Dissertation Title: A Microeconomic Analysis Of the Economics of Higher Education

M.B.A. Management Information Systems
North Carolina Central University, Durham, North Carolina
Thesis Title: A Resource Requirements Prediction Module for North Carolina Central University

B.A. Economics & Math
Johnson C. Smith University, Charlotte, North Carolina

ACADEMIC TEACHING EXPERIENCE:

1992-Present Associate Professor of Economics
North Carolina Agricultural & Technical State University-Greensboro, NC

1984 - 1992 Assistant Professor of Economics
North Carolina Agricultural & Technical State University-Greensboro, NC

OTHER PROFESSIONAL EXPERIENCE:

Environmental Protection Agency- Intergovernmental Personnel Act Scholar (2000-2002)
Office of Air Quality, Planning & Standards, Innovative Strategies, Econometrics & Economics Group, Durham, North Carolina

Scholar in Residence-Central Intelligence Agency - summers 1997-2001
Econometrics and Statistical Analysis, CIA Headquarters, Langley, VA

Transportation Research Board Panel Member (NCHRP2-19)
Economics Incentives for Transportation Research, Washington, DC 1994-Present

Director of the Summer High School Transportation Institute
Summers 1995-1996, Co-Director of the Summer High School Transportation Institute

Research Fellow for the Institute for Policy Reform Washington, DC 1994-1996
Fulbright Scholar - University of the West Indies Cave Hill Campus Barbados, West Indies 1988-1989

TEACHING INTEREST:
Environmental Economics, Statistics, Quantitative Analysis, Econometrics

RESEARCH INTEREST:

PROFESSIONAL MEMBERSHIPS:

PUBLICATIONS:


"Have Exports Caused Manufacturing Growth in Barbados?" Pennsylvania Economic Review, Vol. 6, No. 1, Fall 1997 (Co-authored with Osman Suliman)


PROFESSIONAL PROGRAM PRESENTATIONS:

ALEXANDRA KUREPA
Professor
Department of Mathematics, North Carolina A&T State University
kurepa@ncat.edu

EDUCATION
Ph.D. in Mathematics, August 1987, University of North Texas, Denton, TX
M.S. in Mathematics, University of Zagreb, Zagreb, Croatia (Yugoslavia)
B.S. in Mathematics/Computer Science, University of Zagreb, Zagreb, Croatia

TEACHING EXPERIENCE
Professor, North Carolina A&T State University, 2001- present
Associate Professor, North Carolina A&T State University 1996-2001
Assistant Professor, North Carolina A&T State University 1993-1996
Assistant Professor, University of Zagreb, 1987-88.

GRANTS AWARDED
ONR (Office of Naval Research): “Computational Methods for Target-Tracking Problems”, March 2003- June 2006,
(with Giles Warrack ) Award: $597,743.
amount awarded: $1000.
TCU/RF Grant for research on "Partial Differential Equations and Applications" for 1989/90. Grant amount
awarded: $ 3,387.

Graduate Students at NC A&T
Mentor 1 Master’s Degree Student - “Oscillation of a Singular Differential Equation” Oversaw 4 conference
presentations of his research
Master’s Committee Member for 5 students
Supervised Teaching Mentor for 9 graduate students
Superviser of 14 graduate students in the GAANN program and 2 in the ONR program

PUBLICATIONS
(1999), 1-6.
(with W. Peterson)
"Energy analysis of a nonlinear singular differential equation and applications", Revista Colombiana de
Matemáticas 21 (1988), 155-166. (with A. Castro)

MEMBERSHIPS
American Mathematical Society,
Mathematical Association of America,
Association for Women in Mathematics,
National Council of Teachers of Mathematics,
North Carolina Council of Teachers in Mathematics
Jianzhong Lou
Associate Professor
Department of Mechanical & Chemical Engineering
lou@ncat.edu

Education:
• B.S. Chemical Engineering, Zhejiang University of Technology, Hangzhou, China, 1982
• M.S. Chemical Engineering, University of Utah, Salt Lake City, Utah, 1992
• Ph.D. Chemical Engineering, University of Utah, Salt Lake City, Utah, 1994

Academic Experience:
• Associate Professor, North Carolina A&T State University, Greensboro, North Carolina, 2001-present
• Senior Scientist, Clopay Corporation, Cincinnati, Ohio, 2000-2001
• Supervisor of Laboratory, Staff Engineer, Tate & Lyle, Arabi, Louisiana, 1994-2000
• Assistant Professor of Chemical Engineering, Zhejiang University of Technology, Hangzhou, China, 1985-1990

Selected Publications/Presentations:
PATRICIA J. PRICE LEA, R.N.,C., M.S.N., M.S.Ed., Ph.D.
Dean
Department of Nursing
pricelea@ncat.edu

Education:
- 1996, Ph.D. program in Nursing, Wayne State University, College of Nursing, Detroit, Michigan.
- 1975, MSN Nursing, University of North Carolina, Chapel Hill, North Carolina.
- BSN Nursing, Winston-Salem State University, Winston-Salem, North Carolina.

LICENSE
- R.N. North Carolina License
- R.N. Virginia License
- R.N. Michigan License (Inactive Status)

CERTIFICATION
Maternal Newborn Nursing National Certification Corporation for the Obstetric, Gynecologic, and Neonatal Nursing Specialties

Academic Experience:
- Dean, School of Nursing, North Carolina Agricultural and Technical State University, Greensboro, NC, 2002.
- Interim Dean, School of Nursing, North Carolina Agricultural and Technical State University, Greensboro, NC 2001
- Associate Professor of Nursing, School of Nursing, North Carolina Agricultural and Technical State University, Greensboro, NC, 1981-2001.
- Visiting Faculty, Rockingham Community College Maternity Nursing

Consultation:
- 2002, Family Life Council
- 1996-Present, Caswell Parish –Health Care Issues and Violence Prevention
- 1997-2000, Item Writer- New York Board of Regents
- 1994-1996, Minority Research Program
- 1995, Technical Assistance for Reduction of Infant Mortality

Selected Publications/Presentations:

Publications
- Price Lea, P. 2002.(Contributor) SREB Study Indicates Serious Shortage of Nursing Faculty. www.sreb.org.
- Price Lea, P.J. & Hicks, S. (1999). Nursing students prepare for the competitive edge in the new millenium. All That Jazz, 3(June), 86-90.
Published Symposiums

- 1999, University of Hawaii Annual Research, “Low Birth Weight and Abuse During Pregnancy”

Presentations

- Price Lea, P. (2004) PEARLS from a dean’s perspective: Association of Black Nursing Faculty Annual Meeting
- Price Lea, P. & Lea, E. A. (2000). Evaluating Web-sites. (Faculty -Student Mentee Project)
- Price Lea, P. J. (1998). “Points of Light” Faculty Speech for Diploma Ceremony, Greensboro
- Dunnedin, New Zealand.

Poster Presentations

- Price Lea, P. & Hicks, S. (2004). Integrating genetics in the nursing curriculum, North Carolina

Selected Research Projects:

- Co-investigator Passport to health Center on Health Disparities NINR
- Principal Investigator, Family Violence Renewal Grant FCVP Program, North Carolina
- Agricultural and Technical State University.
- Principal Investigator, FUTURES Grant, North Carolina A&T State University
- Co-Investigator, Industry Cluster Grant, North Carolina A&T State University
- Co-Investigator, Eisenhower Grant
- Principal Investigator, Family Violence Grant, School of Nursing, North Carolina
- Agricultural and Technical State University
- Co-Investigator, Cancer Screening Training Grant
- Co-Investigator, Development and Evaluation of a Mentoring Program
- Grant Review, Local Non-Profit Organization - consultant
- Industry Cluster Grant - Nursing History (not funded)
- Co-Investigator, Cancer Training and Research Grant (not funded)
- Proposal, Data Collection and Analysis for NIH Funded Supplement Battering in African American Pregnant Wome
Gudiogopuram B. Reddy  
Professor and Chairman  
Department of Natural Resources and Environmental Design  
stanfiel@ncat.edu

**Education:**
- B.S. in Agriculture, Andhra Agricultural University, India, 1966.
- M.S. in Agronomy, Andhra Agricultural University, India, 1968.
- Ph.D. in Soil Microbiology, University of Georgia, 1974.

**Positions and Honors**
- Recognition of Sciences and Leadership in NC A&T State University, 1988
- White House Appointment: Blue Ribbon Panel of Judges for Take Pride in America, 1992
- Gamma Sigma Delta Scientist Award, NCA&T State University, 1993
- WHO’s WHO in Science and Engineering in America, 1996
- Chaired the National Conference on Environmental Remediation Science and Technology, Greensboro, NC, 1998
- NC A&T Senior Research Award Recipient, 2004

**Other Experience and Professional Memberships**
- Present position: Professor and Chairman, North Carolina A&T State University
- Previous Employment:
  - 1984-1990 Associate Professor, North Carolina A&T State University
  - 1979-1983 Assistant Professor, North Carolina A&T State University

**Publications**

**Research/ Support**


**Graduate Students**

For the past five years Dr. Reddy advised five graduate students leading to M.S. degree in Plant and Soil Science.
MANUEL REYES REYES  
Associate Professor  
Department of Natural Resources and Environmental Design  
Department of Civil, Architectural, Agricultural and Environmental Engineering  
Email: reyes@ncat.edu

Education
LOUISIANA STATE UNIVERSITY and Agricultural and Mechanical College, Baton Rouge, Louisiana, USA.  


UNIVERSITY OF THE PHILIPPINES AT LOS BAÑOS, College, Laguna, Philippines.  
*Bachelor of Science in Agricultural Engineering*, April 1980.

Academic Experience
*Associate Professor*, North Carolina A&T State University, Greensboro, North Carolina, 1999-present  
*Instructor/Graduate Student*, University of the Philippines at Los Baños, College, Laguna, Philippines 1980-1987.  
*Farm Manager*, Santo Rosarios development Corporation, Coron, Palawan, Philippines. 1980-1983

Affiliations
- American Society of Agricultural Engineers Member  
- NC-WRRI Technical Panel Reviewer in 2002 and 2003  
- Regional Project S-249 Technical Committee: ‘The Impact of Agricultural Systems on Surface and Groundwater Quality’. The only member from an 1890 university. (1993 to 1996)  
- Regional Project S-1004 Technical Committee: “Development and Evaluation of TMDL Planning and Assessment Tools and Processes”  
- Peer Reviewed several papers for the Journal of Environmental Quality  
- Gamma Sigma Delta Member

Graduate students: (All M.Sc.)
- **Magsood Kahn. 1996. Completed Ph.D. 2002.**  
- **Kenneth Okereke. 1998. Completed another M.Sc. degree at Iowa State University [©] in 2000.**  
- **Stephen Gareau. 2002.**  
- **Graduate Committee Member (3 M.Sc. Students)**
Funded Projects


Co-Principal Investigator.

- Interdisciplinary program in soil and water quality research and education. NCA&TSU. 2003-2004. ($15,000).
- Student support initiatives: To increase enrollment and enhance technical expertise of graduates in agricultural and Biosystems engineering that will impact USDA-NRCS. 2000-2004. ($350,000).
- 'Analysis of impacts of agricultural policies designed to protect soil and water resources: a whole-farm economic and environmental analysis,' USDA-NRCS. 1994-1996 ($80,000).

PUBLICATIONS

Refereed

KENNETH L. ROBERTS
Department of Chemical Engineering
North Carolina A&T State University
Greensboro, NC 27411-0001
(336)334-7564(tel)/(336)334-7904(fax)/kroberts@ncat.edu (email)

Education
Ph.D., Chemical Engineering, University of South Carolina, 1997
M.S., Chemical Engineering, Georgia Institute of Technology, 1992
B. Ch.E., Chemical Engineering, Georgia Institute of Technology, 1990

Professional Experience
2001-Present Visiting Faculty Researcher, Chemical Technology Division, Oak Ridge National Laboratory, Oak Ridge, TN.
2000-2001 Associate Director, NSF North Carolina-Louis Stokes Alliance for Minority Participation, North Carolina A&T State University, Greensboro, NC.
1999-2001 Visiting Faculty Researcher, Center for Electrochemical Engineering, The University of South Carolina, Columbia, SC.
1998-Present Program Coordinator, U.S.-Ghana Chemical Engineering Exchange Program, North Carolina A&T State University, Greensboro, NC.
1997-Present Assistant Professor, Dept. of Chemical Eng., N.C. A&T State Univ., Greensboro, NC.
1992-1996 Research/Teaching Asst., Dept. of Chemical Eng., Univ. of S. Carolina, Columbia, SC.
1993 DOE Trainee, Equipment Eng. Section, Westinghouse Savannah River Site, Aiken, SC.
1991 Research and Development CO-OP, Amoco Chemical Company, Naperville, IL.
1990-1992 Teaching Asst., School of Chemical Eng., Georgia Institute of Technology, Atlanta, GA.

Research Interests-Development of advanced materials systems and processes for energy and environmental applications; Heterogeneous catalysis; synthesis, characterization and evaluation of catalytic and electrocatalytic materials; Applications of solid/fluid phase equilibria; Environmental remediation.

Teaching Interests-Integration of Research and Technology into Engineering Education; Gender and Diversity Issues in Math, Science, Engineering and Technology Education; International Educational Exchange Initiative Development; Cooperative Teaching Methods in Engineering, Science and Math Education.

Educational Programs Experience
Program Coordinator, U.S./ Ghana Chemical Engineering Exchange Program, North Carolina A&T State University, Greensboro, NC (1998 to Present). Responsibilities include recruitment of students for international training programs and development of international research and faculty training collaborations. Funding from Alcoa Foundation.

Program Coordinator, Summer Undergraduate Experience (SURE) Program at NC A&T (1998 to Present) Program seeks to strengthen student transitions from STEM and Pre-Engineering disciplines to undergraduate engineering and/or graduate STEM studies by means of eight weeks of research training/faculty mentoring, professional development seminars, and research laboratory/industrial site visits. Funded from NASA.

Associate Director, North Carolina-Louis Stokes Alliance for Minority Participation, North Carolina A&T State University, Greensboro, NC (2000-2001). Responsibilities include student transitions programs and MSET undergraduate research training activity development. Funding from NSF.

Honors and Awards
3-M Non-Tenured Faculty Research Award (2000-2003)
North Carolina-LSAMP Outstanding SMET Faculty Mentor Award (1999)
American Society for Engineering Education/MIND New Faculty Award (1998)
Faculty of the Year in Chemical Engineering, North Carolina A&T State University (1997-1998)
Professional Affiliations and Activities

American Institute of Chemical Engineers, American Chemical Society, North American Catalysis Society,

Panel Chair and Reviewer, National Science Foundation, DUE-ILI27 (1998)

Member, Waste Management Certification Board, North Carolina A&T State University (1999 – Present)

Reviewer, National Science Foundation, DUE-CCLI2 (1999), National Science Foundation - Kinetics, Catalysis and Molecular Processes, Division of Chemical Transport Systems (2002)


Selected Reviewed Technical and Educational Publications (11 Total)

Selected Technical Presentations (76 Total)

Selected Educational Presentations (5 Total)

Graduate Students Advised/ Co-Advised (11 Total)

Undergraduate Students Mentored (53 Total)

K-12 Students and Educators Mentored/Advised (5 Total)
ABOLGHASEM SHAHBAZI  
Professor of Agricultural Engineering  
Phone (336) 334-7787  
ASH@NCAT.EDU

Education:

Experiences:
Academic Experience: Professor, June 2002, Department of Natural Resources, North Carolina A&T State University, Greensboro, NC 27411

Funded Research:
A. Shahbazi and Donald McDowell, 2003-2004, Assessment of crop and forest residues in NC, Supported by North Carolina State Energy Office, $100,000
Shahbazi, A. 2000-2003, Assessing the Performance of Thin-Film Photovoltaic Modules in a Residential PV Application, Supported by North Carolina Energy Division, $50,000
Shahbazi, A. and Arup Mallik, 1998-2000, Utilization of Wood Waste and Residue in North Carolina, Supported by North Carolina Energy Division, $70,000
Shahbazi, A., 1998-2000, Continuous Fermentation of Mixed Substrate to produce Lactic Acid with Immobilized Bacteria, Supported by USDA, CSREES, Evans-Allen Fund, $140,000
Shahbazi, A., 1994-1997, The Effect of pH and Substrate Concentration in the fermentation of sugars, Supported by USDA, CSREES, Evans-Allen Fund, $150,000
Goswami, Y. Shahbazi, A., 1989 – 1990, Designing a low cost and practical solar fruit drying system for developing countries, Supported by the US-Agency for International development, $100,000.

Publications
Shahbazi, A. S. Ibrahim, M. Salameh, and V. Shirley, 2003, Immobilization of Lactobacillus helveticus on a spiral sheet bioreactor for the continuous production of lactic acid”; to be published in MILCHWISSENCHAFT, Accepted for publication.
Morrison Z., Ibrahim S., Salameh M., Shahbazi A., and Seo C. W., 2001, Continuous production of antimicrobial compound, lactic acid and acetic acids from sweet whey by sodium alginate entrapped bifidobacteria cells, Submitted to J. of Dairy Science
Anand Padman, J. Kumar, A. Shahbazi, 1997, Bioconversion of organic wastes to ethanol using immobilized thermophilic bacteria, American Environmental Laboratory, Vol.9, No. 9.


Goswami, Y., A. Lavania, and A. Shahbazi, 1991, Analysis of a geodesic dome solar fruit dryer, Drying Technology, 9(3), 677-691


Thesis Committees Chaired
Assessment of Energy Potential from Crop Residues in North Carolina, 2004, Mr. Saed Roudsari, Agricultural and Biosystems Engineering, NCA&T SU.

Performance Evaluation and Economic Analysis of a Grid-Connected Photovoltaic System, 2002, Mr. Debashish Goswami, Agricultural and Biosystems Engineering, NCA&T SU.

Reduction of MTBE in Ground Water using Select Active System, 2001, Mr. Achebe Hope, Agricultural and Biosystems Engineering, NCA&T SU.

The Effect of Ph and Sugar Concentration on Lactic Acid Production by L. helveticus, 1995, Mrs. Mei Du

The Effect of Ph and Sugar Concentration on Lactic Acid Production by L. bulgaricus, 1994, Mr. Shahid Ali

Bioconversion of Organic Wastes to Ethanol Using Immobilized Thermophilic Bacteria, 1992, Mr. A. Padmanabham

Studying the Effect of Metals on the Fermentation of Food Processing Wastes, 1991, Mr. E. Das

Increasing Ethanol Productivity through Co-Fermentation of Food Processing Wastes, 1990, Ms. Rose Mathew
I. Education

Institution and Location

1. Faculty of Nursing and Obstetrics of Guarulhos (FEOG), Guarulhos, BZ
   - Degree: B.S.N. (Licentiate)
   - Year: 1986
   - Field of Study: Nursing

2. Federal University of Sao Paulo (UNIFESP), Sao Paulo, BZ
   - Degree: C.S.
   - Year: 1991
   - Field of Study: Medical-Surgical Nursing

3. Federal University of Sao Paulo (UNIFESP), Sao Paulo, BZ
   - Degree: M.S.N.
   - Year: 1995
   - Field of Study: Adult Health Nursing

4. Case Western Reserve University (CWRU), Cleveland, OH
   - Degree: Ph.D.
   - Year: 2003
   - Field of Study: Nursing

II. POSITIONS AND HONORS

A. PROFESSIONAL TEACHING EXPERIENCE

1986 - 1987
Clinical Professor, Nursing, Faculty of Nursing and Obstetrics of Guarulhos (FEOG), Guarulhos, Brazil

1988 - 1993
Clinical Professor, Nursing, Faculty of Nursing and Obstetrics of Guarulhos (FEOG), Guarulhos, Brazil

1989 - 1994
Professor, Nursing, Israelite Albert Einstein Hospital (HIAE), LPN School of Nursing, Sao Paulo, Brazil

1993 - 1994
Assistant Professor, Nursing, Federal University of Sao Paulo (UNIFESP), Sao Paulo, Brazil

1995 - 1995
Professor, Nursing and Biostatistics, Bandeirantes University (UNIBAN), Sao Paulo, Brazil

1995 - 1995
Professor, University of Great ABC (UNIABC), Sao Caetano do Sul, Brazil

1997 - 2000
Assistant Professor, Nursing, North Carolina Agricultural and Technical State University, Greensboro, NC

2004 – present
Clinical Nurse and Clinical Nurse Supervisor in Medical-Surgical and Critical Care Units, University Hospitals of Cleveland, Cleveland, OH

1985 – 1989
Staff RN in Medical-Surgical Unit; Nurse Supervisor in ICU and Medical-Surgical Units, Head nurse in ICU, and Director of Nursing Service, Iguatemi Hospital, Sao Paulo, Brazil

1995 - 1998
Staff RN in Geriatric and Subacute Units; and Nurse Supervisor in Geriatric and Subacute Units, Britthaven, Inc., Franklin, Charlotte, Chapel Hill, NC

1999 – 2000
Staff RN in Medical-Surgical Units, Favorite Nurse, Independence, OH

1999 – 2000
Staff RN in Subacute Rehabilitation Unit, University Hospitals of Cleveland, Cleveland, OH

1997 – 2000
Staff RN in Cardiovascular Surgery (step-down unit), Wake Medical Center, Raleigh, NC

2000 - 2004
Clinical Nurse and Clinical Nurse Supervisor in Medical-Surgical and Critical Care Units, University of North Carolina Hospitals, Chapel Hill, NC

C. Professional Memberships

2001 – Present
Member, Sigma Theta Tau International, Apha Mu Chapter. Membership ID N0.
D. Certification

1999 - 2004 Certified as Clinical Nurse Specialist in Medical Surgical Nursing, American Nurses Credentialing Center. Certificate No. 3222224-05

E. Honors and Awards

2003 PhD Dean’s Legacy Award winner, Frances Payne Bolton School of Nursing Case Western Reserve University, Cleveland, OH

2002 – present Listed in the directory of certified nurses, pages: 187 and 862, American Nurses Credentialing Center, Washington, DC

2002 – present Member, editorial review board of the Online Brazilian Journal of Nursing, ISSN 1676-4285, Niteroi, Brazil

2002 - present Member, editorial review board of Nursing, Brazilian Edition, SGMJ 401542, Sao Paulo, Brazil

II. Peer-review Publications

A. Published


B. In Press


PAUL MICHAEL STANFIELD  
Assistant Professor  
Department of Industrial and Systems Engineering  
stanfiel@ncat.edu

Education:
- Ph.D. in Industrial Engineering, North Carolina State University, 1995.

Academic Experience:
- Assistant Professor, Industrial and Systems Engineering Dept., NC A&T State 1999-present
- Adjunct Assistant Professor, Industrial Engineering Dept., NC State University, 2000-present
- Adjunct Assistant Professor, Industrial and System Engineering Dept., NC A&T State, 1996-1999

Other Experience
- Consulted with Becton Dickinson, BellSouth, Bosch/Siemens, Coca-Cola, Crown, Eveready, Firestone, Frigidaire, Lorillard, Miller Brewing, Naval Aviation Depots, Philip Morris, Planters/Lifesavers, PPG Industries, Procter & Gamble, R.J. Reynolds, and Sara Lee
- Region 3 Vice President of the Institute of Industrial Engineers
- Leadership Greensboro graduate 1996
- Piedmont Triad Leadership Network graduate 1998
- Selected as one of the Forty Leaders Under Forty – 1998 (inaugural year of award)
- Piedmont Triad President of the Institute of Industrial Engineers

Selected Publications/Presentations

Selected Research Projects

Fundied Projects:
- Discipline and Curriculum Integration through the ALIVE System, National Science Foundation, $375,000, 2004-2007.
• An Engineering and Education Partnership for Development of an Institutional Model for Bridges to Student Success in Science and Engineering at an HBCU, National Science Foundation BEE program, $100,000, 2002-2003.

Proposed Projects:
• Interdisciplinary Program to Recruit, Prepare, and Promote Women and Minorities for Employment in the IT Workforce, National Science Foundation BEE program, $299,602, submitted 11/01.

Master’s Thesis/Projects:

Selected Honors and Awards
• 2003 North Carolina A&T State University Outstanding Young Investigator Award
• 2003 NC A&T State College of Engineering Research Excellence – Young Investigator
• 2002 Goody’s Powders Excellence in Teaching Award
• 2001 Institute of Industrial Engineers Outstanding Young Industrial Engineer Award
• 2001 NC A&T State College of Engineering Teaching Excellence Award – Assistant Professor Level
• 2000-2001, 2001-2002 Department of Industrial and Systems Engineering Faculty of the Year
• Institute of Industrial Engineers Pritsker Doctoral Dissertation Award
• Institute of Industrial Engineers Graduate Research Award
• Institute of Industrial Engineers Gilbreath Fellowship
• Member of Tau Beta Pi Engineering, Omega Rho Operations Research, Beta Gamma Sigma Business, Phi Kappa Phi Academic, and Alpha Pi Mu Industrial Engineering Honor Societies

Selected Teaching
• INEN289 Engineering Teams and Leadership; 1 cr.; Fall 2003, Fall 2004.
• INEN489 Professionalism and Ethics; 1 cr.; Fall 2003, Fall 2004.
• INEN658 Project Management, 3 cr.; Fall 2000, Fall 2002.
• INEN832 Information Technology Management; 3 cr.; Spring 2003.
• INEN853 Enterprise Integration; 3 cr.; Spring 2001, Fall 2003.
GUOQING TANG  
Department of Mathematics  
North Carolina A&T State University  
Greensboro, NC 27411  
Phone: (336) 334-7822/Fax: (336) 256-0876/E-mail: gtang@ncat.edu

Education
1992 Ph.D. Rutgers University Mathematics
1984 M.S. Nanjing Univ of Sci & Tech Applied Math and Statistics
1982 B.S. Anhui University Applied Mathematics

Professional Experience
2003-present Professor, Mathematics Department
2001-present Director of Research, College of Arts and Sciences
2002-2003 Research Associate Professor, Physics Department
1999-2003 Associate Professor and Coordinator of Applied Mathematics Program
1992-1999 Assistant Professor (1992-1994 Visiting Assistant Professor)
Mathematics Department, North Carolina A&T State University
1987-1992 Teaching/Research Assistant and Instructor
Rutgers University
1984-1987 Instructor
Nanjing University of Science and Technology

Research Interests
Nonlinear dynamical control systems, differential geometric optimal control, robust control and feedback stabilization, applied and environmental geophysics, scientific computing, and mathematical modeling in environmental assessment and control

Selected Publications
Clemence, D. P. and G. Tang, editors (In preparation for AMS Contemporary Mathematics Series) Analytical and Numerical Approaches in Nonlinear Wave Propagation
“On the existence of an optimal synthesis for linear quadratic optimal control problems with a fixed terminal point,” in Proc. 1995 American Control Conference, Seattle, WA, June, 1995,

**Grants and Other Forms of Research Support**
2003-06: "Collaborative Research: Enhancing Diversity in Geosciences in North Carolina," with S. Bililign, National Science Foundation, $449,988
2002-04: “Physical insight and mathematical methods in seismic data analysis,” with C. Jackson, National Science Foundation, $99,851
2002-04 “Development of a geophysical field research and training program,” with C. Jackson and D. Clemence, National Science Foundation, $134,601
2003: “Interdisciplinary Computational Science Graduate Program Planning,” the University of North Carolina General Administration, $74,523
2002: “Transforming the masters program in applied mathematics, physics and chemistry into an interdisciplinary computational science program,” with C. Jackson, S. Bililign, D. Clemence, Y. Wang, and S. Providence, Council of Graduate Schools/Sloan Foundation, $6,995
2001-02: “Mathematical Methods in Nonlinear Wave Propagation,” with D. Clemence, National Science Foundation, $27,500

**Invited Talks/Lectures**
3. *Geometric Optimal Control on Matrix Groups*, Invited Systems and Control Seminar Talk, Rutgers Center for Systems and Control Theory, Rutgers University, April, 1999
4. *Orienting a satellite with two rotors attached along its two fixed orthogonal axes in minimum time*, Invited Current Research Lecture, 1997 AMS Summer Research Institute, Boulder, Colorado, June 29-July 19, 1997
5. *Cyberspace, information super highway, and applications in scientific research and technological innovation*, Invited Internet presentation and demonstration, High Point University, High Point, NC, October, 1996

**Professional Affiliations**
Society of Applied and Industrial Mathematics
Society of Exploration Geophysicists
American Society of Engineering Education
Dr. Godfrey Arinze Uzochukwu
Professor
Department of Natural Resources & Environmental Design
Waste Management Institute
uzo@ncat.edu

Education:
• B.S. (1979) Oklahoma State University
• M.S. (1980) Oklahoma State University
• Ph.D. (1983) University of Nebraska
• Post-Doc (1984) Texas A&M University

Experience:
TEACHING-DEPARTMENT OF NATURAL RESOURCES
(North Carolina A&T State University, Greensboro, NC.)
• July 1993 - Present (Professor)
• July 1989 - June 1993 (Associate Professor)
• January 1985 - June 1989 (Assistant Professor)
Teach interdisciplinary courses in environmental sciences. Research areas include: soil and mineral properties for better land use, uses of natural resources data, assessment and evaluation of environmental technologies, interdisciplinary and multidisciplinary environmental processes and ecology.

POSTDOCTORAL RESEARCH
(Texas A&M University, College Station, Texas).
• January 1984 - December 1984
Modified a procedure for identification and study of soil manganese minerals by x-ray diffraction.

Affiliations:
2001-Present: Member, Futures Planning and Resource Council
2002-Present: Chair, FUTURES Goal II-Interdisciplinary Programs and Centers
1999-Present: Site Coordinator, NSF Science and Technology Center for Environmentally Responsible Solvents and Processes (A&T, NCSU, UNC-CH and UT-Austin)
PROFESSIONAL SOCIETIES:
• American Society of Agronomy
• International Geo science Education
• Soil Science Society of North Carolina
• Soil Science Society of America
• Clay Mineral Society of America
• National Association of Environmental Professionals

Publications
• SSSNC

Funded Programs:
• USDOE-SR , $44,000 2002 National Environmental Conference
• NSF STC (PI), $2,000,000 (1999-2004 ) Center for Environmentally Responsible Solvents and Processes
• ERDA (PI) , $150,000 Technical Support of Hydrology, Natural Attenuation and Risk Assessment (2000-2001)
• USEPA (PI) , $3,260 (1999) Environmental Internship
• USDOE-SRS (PI) , $250,000 (97-98) Assessment and Evaluation of Environmental Technologies
• USEPA (PI) , $16,500 (94-96) Environmental Internship for undergraduate students
• USDOE-SR (PI), $1,400,000 (94-98) Infrastructure Support for a Waste Management Institute
• NSF/UNC Chapel Hill (PI) , $51,000 (1989-1992) Research Experiences for minority students
• National Science Foundation (PI) , $18,000 (1987) Investigation of near surface and subsurface geologic condition
• DOE (Co-PI), $99,000 (1987) Oak Ridge Assoc. Universities
• USDA (Co-PI), $70,000 (87-89) Evaluation of S.E. soil properties for water erosion prediction
• DOE (Co-PI) , $250,000 (91-95) Academic Partnership Program in Environmental Technology
Willie Leonard Willis  
Professor  

Department of Animal Sciences  
Phone: (336) 334-7786  
willisw@ncat.edu

Education
1982    Ph.D., Colorado State University - Animal Science
1980    M.S., Colorado State University - Animal Science
1977    B.S., Fort Valley State University - Animal Science

Employment
Professor, Department of Animal Sciences, N.C. A&T State University, 1984-Present
Department Head, Perdue Foods, Inc., Accomac, VA, 1983

Affiliations
Gamma Sigma Delta Honor Society
Poultry Science Association
North Carolina Poultry Federation
North Carolina Agromedicine Society
Phi Kappa Phi Honor Society
Curriculum Vita
Willie L. Willis

Funded and applied for Research
Campylobacter jejuni Safety Assessment of North Carolina’s Broiler chickens.  

Molecular Epidemiology of Campylobacter jejuni in Poultry Production.  
$117,000 – period of 3 years.  CSREES  1993-1996.

Comparative Effects of All-Vegetable and Animal Protein Diets on Pathogen Reduction.  $120,000 – period of 3 years (1996-1999).  Evans-Allen CSREES.

A Fiber-Optic Biosensor for Rapid Detection of Pathogens in Poultry Products.  

Impact of Emerging Technologies on Thermal Inactivation of Food Borne Pathogens.  

Diversity of Food-borne Pathogens on Poultry Farms and relationship with Biosecurity strategies.  $61,000 - period of 3 years.  2001-2004.  USDA/CSREES.

Publications


**Book Monograph**


**Proceedings**


NAIL K. YAMALEEV, Ph.D.
Department of Mathematics
North Carolina A&T State University
Phone: (336) 334-7254, Ext. 2003
E-mail: nkyamale@ncat.edu

Education
Ph.D. in Mathematical Modeling and Numerical Methods (1993), Moscow Institute of Physics and Technology, Russia
M.S. in Aerodynamics and Thermodynamics (1989), Moscow Institute of Physics and Technology

Professional Experience
8/03 – present Associate Professor, Department of Mathematics, North Carolina A&T State University, Greensboro, NC
10/02 – 07/03 Research Associate, Center for Aerospace Research, North Carolina A&T State University, Greensboro, NC
10/99 – 08/02 National Research Council Senior Research Associate, Computational Modeling and Simulation Branch, NASA Langley Research Center, Hampton, VA
02/99 – 09/99 Visiting Scientist, Institute for Computer Applications in Science and Engineering (ICASE), NASA Langley Research Center, Hampton, VA
05/97 – 01/99 Alexander von Humboldt Foundation Research Fellow, Institute for Mechanics, Technical University (RWTH), Aachen, Germany
09/92 – 12/02 Senior Research Scientist (1996), Department of Computational Mathematics, Institute of Mathematics, Russian Academy of Sciences, Ufa, Russia
09/89 – 08/92 Research Assistant (part time), Department of Computational Mathematics, Moscow Institute of Physics and Technology, Russia

Teaching Experience
08/03 – present Associate Professor, Department of Mathematics
North Carolina A&T State University, Greensboro, NC
Undergraduate courses taught: Introduction to Differential Equations, Introduction to Applied Mathematics, Precalculus
09/95 – 01/97 Senior Lecturer (adjunct faculty), Department of Continuum Mechanics
Bashkir State University, Ufa, Russia.
Graduate courses taught: Computational Fluid Dynamics
02/93 – 06/95 Lecturer (adjunct faculty), Department of Computational Mathematics, Bashkir State University, Ufa, Russia
Graduate courses taught: Numerical Methods for PDEs
Undergraduate courses taught: Introduction to Numerical Methods,
FORTRAN, FoxPro

Research Interests
• Reduced-order models for active flow control and manufacture of composite materials
• High-order numerical methods for partial differential equations (PDEs)
• r-, h-, and p-refinement adaptive grid methods
• Iterative methods for high-Reynolds-number flows
• Asymptotic-numerical methods
Research Grants
• National Institute of Aerospace (NIA) Research Grant, Validation of Modern CFD tools for Efficient Simulation of Synthetic Jet Actuators,” Principal Investigator, 10/03 – 09/04, $50K
• NASA URETI program “Third Generation Reusable Launch Vehicles,” Task: “Mixing and Combustion Efficiency Including Mode Transitions,” Co-Investigator (with S. Chandra), 10/03 – 9/06, $50K
• U.S. Army Research Laboratory Grant, “Modeling of the multi-scale transport phenomena during manufacture of polymer based composite materials” Co-Investigator (with R. Mohan), 01/04 – present.
• National Institute of Aerospace (NIA) Research Grant, “Ultrafast Multiscale High-Order Methods for PDEs,” Co-Investigator, (with F. Ferguson), 10/02 – 09/03, $50K
• Presidential Research Grant for Young Talented Scientists, Russia, “Iterative space–marching methods for compressible flows at all speeds”, Principal Investigator, 01/94 – 12/97
• International Science Foundation (USA) Individual Research Grant, 1993

Professional Activities
Acting referee for: Journal of Computational Physics
SIAM Journal on Numerical Analysis
AIAA Journal
Journal of Scientific Computing

Selected Publications
GUOCHEN YANG
Associate Professor
Department of Natural Resources
Telephone: 336-334-7779; Fax: 334-336-7844;
E-mail: yangg@ncat.edu

Education:
Ph.D.: Horticulture & Forestry (plant biotechnology), University of Nebraska-Lincoln (UNL), 1993.
B.S.: Horticulture (vegetable crops), Jilin Agricultural University, Changchun, P. R. China, 1982.

Professional Experience:
2002 – now  Associate Professor, North Carolina A&T State University (NCA&T).
2000 - 2002  Assistant Professor, NCA&T.
1994 - 1999  Research Plant Biotechnologist (with teaching responsibilities), NCA&T.
1994 – 1994  Post-Doctoral Research Associate, UNL.
1987 – 1993  Graduate Research Assistant (plant Biotechnology), UNL.
1982 – 1986  Instructor (plant breeding, with research responsibility), Jilin Ag. Univ. China.

Honors:
Outstanding Young Investigator Award 2001, North Carolina A&T State University.
USDA 1999 Secretary’s Honor Awards for Personal and Professional Excellence.
Travel Grant Award, 1990, 1992, 1993, Society of Sigma Xi.

Funded Projects:
• Feasible Ag-Biotech Approaches for Phytomedicine Production in Guava, $25,000.00, 07/01/2004-06/30/2005. North Carolina Agromedicine Institute. (PI, pending).
• A Model Interdisciplinary Biotechnology and Biodiversity Program, $15,000.00, 04/11/2002-05/15/2003. NCA&T FUTURES Venture Seed Grants (PI).
• Interdisciplinary Efforts to Produce Highest Quality Water for Utilization in Living Systems, $15,000.00, 04/11/2002-05/15/2003. NCA&T FUTURES Venture Seeds Grants (Co-PI).
• Life Opportunities in Biotechnology, $30,000.00, 09/01/2002-09/30/2005. North Carolina Biotechnology Center/Eleanor F. Nunn Lectureship Co-PI).
• Efficiency Improvement of In Vitro Regeneration for Chestnut Transformation. $161,133.00, 10/01/2001-09/30/2004. USDA/CSREES/Evans-Allen Fund (PI).
• Micropropagation of Native Cane in the Smokey Mountains. $5,000.00, 05/30/2000 - 09/30/2002. USDA/National Park Services (Co-PI).
• Establishing a Model In Vitro Regeneration System for Phytoremediation. $15,000.00, 9/30/1999 - 6/30/2000. USDE/Environmental Management Program/Clark Atlanta University (PI).
• Improving Performance in Two Acid/Aluminum Tolerant Alfalfa Cultivars. $140,000.00, 10/1/1999 - 9/30/2002. USDA/CSREES/Evans-Allen Fund (Co-PI).
• Planning Phytoremediation of S. Buffalo Creek for Improved Water Quality. $20,000.00, 10/1/1998 - 9/30/1999, USDE/Environmental Management Program/Clark Atlanta University (PI).
• Enhancing Environmental Biotechnology Capacity at North Carolina A&T State University. $829,774.00, 07/01/97 - 09/30/02. North Carolina Biotechnology Center (Co-PI).
• Development of an Acid/Aluminum Tolerant Alfalfa Genotype. $140,000.00, 10/1/1996 - 9/30/1999. USDA/CSREES/Evans-Allen Fund (Co-PI).
Publications:


Teaching:

HORT600 Plant Tissue Culture.
HORT700 Plant Biotechniques.
HORT660 Plant Breeding (proposed, pending approval).
NARS110 Plant Science.
Shen, Ji Yao  
Associate Professor  
Department of Manufacturing Systems, School of Technology  
North Carolina A&T State University, Greensboro, NC 27411  
Tel: (336)334-7116(O), Fax: (336)334-7704,  
E-mail: shen@ncat.edu  

Education:  
Ph.D., Aug.1991 Dept. of Mechanical Engineering & Mechanics, Old Dominion University, Norfolk, VA.  
M.S., Dec.1980 Dept. of Aeronautics, Nanjing Aeronautical University, Nanjing, Jiangsu, China.  
B.S., Sept.1966 Dept. of Aeronautics, Northwestern Polytechnic University, Xian, Shaanxi, China.  

Academic History  
8/01-Present Associate Professor, Dept. of Manufacturing Systems, School of Technology, NC A&T State University, Greensboro, NC.  
8/95-8/01 Adjunct Associate Professor, General Engineering, College of Engineering, NC A&T State University, Greensboro, NC.  
1/92-7/95 Adjunct Assistant Professor, Mechanical Engineering, College of Engineering, NC A&T State University, Greensboro, NC.  
9/87-8/88 Visiting Scholar, Dept. of Mechanical Engineering & Mechanics, Old Dominion University, Norfolk, VA.  
11/85-8/87 Visiting Scholar, Dept. of Civil Engineering, University of Southern California, Los Angeles, CA.  
1/80-10/85 Associate Professor, Aeronautical Institute of Technology, Xian, Shaanxi, China.  
4/72-10/78 Engineer, Aircraft Flight Research & Test Center, Xian, Shaanxi, China.  
3/70-3/72 Aircraft Designer, Conceptual Design Division, Shanghai Aircraft Company, Shanghai, China.  
1/68-2/70 Engineer, Aircraft Structure & Strength Research Center, Xian, Shaanxi, China.  
9/66-12/67 Aircraft Designer, Structural Design Branch, Shenyang Aircraft Design Institute, Liaoning, China.  

Teaching Experience:  
• 1988-1989, Teaching Assistant on Mechanism Design, Auto-Control and Digital Control Laboratory Experiment.  

Research Areas:  
1. Structural modeling, analysis, identification and control of large flexible aerospace/aeronautical structures;  
2. Aeroelasticity analysis such as flutter analysis and suppression;  
3. Structural deformation alleviation and active control of vibration by using smart materials as sensors/actuators;  
4. Non-destructive evaluation and health monitoring of aging infrastructures and aerospace structures;  
5. Multi-disciplinary optimization for design of aerospace vehicles;  
6. Industrial materials and material processing.  

Sponsored/Participating Research:  

Professional Society Activities
- Member, American Institute of Aeronautics and Astronautics (AIAA).
- Member, International Society of Optical Engineering.
- Member, American Society of Civil Engineers (ASCE), Committee Member, Sub-Committee on Dynamics & Controls, Aerospace Division, ASCE, Charter Member of the Structural Engineering Institute (SEI) of ASCE.
- Session Chair for the SECTAM XVIII: the 18th Southeastern Conference on Theoretical and Applied Mechanics, Tuscaloosa, Alabama, April 14-16, 1996.
- Session Chair for the Space'96 Conference: the 5th International Conference on Engineering, Construction, and Operation in Space, Albuquerque, New Mexico, June 1-6, 1996.
- Member, Board of Editor and Session Co-Chair for SPACE'94 -- the 4th International Conference on Engineering, Construction, and Operation in Space, ASCE, Feb. 1994.
- Member, Board of Editor for the Proceedings of the 1st SES-ASME-ASCE Joint Meeting, June 1993.
- Co-Chair, Executive Committee, SDVNC'95: International Conference on Structural Dynamics, Vibration, Noise and Control, Hong Kong, Dec. 1995, Sponsored by Chinese Society for Vibration Engineering, American Society of Civil Engineers, American Society of Mechanical Engineers, American Institute of Aeronautics & Astronautics, etc.

PUBLICATIONS
In recent years, 81 technical papers have been published or presented at various Conferences and in the Journal of Sound and Vibration, the Journal of Vibration and Acoustics, the Journal of Aerospace Engineering, the Journal of Mechanics Research Communication, and International Journal of Modeling and Simulation.
ANTHONY K. YEBOAH  
Chairperson  
Cooperative Extension  
yeboaha@ncat.edu

Education:
- Ph.D. in Industrial Engineering, North Carolina State University, 1995.

Academic Experience:

Undergraduate Course
- AGEC 646 – Intermediate statistics; 3 credits, intermediate level topics on test of hypothesis, analysis of variance, regression and correlation.

Graduate Courses
- AGEC 705 – Advanced Statistics; 3 credits, advanced topics on analysis of variance, covariance, regression, correlation, multistage sampling and experimental design.
- AGEC 708 – Econometrics; 3 credits, application of econometric techniques to agricultural and economic problems; theory and estimation of structural parameters.
- AGEC 710 – Microeconomic Theory; 3 credits, price theory, and the theory of the firm, uncertainty and economics of information, and the decision-making units in the economy and their market relationships.
- AGEC 740 – Production Economics; 3 credits, production economics theory in a quantitative framework, technical and economic relationships.

Professional Experience
- 2003 to Present: Professor and Chairperson, Dept. of Agribusiness, Applied Economics & Agriscience Education.
- 2000 to 2003: Professor and Interim Chairperson, Dept. of Agribusiness, Applied Economics & Agriscience Education.
- 1989 to Present: Professor, Dept. of Agribusiness, Applied Economics & Agriscience Education.
- 1984 to 1989: Associate Professor, Dept. of Agribusiness, Applied Economics & Agriscience Education.
- 1980 to 1984: Assistant Professor, Dept. of Agribusiness, Applied Economics & Agriscience Education.

Selected Publications


Grants
- Peri-urban Horticultural Production in OHVN Zone of Mali: IPM CRSP ($30,000, USAID)
- Exploring Survival Issues of Minority & Small Farms in North Carolina ($140,000, USDA)
- Enhancing the Information Technology Capabilities of the School of Agriculture ($190,000, USDA)
- Enhancing the Information Technology Capabilities of the School of Agriculture ($178,000, USDA)
- Farm Information Systems ($67,650, USDA)
- Mali Farming Systems Research and Extension ($470,000, USAID)
- Record-keeping & Farm Accounting ($185,000, USDA)

Thesis Committees Chaired
Master’s Thesis Chaired (in Progress)
Title: Assessing the On-Farm Economic Profitability and Feasibility of the Integrated Pest Management Technology: The Case of Green Beans Production in Central Mali. Expected Completion Date: May 2004

Professional Affiliations
American Association of Agricultural Economics
Southern Association of Agricultural Economics
Association of Social Behavioral Scientists
Southern Rural Sociology Association
Black Farmers and Agriculturalists Association
Gamma Sigma Delta
APPENDIX E

Support Letters
DEPARTMENT OF THE ARMY
ENGINEER RESEARCH AND DEVELOPMENT CENTER, CORPS OF ENGINEERS
WATERWAYS EXPERIMENT STATION, 3909 HALLS FERRY ROAD
VICKSBURG, MISSISSIPPI 39180-6199

March 18, 2004

Executive Office

SUBJECT: Letter of Support for PhD Program in Energy and Environment

Dr. James C. Renick
Office of the Chancellor
North Carolina A&T State University
1601 East Market Street
Dowdy Administration Building
Greensboro, North Carolina 27411

Dear Dr. Renick:

It was a pleasure meeting you during my recent visit to Greensboro to sign the Partnership Agreement between North Carolina A&T State University (NCA&T) and the US Army Engineer Research and Development Center (ERDC). This was my first visit to NCA&T and I was very impressed with your research capabilities and facilities. As you are aware, this agreement extends the excellent partnership NCA&T has had with the ERDC’s Construction Engineering Research Laboratory (CERL) to all seven laboratories within the ERDC. I look forward to the continued growth of our partnership.

One of the next steps in the partnership growth, and more importantly the growth of NCA&T, is to continue our long commitment to NCA&T by supporting your University’s efforts to establish a Doctoral program in the area of Energy and the Environment. This area of research in ERDC is primarily conducted at CERL so I have asked Dr. Alan Moore, the Director of ERDC-CERL, to lead this effort. Dr. Moore can be contacted at 217-373-7202.

Sincerely,

James R. Houston, PhD
Director

Copy Furnished:
Dr. Kenneth Murray, Associate Vice Chancellor and Dean, Graduate Studies
Dr. Alan Moore, Director, ERDC-CERL

Office of Provost and
Vice Chancellor for Academic Affairs

APR 01 2004
NC A&T State University
Greensboro, N.C. 27411
April 26, 2004

Dr. Kenneth H. Murray  
Dean, Graduate Studies  
North Carolina A&T State University  
Greensboro, NC 27411

Dear Dr. Murray,

I have carefully read your final draft of the proposal for the Ph.D. program in Energy and Environmental Studies. It has matured nicely and I feel that this is an excellent opportunity and a great program.

Energy is one of the key issues at the heart of nearly all environmental issues. Energy alternatives and options are going to play a key role in our success as a society. A Ph.D. program as you have proposed will fulfill a key niche in these emerging areas. Some of your graduates will go on to productive jobs in business, government or society where this mix of skills and stature will enable them to play leadership roles. Some will also go on to careers in academia where they can continue to build on the interdisciplinary strengths that are in your program. In both areas, the existing field lacks true diversity and your program will be a huge boost to the efforts to increase the diversity of these fields.

I believe that the future of the modern university and the success of society will increasingly depend on our ability to create interdisciplinary problem-solvers. North Carolina A&T State University has an interdisciplinary focus as part of its long-term strategic plans and this program is a perfect implementation of that focus. This Ph.D. program should be good for your university, good for the field and very valuable to society. I heartily endorse the program. Please let me know how I can help in the future.

Sincerely,

Anthony Michaels
March 2, 2004

Dr. James C Renick
Chancellor
Dowdy Building
N.C. A & T State University
Greensboro NC 27411

Dear Dr. Renick:

This letter concerns the establishment of a doctoral studies program in energy and environmental issues at North Carolina A&T State University.

North Carolina A&T State University has long been a leader in the southeast in energy and environmental disciplines. It is a logical and admirable step that the University wants to establish an even higher level of educational endeavor through the development of a curriculum in this area of expertise. I commend the University for recognizing this need and for taking the initiative to create a doctoral studies program covering these issues.

The DOE Office of Energy Efficiency and Renewable Energy is charged with strengthening our nation’s energy security, environmental quality and economic vitality by building public and private partnerships that promote energy efficiency and productivity, bringing clean, reliable and affordable energy technologies to the marketplace. Establishing such a program will build a partnership between the University and the professional practitioners which will help to strengthen and empower tomorrow’s leaders in this field.

Research shows that minority institutes of higher learning in the southeastern U.S. have not focused as much of their curricula on the areas of energy and environmental studies as had been anticipated in view of our nation’s increased dependence on foreign fuel sources and the added focus on environmental concerns. North Carolina A&T State University has consistently proven to be the exception. Solutions to our energy needs and the associated environmental concerns strongly depend on future generations who are schooled in these areas which are critical to our national agenda.

I welcome the opportunity to discuss this matter further with anyone who is interested in supporting this program effort.

Sincerely,

James R. Powell
Director
Dr. James C. Renick  
Chancellor  
Dowdy Building  
North Carolina A&T State University  
Greensboro, NC 27411

Dear Dr. Renick:

I am writing to congratulate your effort to establish a doctoral studies program in energy and environmental issues at North Carolina A&T State University.

As Chair of the Advisory Board for your Center for Energy Research and Technology, I have had the privilege and opportunity to observe your University's commitment and dedication to advancing the intellectual and academic understanding of energy, environment and related disciplines. Your efforts to establish A&T as a leader and prominent contributor to the development of our future professionals in areas so important to our nation are to be commended.

For much of my professional career, I have been associated with our national energy efficiency and renewable energy programs, particularly those supported by the U. S. Department of Energy, and am a firm believer that our nation's energy security, environment quality and economic vitality depends largely on our ability to develop clean, reliable and affordable technologies. For this, we must turn to our higher education institutions with the challenge to populate our evolving workforce with fully-prepared professionals.

I am particularly excited about your plans to continue to promote strengthening timely curricula at one of our historically Black universities, thus, enhancing the demand for well-prepared graduates of your great institution. North Carolina A&T has made great strides in this regard, and this next step will only build on that success.

If desired, I would be pleased to discuss this and related matters with those interested in supporting your effort.

Sincerely,

[Signature]

Marvin E. Gunn, Jr.
Manager
April 29, 2004

Dr. Kenneth H. Murray  
Dean, Graduate Studies  
North Carolina A&T State University  
Greensboro, NC  27411

Dear Dr. Murray,

I have carefully read your final draft of the proposal for the Ph.D. program in Energy and Environmental Studies. It has matured nicely and I feel that this is an excellent opportunity and a great program.

Energy is one of the key issues at the heart of nearly all environmental issues. Energy alternatives and options are going to play a key role in our success as a society. A Ph.D. program as you have proposed will fulfill a key niche in these emerging areas. Some of your graduates will go on to productive jobs in business, government or society where this mix of skills and stature will enable them to play leadership roles. Some will also go on to careers in academia where they can continue to build on the interdisciplinary strengths that are in your program. In both areas, the existing field lacks true diversity and your program will be a huge boost to the efforts to increase the diversity of these fields.

I believe that the future of the modern university and the success of society will increasingly depend on our ability to create interdisciplinary problem-solvers. North Carolina A&T State University has an interdisciplinary focus as part of its long-term strategic plans and this program is a perfect implementation of that focus. This Ph.D. program should be good for your university, good for the field and very valuable to society. I heartily endorse the program. Please let me know how I can help in the future.

Sincerely,

Anthony Michaels

University of Southern California  
Los Angeles, California  90089-0371  
Tel: 213 740 6780  
Fax: 213 740 6720  
e-mail: tony@usc.edu  
web page: wrigley.usc.edu
APPENDIX F

Annual Assessment Process
Overview of the Annual Assessment and Program Evaluation Review

Assessment is a process that provides a “culture of evidence” that can be used to determine if the mission and goals of the university are being met” (Wolf, 1990). According to Erwin (1998:15), assessment is the process of defining, selecting, designing, collecting, analyzing, interpreting, and using information to increase students’ learning and developing”. The purpose of the assessment process is to provide information to drive systematic program improvement.

With the above guidance, there are four primary purposes for conducting assessment and program review at North Carolina Agricultural and Technical State University (NCA&TSU):

- NC A&T State University is committed to excellence in all its programs and activities as it addresses the educational needs and expectations of its stakeholders.

- The Institutional Assessment plan is required by the new “accountability” legislation that mandates annual assessment of student learning and development, faculty development and quality, and progress towards the University’s mission.

- Our regional accrediting agency, the Southern Association of Colleges and Schools (SACS), requires institutions to conduct “systematic, broad-based planning and evaluation activities.” Furthermore, we are required by SACS to develop educational goals, identify strategies to accomplish these goals, and design and implement procedures to evaluate the extent to which these goals are being achieved. This evaluation “must include educational goals at all academic levels (undergraduate and graduate).” The institution must define its expected educational results and describe its methods for analyzing the results (SACS, 1998). The institution is expected to use the results of these goals to improve educational programs, operations, and services.

- Stakeholders expect NCA&TSU to maintain quality and accountability. State government, taxpayers, students, parents, businesses and industries all contribute to the financing of higher education. Therefore, these stakeholders expect value and quality for their support (Smith and Bradley, 1995), organizational processes, structures, policies, and practices. Continuous improvement is an outcome of assessing our institutional effectiveness.

- Institutional effectiveness clearly allows the university to describe the various organizational processes, structures, policies and practices. Continuous quality improvement is an outcome of assessing our institutional effectiveness. A&T’s effectiveness as an institution is measured by the extent to which it accomplishes its mission, goals and objectives.

Therefore, one measure of institutional effectiveness is the systematic assessment and evaluation of academic programs. Findings from this process are used for continuous program improvement.

Assessment measures include both direct and indirect methods. Direct methods of learning require students to demonstrate their knowledge and skills in response to a designated instrument. Examples include objective tests, essays, presentations, classroom assignments, and standardized exams. Assessment measures are also comprised of locally developed tests or commercially developed instruments as well as a mixture of both. Locally developed instruments are those constructed by faculty. Commercially developed tests are produced and distributed by testing companies and services. Some examples of assessment measures are:

- comprehensive exams and other tests
- laboratory exercises
- experiments
- laboratory skills assessment
• senior projects or theses or performances for undergraduate programs
• portfolios
• annual review of students, especially graduate students
• exit interviews, alumni surveys, graduate surveys, graduating surveys
• results of licensing exams
• rates of graduate school enrollment for undergraduate students
• external awards and competitions
• student publishing records
• case studies
• student satisfaction levels
• job placement

Effective assessment is comprised of multiple measures of both quantitative and qualitative methodologies. Faculty determine the types of assessment measurements based on the expected outcomes of student learning at various points of the college experience (e.g., entering students, continuing students in majors, withdrawing students, graduating students, alumni, and employers who hire graduates). Outcomes for these various time points can be measured for basic skills, general education, major field of study, and student experiences.

**Basic Steps in Developing an Assessment Plan**

To be effective, an assessment plan should include the following important steps:

- Assessment should flow from the mission statement and should be an ongoing process, which is integrated into the academic program.

- Faculty should decide which student learning goals and outcomes will be assessed and at what point in the college experience.

- Institutional data should be identified that can assist with measuring outcomes.

- Assessment should use multiple measures including both quantitative and qualitative methods.

- A time line for the implementation of the assessment plan should be developed.

- The results of assessment activities should lead to program improvement.

- Procedures for improvement and continued evaluation based on assessment results should be developed and implemented.

- The assessment plan should include evaluation, revision of the plan based on findings, and the budgeting of funds for continuous evaluation and program improvement. Effective program evaluation allows for a continuous feedback loop so that data can be used to identify program strengths and weaknesses as well as make program changes.

- Assessment results should be reported to various sources, e.g., university administration, external funding agencies (as indicated), and legislators, Office of the President).

A successful assessment program requires faculty ownership, responsibility, and accountability since faculty members are directly involved in the student learning.
Outline for Annual Assessment and Program Evaluation Reports

I. Brief Overview of Department and Program(s)

II. Strategic Plan, [This should be included for the department where the program(s) being assessed and evaluated reside(s)].
   A. Vision
   B. Mission
   C. Goals/Objectives (include the information below for each goal/objective)
      1. Outcomes Achieved/Results for Each Goal
      2. Assessment Measurements (qualitative or quantitative measures e.g., surveys, retention data, questionnaires, etc.
      3. Assessment Procedures (describe the procedures for using the assessment measurements to collect data or information required)
      4. Administration of Assessment Procedures (Who is responsible for conducting or administering assessment procedures?)
      5. How findings from assessments are used to improve the program (describe how findings will be/were used for program improvement, e.g., curriculum revision, enrollment management, budget planning, etc.)

III. Briefly describe how the program’s/department’s strategic plan is related to the college’s/school’s mission goals and strategic plan as well as the University’s mission and goals.
   A. Student Profile (data for past three-five years including the current academic year)
      1. Admission Requirements (SAT scores and high school GPA). If the program does not have an admission requirement, include the average SAT and high school GPA.
      2. Total enrollment in department and program(s)
      3. Number of majors in honor program
      4. Number of transfers (average admission GPA)
      5. Progression requirement (if applicable)
      6. Enrollment in degree credit distance learning
   B. General Education
      1. Freshmen performance data (e.g., proficiency exams, placement exams)
      2. Other measures or indicators
C. Academic Major/Program (past three years)
   1. Results of any licensure examinations (for a three-year period)
   2. Accreditation reviews
   3. Internal program reviews (outside consultants)
   4. Retention and graduation rates
   5. Graduates (alumni surveys)
   6. Continuing education and employment
   7. Results of employer surveys (if available)
   8. Evaluation of student experiences

IV. Faculty Development and Quality
   A. Faculty personnel policies regarding appointment, promotion, tenure and merit salary increases on basis of:
      1. (Learning) Teaching-evaluation of instructors and instruction (summary of annual reports)
      2. (Discovery) Research and scholarly productivity and creative activities
      3. (Engagement)- Service activities
   B. Faculty profile – distributed by:
      1. Highest degree earned
      2. Rank and tenure
      3. Age ranges (do not include faculty names)
      4. Sex
      5. Race

V. Student Learning Outcomes
   A. Student Learning Outcomes
      1. List student learning outcomes for the program scheduled for review. Each program should identify the competencies e.g., knowledge, skills or behaviors expected of graduates of the program, which is determined by an awareness of who the students are and what you expect them be able to do when they graduate (Form A).
      2. List any other program goals not included in the strategic plan. Program goals could include job placement, enrollment in graduate school, success on licensure examinations, employment skills, etc. (Form A)
      3. List evaluation methods (qualitative and quantitative assessment measures). List them as locally developed measures (faculty made tests, presentations, portfolios, etc.) Form B or commercially developed measures (tests, surveys, etc.) Form C.
4. Findings from assessment measures for student learning outcomes and program goals. Describe the findings or results of assessment measurements (Form D).

5. Describe changes made to improve the program as a result of assessing student learning outcomes and program goals, e.g., curriculum, etc. Describe the process for making changes, e.g., who was involved in the decision making process and how decisions were made. (Form D)

VI. Progress Toward University’s Mission

A. Access (past three years)
   1. Enrollment patterns and trends – undergraduate and graduate students, where applicable (age, sex, race)
   2. Enrollment of undergraduate transfers
   3. Enrollment in degree credit distance learning
   4. Awarding of degrees (past three years)
   5. Degrees by division or level

B. Faculty Development (description of these activities over a three-year period)
   1. Discovery (Organized research)
      a. Number of applications
      b. Number of awards or grants and total amount
   2. Engagement (Public and community service)
      a. Number and value of grants and contracts
      b. Community service activities
   3. Other scholarly and creative activities (publications, presentations, portfolios, exhibits, performances, etc.)

C. Interdisciplinary Activities

VI. Analysis and Summary of Data

A. Identify trends (Opportunities and Threats)
B. Discuss strengths of the department/program(s)
C. Discuss challenges and potential solutions
D. Discuss your analysis of the 3-5 years enrollment trends in your department/program
E. Discuss the analysis of retention trends in your department/program

12/02; 5/03; 11/03; JGB
Form A

North Carolina A&T State University

Assessment of Student Learning Outcomes

College/School/Department

_______________________________________

Program/Degree Level

Assessment Period

Date Submitted

I. Program-Level Student Learning Outcomes

Please use this form to list the student learning outcomes for all programs in your department/school. Use a separate form for each program; and you may have fewer or more outcomes than space is allotted. If needed, make copies of this form.

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Other Programs Outcome Goals such as job placement, graduate school enrollment, success on licensing exams; development of workplace skills such as dependability, initiative, leadership, group-working skills; commitment to citizenship; program satisfaction and job satisfaction; persistence and time to degree, etc. Be specific, e.g. “At least ¼ of each graduating class will apply to graduate school.”

Adapted from GMU 2002; Revised 5/03, 11/03
Form B

North Carolina A&T State University

Department/School ____________________________________________

Degree Program ______________________________________________

Assessment Period_____________________________________________

Date Submitted________________________________________________

II. Evaluation Methods

_In each row, please list methods (measurements) used to assess each student learning outcome. Put the outcome number(s) in parenthesis beside each corresponding measurement._

<table>
<thead>
<tr>
<th>Commercially (Standardized) Available Tests/Surveys</th>
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Adapted from GMU 2002; Revised 5/03; 11/03
Form C

North Carolina A&T State University

II. Evaluation Methods

College/School/Department

<table>
<thead>
<tr>
<th>Program/Degree Level</th>
<th>Assessment Period</th>
<th>Date Submitted</th>
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List methods/measurements (qualitative and/or quantitative) used to assess student-learning outcomes. Put the corresponding outcome number(s) in parenthesis beside each corresponding measurement.

<table>
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<th>Locally Developed Methods</th>
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Adapted from GMU 2002; Revised 5/03; 11/03
III. Major Findings/Assessment Data Collected and Use of Results to Improve the Instructional Program

Please list the major findings/assessment data collected for each student-learning outcome (use the number of each outcome listed on Form A). Describe how results were used to improve the program; identify the decision-making process and persons/groups/committees involved.

<table>
<thead>
<tr>
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<th>a. Major Findings/Results</th>
<th>b. Decision-making Process (groups/committees)</th>
<th>c. Describe how results were used to improve/change the program</th>
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Adapted from GMU 2002; Revised 5/03; 11/03
Appendix G

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK
### Program Information

**INSTITUTION**: North Carolina A&T State University  
**DATE**: May 2004  
**Program (API #, Name, Level)**: 30.9999 Energy and Environmental Studies (Interdisciplinary)  
**Degree(s) to be Granted**: Doctor of Philosophy  
**Program Year**: 2005-2006

### ADDITIONAL FUNDS REQUIRED - BY SOURCE

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**151 Libraries**

**TOTAL ADDITIONAL COSTS . . .** $267,094

**NOTE**: Accounts may be added or deleted as required.
### SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

**INSTITUTION:** North Carolina A&T State University  
**Program (API #, Name, Level):** 30.9999 Energy and Environmental Studies (Interdisciplinary)  
**Degree(s) to be Granted:** Doctor of Philosophy  
**DATE:** May 2004  
**Program Year:** 2006-2007

#### ADDITIONAL FUNDS REQUIRED - BY SOURCE

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### SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

**INSTITUTION**: North Carolina A&T State University  
**Program (API #, Name, Level)**: 30.9999 Energy and Environmental Studies (Interdisciplinary)  
**Degree(s) to be Granted**: Doctor of Philosophy  
**Program Year**: 2007-2008  
**DATE**: May 2004

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APPENDIX H

Consultant Report
Review of Plan to Establish a Doctor of Philosophy Degree in Energy and Environmental Studies
North Carolina Agricultural & Technical State University

C. Russell Philbrick
Professor of Electrical Engineering
Chairman Graduate Committee
Department of Electrical Engineering
Penn State University
University Park, PA 16802

1. SUMMARY

A program has been proposed for a new doctoral degree in the interdisciplinary area “Energy and Environmental Studies” at North Carolina Agricultural & Technical State University. The degree will provide the breadth from interdisciplinary areas to prepare the doctoral candidate to address the problems related to the energy resources required to meet our society’s energy demands, and the corresponding issues of pollution.

The proposed program should result in the most significant new program for the university during this decade. The plan to institute the doctoral program in Energy and Environmental Studies is most timely and appropriate. The single most important need in our society today is rooted in the requirements for energy resources to sustain social development while eliminating, or at least minimizing, the pollution sources associated with energy production. Every rational person recognizes the fact that we cannot long continue our dependence on anthropogenic energy sources, because of limited resources and their associated environmental consequences. In the near term, we must develop and improve the utilization of nuclear and alternative sources of energy, reduce pollution byproducts, and improve our energy efficiency. In the long term, we must develop new technologies to provide energy for future generations. The longer term solutions, such as development of fusion reactors, improved collection of solar energy, and major improvements in our efficient use of energy, should eventually minimize our dependence on anthropogenic fuels and nuclear fission reactors. This grand goal can only be achieved through our devoted attention to the struggles required in developing the technologies, creating the economic models, preparing the regulatory framework to transition future systems, and implementing the business models for distributing energy resources during the coming decades. The proposed degree provides an opportunity to prepare men and women with the advanced level of education to lead our society in solving these multifaceted problems. The intellectual pursuits of students, faculty and graduates will contribute to developing the environmentally sound solutions for the energy needs of our society. The proposed program should be adopted and supported to the fullest extent possible because of its potential payoff for our future.

The reasons that I am pleased have the opportunity to comment and to provide my strongest recommendation for support of this program are based on a career of studying the physical and chemical processes of the atmosphere. I have been astounded by the many ways
that mankind has actually caused changes in the properties of our atmosphere on a global scale. We have embarked, unwittingly and without understanding the consequences, upon a gigantic experiment to modify the atmosphere and our planet — we must prepare ourselves to deal with all of the associated problems and work diligently to find solutions to prevent major disasters for humankind. I have devoted much of my research efforts during the past ten years to develop new tools for measuring atmospheric properties and using them to investigate the processes controlling air pollution episodes. I believe that the university must provide the central role for addressing the problems and providing future solutions. During the past twelve years, I have served on the Graduate Committee of the Department of Electrical Engineering and have lead that activity as Chairman during the past four years. My university experiences have provided some insights into the operations of at least one graduate program, and these along with my research related concerns for the environment are the basis for the following concerns and suggestions.

2. CRITIQUE

The ENEV proposed degree holds much promise for the future training of students to take on the challenges that lay ahead. The proposed plan has been thoughtfully prepared and it should answer one of the most urgent needs of our society today. The several items suggested and described below are intended to contribute and strengthen the plan.

(1) The idea of requiring a set of core courses that focus on the major interdisciplinary topics should provide the important amount of breadth for the area. However, it is most important that the students also develop their specialization discipline to be able to stand at the forefront of the current knowledge in that topic. So, we must be sure that the students program does not become a wide scatter of introductory level courses, but contains a set of several sequential courses that fully develop a topic and lead the student to the state-of-the-art in that area. It would be most helpful if several examples of sets of graduate courses and sequences that lead to specializations could be provided as examples for the students to consider in the future. It is the next step taken by the student from that vantage point that can result in the discoveries and/or ideas which expand our knowledge.

(2) This degree program should result in a major opportunity for the university to develop a new avenue for communications and possible research collaborations, across traditional boundaries between departments in the university. The suggestion of having the doctoral committee composed of three faculty from the specialization and two faculty from other disciplines should provide the depth and the breadth that would most benefit the student’s program, and also will result in developing the interdisciplinary ties among the faculty. So many of the major advances today, and particularly tomorrow, are the result of synthesis of ideas that come from diverse areas.

(3) One concern that should be considered is how to attract really high caliber students, particularly those strong in science and engineering, into this program during the first few years. Special efforts should be given to recruitment of exceptionally capable students during the first few years, and this effort will lead to self perpetuation in future years. The recruitment during
the initial years would be an especially astute place to provide additional recruitment incentives, such as $5,000 fellowships added to GRA/TA offers.

(4) Three topics related to the core course group should be further considered in the following context:

(a) The order of the course listing should probably begin with the two courses that provide the technical fundamentals. These should be listed first and taken early in the student’s program (so the course numbers ENEV 840 and 850 should exchange with the ENEV 810 and 820). It will be much more meaningful for the student to consider the legal and economic significance of energy and environment decisions after the technical issues are understood.

(b) The courses described do not appear to include analysis of the current energy sources, their associated costs, and concerns for their various pollution contributions. The energy content, efficiency, reserves, current use rate, etc. should be examined for each type of current and developing energy resource. In particular, the gas, oil, coal and nuclear sources for energy should be examined. Several very useful government publications from the NSF, NRC and others provide results from recent scientific studies and should be included for the students’ examination of these topics.

(c) The proposed course ENEV830 does not seem to warrant inclusion as a PhD level course. Usually the topics of data acquisition and management are considered to be relegated to undergraduate training. It just does not seem to merit the same status as the other proposed courses.

(5) While the examination of traditional energy resources (gas, oil, coal), the development of alternative energy sources (nuclear, hydro and wind), and the investigation of emerging technologies (fuel cells, hydrogen) will capture most attention, we must invest more in the distant future. To prepare for the following generation, we must develop plans for energy and for the environment that extend more than a few decades into the future. One of the future hopes for a long-term, efficient, and low polluting energy supply is the development of controlled fusion reactors. This type of longer vision is so important in the university program and it does not appear in the present plan. Even though the opportunity for using this technology is probably two decades away, or longer, it does merit high priority consideration as a future energy source for planet Earth.

### 3. RECOMMENDATIONS

The topics that have been brought together in the interdisciplinary ENEV doctoral program proposed represent one of the most fundamental needs for our future. The efforts begun here should be most vigorously pursued to carry through the plan for offering a doctoral degree which enables the best and brightest young minds to confront the problems resulting from the demand for energy and the associated consequences. Because of the importance of this undertaking, and the overall potential benefit for the region and the nation, the administration and governing officers of the university should be encouraged to petition the state for a significant funding increment to carry through an even more ambitions plan than that proposed here for developing this doctoral program. It is usually easier to argue to squeeze a new program
into existence by adjusting a few resources here and there, however the importance of the present undertaking warrants a bolder approach. Additional resources could bring a few highly qualified faculty to augment important areas, resulting in a nationally recognized program with eminently qualified graduates within a shorter time period. This proposed program is worthy of the efforts to seek major new resources to develop the program. It is recommended that the university administration actively pursue new resources to rapidly develop an even more ambitious program than that envisioned in this document. The university alumni should be asked to help attract and support the brightest students with added fellowship contributions.

The importance of identifying and coalescing the faculty members who can best support this interdisciplinary degree should be a high priority. The faculty should become drawn into the process and committed to the plan. The benefits in becoming part of the program should come from sharing in developing both programmatic and technical ideas, and these aspects should be encouraged. A combination of faculty program development meetings and a technical seminar series would help foster the proposed development.

The opportunities to develop positive relationships between energy production companies and environmentally concerned groups can be facilitated by the university. The access to the North Carolina energy companies, the N.C. Department of Environmental Protection, and the national laboratories of the US Environmental Protection Agency should be actively pursued. The intellectual environment of the university is the best place to develop the forum for exchanging ideas and exploring solutions for near term problems. The fact that the national EPA laboratories are located so near should be a great advantage, and a mutually beneficial relationship should be pursued.

As part of the activities to refine and define the program details, some efforts should be made to identify selected courses and sequences of courses that could be used to describe specializations within the broader area of the ENEV program. Also the laboratories listed as part of the university should be examined and a few identified as having a key relationship to the ENEV program.
C. RUSSELL PHILBRICK  
Professor of Electrical Engineering,  
Director of PSU Lidar Laboratory, Senior Scientist of Applied Research Laboratory  
Department of Electrical Engineering  
315 Electrical Engineering East  
University Park PA 16802  
814-865-2975 (crp3@psu.edu)  

EDUCATION  B.S. (1962), M.S. (1964) and Ph.D. (1966) - Physics  
North Carolina State University, Raleigh, NC  

PROFESSIONAL EXPERIENCE  
1988-Present Professor of Electrical Engineering, Pennsylvania State University, University Park, PA,  
Remote Sensing Department Head (1993-1998), Senior Scientist at the Applied Research Laboratory, and Communications and Space Sciences Laboratory  
1978-1988 Supervisory Physicist - Air Force Geophysics Laboratory, Hanscom AFB, MA  
1969-1978 Research Physicist - Air Force Cambridge Research Laboratory (now AFRL)  

TECHNICAL ACTIVITIES AND RESPONSIBILITIES  
1988-Present Professor of Electrical Engineering, lecture courses include optical engineering, remote sensing, electro-optics, space physics, upper atmosphere/ ionosphere physics. Applied Research Laboratory Senior Scientist for optical communications, EO applications, development of lidar techniques. Four lidar systems have been developed at PSU with staff and students and they are used by graduate students for many investigations and thesis topics. PI for the NARSTO-NE-OPS investigations to study the processes controlling the evolution of air pollution episodes in the eastern US during the period 1998-2003. Established a field site in Philadelphia that was used as the primary location for the investigations of the urban and transported air pollution sources in the eastern US corridor. The efforts have included preparation of the first operational prototype lidar instrument, which was demonstrated for the Navy on the USNS Sumner in 1996. The PSU lidar instruments have been used for shipboard measurements of the marine environment, for arctic and antarctic atmospheric investigations, and for studies of air pollution episodes in Los Angeles and Philadelphia. The investigations have included LAtitudinal DIstribution of Middle Atmospheric Structure (LADIMAS) from Arctic to Antarctic on the RV Polarstern, September 1991-January 1992; Resent research activities have focused on investigations of air quality using lidar techniques. Educational accomplishments include guiding approximately 50 graduate theses and 15 honors theses, development of graduate and advanced undergraduate courses in areas of remote sensing, optical engineering, laser remote sensing and space physics. Chairman of the Graduate Committee of the Electrical Engineering Department, 2000-present. Adjunct Professor in Department of Marine, Earth and Atmospheric Sciences, NC State University, 1998-present.  
1978-88 Program Scientist responsible for all aspects of development of lidar capabilities for atmospheric sounding at AF Geophysics Laboratory. The effort included the development and field testing of two advanced lidar sounders. The capability of lidar to replace the DoD Meteorological Rocket Network for atmospheric data between 10 and 80 km was demonstrated. Served as Technical Advisor for AF program office for development of the ADS system for remote detection of chemical agents. Served on committees that prepared the Air Force Roadmap for Chemical Agent Detection and the Tri-Service Plan for Chemical Agent Detection.  
1976-84 PI for development of a high spatial resolution accelerometer for atmospheric investigations. The instrument provided the most detail measurements to date on gravity waves, atmospheric structure and dynamical properties. Measurements were obtained in several international
scientific investigations and during testing for the atmospheric effects on ballistic reentry vehicles. Techniques were prepared and demonstrated to permit validation of reentry vehicles and a model was prepared for the atmospheric conditions at Kwajalein Missile Range.

1966-78 PI for a series of eight satellite mass spectrometer experiment investigations of the composition and structure properties of the upper atmosphere and ionosphere which are important basis for several atmospheric and ionospheric models. Program scientist for preparation and overall coordination of two scientific research satellites. PI for the ALADDIN series and several others of the major rocket investigations of the middle atmosphere properties and processes.

1966-75 PI for development of liquid nitrogen and liquid helium cryo-pumped mass spectrometers (NACS) for the first direct measurements of mesosphere composition on rocket payloads between 60 and 140 km and responsible for several major international rocket payload investigations and model development for the middle atmosphere.

EXAMPLES OF RECENT PAPERS (during the past three years)


