THE UNIVERSITY OF NORTH CAROLINA
Request for Authorization to Establish a New Degree Program

Date: April 19, 2004

Constituent Institution: North Carolina A&T State University
    CIP Discipline Specialty Title: Computational Science and Engineering (Interdisciplinary)
    CIP Discipline Specialty Number: 14.9999 Level: B_____ M **XX** 1st Prof _____D_____
    Exact Title of the Proposed Degree: ___Computational Science and Engineering_____
    Exact Degree Abbreviation (e.g. B.S., B.A., M.A., M.S., Ed.D., Ph.D.): M.S._____
    Does the 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 (allow at least 3-6 months for proposal review):
    month _**August**____ *year*_____**2004**
    Do you plan to offer the proposed program away from campus *during the first year of operation*?
    Yes _____ No **X**____
    If so, complete the form to be used to request establishment of a distance education program and submit it along with this request. **N/A**

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 2004** _____

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

Chancellor: _____

I.   Description of the Program

A. Describe the proposed degree program (i.e., its nature, scope, and intended audience).
B. List the educational objectives of the program.
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.

A. Proposed Degree Program

North Carolina Agricultural and Technical State University (NCA&T) proposes to establish a master's degree program in Computational Science and Engineering (CSE). The proposed program will be highly interdisciplinary, drawing expertise and resources from various disciplines across the University, and operating outside a department. It will offer an interdisciplinary curriculum combining applied mathematics, high performance parallel and scalable computing, scientific modeling and simulation, data visualization, and domain areas such as physical science and engineering, life sciences, agricultural and environmental sciences, technology and business. The aim of this program is for students to (a) master high performance computer programming tools as well as data acquisition and processing techniques; (b) acquire computational modeling, simulation and visualization skills; (c) relate acquired computational science and engineering knowledge and skills to specific application fields of science, engineering, technology and business; and (d) learn to develop novel and robust computational tools and methods to solve scientific, engineering, technological or business problems. Graduates of this program will be highly versatile computational scientists, engineers, technologists or business executives with a good understanding of the connections among various disciplines, and capable of interacting and collaborating effectively with scientists, engineers and other professionals in other fields.

The proposed MS degree program in CSE builds upon the current University's curricular strength and research capability in science, engineering, mathematics, technology, and business. It is a result of interdisciplinary collaboration among the College of Arts and Sciences, College of Engineering, School of Agriculture and Environmental Sciences, School of Business and Economics, and the School of Technology. It will enhance and supplement current graduate research and education programs in science, engineering, mathematics, technology and business, and further the fertilizing and nurturing of cross-disciplinary interaction and collaboration in CSE among faculty and graduate students. As the first stand-alone CSE graduate degree program in the State of North Carolina and among HBCUs in the nation, the proposed program will increase the eminence of North Carolina A&T State University in this keen technological area.

The proposed graduate degree program in computational science and engineering is an inter-disciplinary Master of Science program, involving the College of Arts and Sciences, College of Engineering, School of Agriculture and Environmental Sciences, School of Business and Economics, and the School of Technology. This CSE master's program would have three tracks with a focus on computational science, but distinguish across the domain areas of specialization. The three tracks with a common curriculum in their core courses will account for the variations in computational science field requirements across the several domains. The proposed tracks are interdisciplinary in nature, and are primarily based on the variations in the background and training in the computational areas between the undergraduate domains. These are not grouped to conform to the individual colleges/schools these domain areas come under.

Computational Science and Engineering

This track is designed primarily for students with undergraduate degrees in engineering, physics, mathematics, and computer science who will be trained to develop problem-solving methodologies and computational tools as well as interdisciplinary technical expertise in CSE for solving challenging problems in physical science, engineering, applied mathematics or computer science. This includes domains that are both in the College of Engineering, and the College of Arts and Sciences. The curriculum will emphasize computational sciences and engineering along with training in the domain areas. The goal of this track is to produce scientists, and engineers with focus, training and application in computational sciences, scalable computing, physics-based modeling and simulations, and with expertise in the application of computational techniques and principles in their primary domain areas. Qualified undergraduate students can be admitted to this stream if they also meet the admission criteria of their major domain field. Based on their undergraduate degrees, the students in this track would have had an increased level of prior training, courses and exposure in mathematics including numerical analysis and programming languages. Students with undergraduate degrees in other science and technology areas may also be admitted, if they meet the admission and course requirements, including pre-requisites for the domain department. The areas of specialization will include, but will not be limited to, computational quantum chemistry, computational nuclear and high energy physics, computational solid or fluid dynamics, computational material science, bioengineering, engineering design and automation, applied and environmental geophysics, computational seismology, nonlinear computational mechanics, super fast algorithms for numerical and algebraic computation, and distributed and high performance computing.

Computational Sciences

This track is designed primarily for students with undergraduate degrees in chemistry, biology, business, and agricultural sciences who will be trained to apply or extend computational tools and methods as well as data acquisition, processing and visualization techniques to study computationally intensive problems in life sciences, agricultural and environmental sciences, and business and economics. This track primarily includes domain areas with lesser training in mathematics including numerical analysis, programming languages and focuses on domains with non-deterministic models. The domains in this track are from the College of Arts and Sciences, the School of Agriculture and Environmental Sciences, and the School of Business and Economics. The goal of this track is to produce biological and life scientists, business professionals and economists, and agricultural scientists with focus and expertise in computational sciences and the primary domain areas. Qualified undergraduate students can be admitted to this stream if they also meet the admission criteria of the major domain area. Based on their undergraduate field, the students in this track would be required to take additional mathematics and programming focused courses. Students with undergraduate degrees in other science, engineering and technology areas may also be admitted if they meet the admission and course requirements, including pre-requisites for the domain department. The areas of specialization will include, but will not be limited to, bioinformatics, computational genomics, computational physical chemistry, computational biochemistry, and computational finance.

Computational Technology

This track is designed primarily for students with undergraduate degrees in technology disciplines with focus on computational science and engineering. These technology disciplines currently include computation technology, computer numerical control machining, remote sensing, GIS/GPS data analysis, and nanotechnology with additional potential disciplines in the future. The goal of this track is to produce

technologists with a focus and training in computational sciences, and in their primary technology domain area. Students with undergraduate degrees in engineering, mathematics, physics and computer science may also be admitted and must meet the course and curriculum requirements in technology.

B. Educational Objectives of the Program

The educational objectives of the proposed program are as follows:

- Educate and graduate students with a mastery of high performance computer programming tools as well as processing, data acquisition, analysis techniques
- Acquire, educate and train in computational modeling, simulation and visualization.
- Relate acquired computational science and engineering knowledge and skills to specific application fields of engineering, science, technology and business.
- Learn to develop novel and robust computational methods and tools to solve scientific, engineering, technological and business problems.
- Educate and produce highly versatile computational scientists, engineers, technologists, or business executives with a good understanding of the connections among various disciplines and capable of interacting and collaborating effectively with scientists, engineers, and professional in other fields.
- Increase the number of graduate professionals available to work in computational science and engineering.
- Increase the diversity of graduate professional especially underrepresented minority and African Americans available to work in computational science and engineering area.
- Assist the State of North Carolina and the nation to increase the pool of graduates with training and experience in computational science and engineering, interdisciplinary applications and research.

C. Relationship to Other Programs

Several academic disciplines are related to the proposed interdisciplinary graduate M.S. program in computational science and engineering. CSE is an interdisciplinary program drawing courses, research, faculty and students from two colleges - Arts and Sciences, and Engineering, and three schools - Agriculture and Environmental Sciences, Business and Economics, and Technology. The program will be supported by the current and emerging strengths in the computational areas of science, engineering, and technology, including infrastructure developments in high performance, scalable computing, and large-scale modeling and simulations. Several faculty and funded research projects exist in the areas of computational sciences and engineering. These will provide the research expertise and infrastructure that enhance the computational science and engineering programs. Computational techniques have already become an integral part of scientific discovery processing and engineering design in addition to experimental and analytical techniques. The demand for computational scientists, engineers and technologists in several critical areas of national interest is continually increasing. The proposed graduate master's program will help meet the increased human resource needs in several areas of computational sciences, engineering and technology. The program will educate, train and graduate under-represented professionals in computational science and engineering, especially African Americans. The proposed program will capitalize on the existing and emerging research strengths in computational science and engineering; and dovetail the FUTURES initiative with a focus on computational science and engineering to increase the eminence of North Carolina A&T State University in this keen technological area.

(1) Courses

Courses for the proposed CSE degree program will build upon existing master's degree programs in the sciences, engineering, mathematics, technology, and business, and will address the goals and objectives of the proposed program. Many of the disciplines and degree programs on campus have in place courses that support the proposed CSE master's degree. For example, numerical linear algebra, numerical PDEs, scientific visualization, distributed and high performance parallel computing, computer organization and scientific programming, data structure, software tools, and computational science and engineering courses already exist in applied mathematics, computer science, physics, biology and mechanical engineering master's programs. Selected existing courses will be used or modified as core courses and others as interdisciplinary or domain elective courses for the program. A few new courses including several core courses for computational sciences and computational technology as well as a couple of bridge courses will be developed for the program. A listing of these courses will be included in the Implementation Proposal.

(2) Faculty

The CSE affiliated faculty of North Carolina Agricultural and Technical State University are active professionally, respected, and talented. Many have published research in respected journals or referred conference proceedings and have ongoing sponsored research projects in the areas of computational sciences and engineering. All faculty involved in the proposed CSE master's program have strong records in research, publications and student research supervision. The Colleges of Arts and Sciences and Engineering have already hired three CSE faculty in mathematics, computer science and mechanical engineering, and the departments of mathematics and chemistry have recently advertised to fill up two positions in computational biomathematics and computational chemistry, respectively. Additionally, through enrollment growth funding the University will commit to the strategic hiring of additional new CSE faculty to strengthen this proposed program. Considering the current faculty, and the anticipated infusion of new faculty with appropriate expertise in computational science and engineering, NC A&T has the necessary faculty expertise and intellectual underpinnings for a respected interdisciplinary CSE master's program.

(3) List of facilities and location

The facilities needed for this program are mainly faculty and student offices, computer labs and high performance parallel and scalable computing facilities, all of which are reasonably available on campus. Additional office space needs due to the growth of student population and the addition of faculty will be provided by the University through its building plan via the bond program.

University-wide computing equipment and software purchase and/or upgrade costs are covered by state appropriation and student fees. College, school and department level computing facilities are normally set up and maintained through external grants. The five participating colleges/schools and almost all science, engineering, mathematics, technology and business departments all have their own computer laboratories for undergraduate and graduate education and research and have network access to the University, and state-wide computing facilities. All computers are linked using Ethernet running TCP/IP. In addition, faculty have networked personal computers running Windows 2000/XP and/or Linux, Sun, IBM, or SGI Workstations for research and instruction needs. In addition, there are a large variety of software systems and tools available on various platforms such as main frame UNIX, DEC SGI or SUN file servers or workstations, and PCs operated and maintained by the University's Information Technology & Telecommunications (IIT). All campus buildings currently are fully wired with 10/100 Mb/s coaxial or 1 Gb/s fiber optic network. The University has 22 personal computer laboratories in 12 buildings across the campus, which is wired to the Internet and is for student use. ITT provides client services, systems and software networking and instructional and research computing services to the University. All of these

computing facilities provide the basis on which to integrate scientific computation with graduate instructional and research programs in science, engineering, and technology.

The following research and high performance computing facilities offer additional resources to the infrastructure of the proposed CSE program.

- Engineering Computer Center-McNair Hall
- Arts and Sciences Computational Science Laboratory-Marteena Hall
- 18-node 36-processor IBM Linux cluster-Fort IRC
- 32-processor SGI 3900 shared memory system-Fort IRC
- Center for Composite Materials Research-Fort IRC
- Center for Advanced Materials and Smart Structures-Fort IRC
- Institute for Human-Machine Studies-McNair Hall
- Center for Autonomous Control and Information Technology-Fort IRC
- National Institute of Aerospace-Fort IRC
- Center for Electronics Manufacturing-Smith Hall
- Geographic Information System Laboratories-Sockwell Hall and Carver Hall
- Applied Geophysical Science Laboratories-Wendover Building
- Physical Laser Laboratory-Fort IRC
- Scientific and Visualization Laboratory (proposed)
- Virtual and Immersive Visualization Center (proposed)
- UNC-GA computational engineering and Science education and research initiative (proposed)

Finally, the costs for additional library holdings will also be absorbed by the five participating college/school library purchase allowances. The NCA&T library resources accessible to graduate students exceed 600,000 volumes. The current holdings include more than 390,000 bound volumes, 2,000 serial subscriptions, and, as a selected depository in North Carolina for United State government documents, the library contains a collection of over 211,800 official government publications. In addition, the library contains a superior collection in videotapes, microfilms and other audiovisuals. Graduate students can also check out books or obtain copies of articles from other University of North Carolina System libraries through interlibrary loan. Individual research groups can purchase additional reference books and subscribe to professional journals through their external funding, and personal subscriptions.

(4) Other resources

The program capitalizes on its collaborative relationships with university partners, such as DOD and DOE national labs, NASA research centers, the high performance computing industry including IBM, Cray, SGI, and Sun Microsystems, and the National Center for Supercomputing Applications.

II.   Justification for the Program

A. Describe the proposed program as it relates to:

1. the institutional mission and strategic plan
2. student demand
0. societal need (For graduate, first professional, and baccalaureate professional programs, cite manpower needs in North Carolina and elsewhere.)
4. impact on existing undergraduate and/or graduate academic programs of your institution. (e.g., Will the proposed program strengthen other programs? Will it stretch existing resources? How many of your programs at this level currently fail to meet Board of Governors' productivity criteria? Is there a danger of proliferation of low-productivity degree programs at the institution?)

A-1: Relationship of the proposed degree program to institutional mission

Early in 2000, North Carolina Agricultural and Technical State University embarked on a strategic visioning process called FUTURES. The result of this endeavor is *Uncompromising Excellence: A Blueprint for the Future* (http://www.ncat.edu/futures/), which redefines the University's mission as follows:

> *"...a learner-centered community that preserves and develops intellectual capital through interdisciplinary learning, discovery, engagement and operational excellence."*

The proposed CSE master's degree program is consistent with the University's FUTURES vision and supports its aspiration to become the premier interdisciplinary university in the nation. As can be seen, the proposed CSE program aligns it well with three of the five themes of FUTURES:

- Distinctive Visionary Interdisciplinary Programs and Centers: by planning and developing an interdisciplinary computational science and engineering program which would be the first standalone CSE graduate degree program in North Carolina and among HBCUs in the Nation.
- Enhanced and Diversified Resources: by exploring industry and business contributions and human and facility resources sharing through partnerships with business, industry, national labs and government agencies.
- Responsive Learning Environment: by providing interdisciplinary CSE research and education opportunities to graduate students, and broadening their career paths.

The proposed CSE master's program will be interdisciplinary in nature, drawing courses, research, faculty and students from two colleges - Arts and Sciences, and Engineering, and three schools - Agriculture and Environmental Sciences, Business and Economics, and Technology. The program will be supported by the current and emerging strengths in the computational areas of science, engineering, and technology, including infrastructure developments in high performance, scalable computing, and large-scale modeling and simulations. Several faculty and funded research projects exist in the areas of computational sciences and engineering. These will provide the research expertise and infrastructure that enhance the computational science and engineering programs. Computational techniques have already become an integral part of scientific discovery processing and engineering design in addition to experimental and analytical techniques. The demand for computational scientists, engineers and technologists in several critical areas of national interest is continually increasing. The proposed graduate master's program will help meet the increased human resource needs in several areas of computational sciences, engineering and technology. The program will educate, train and graduate under-represented professionals in computational science and engineering, especially African Americans. The proposed program will capitalize on the existing and emerging research strengths in computational science and

engineering; and dovetail the FUTURES initiative with a focus on computational science and engineering to increase the eminence of North Carolina A&T State University in this keen technological area. engineering; and dovetail the FUTURES initiative with a focus on computational science and engineering to increase the eminence of North Carolina A&T State University in this keen technological area.

A-2: Student Demand

An important element of any advanced program is its potential to attract and to graduate students. Among all U.S. universities, North Carolina A&T State University has been at or near the top in the number of African American graduates produced at the B.S. level in engineering for several years. NCA&T currently has a student enrollment of about 10,000 with over 1,300 graduate students and faculty/staff of nearly 1400. The science, engineering, mathematics and computer science enrollment trends and number of graduates during the five-year period of 1998-2003 are listed as follows.

Graduate Degrees Conferred

	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Agricultural Science	5	2	1	3	6
Biology	7	8	7	4	10
Chemistry	6	4	3	8	8
Mathematics	7	9	4	5	2
Physics	1	3	1	1	6
Engineering	54	52	41	46	45
Computer Science	28	29	36	20	32
Technology		19	24	26	36

Undergraduate Degrees Conferred

	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Agricultural Science	14	18	13	28	16
Biology	26	28	23	26	25
Chemistry	6	6	7	7	8
Mathematics	8	15	13	3	7
Physics	1	4	4	4	2
Engineering	197	196	170	159	159
Computer Science	56	71	61	52	54
Technology		105	119	119	151

Graduate Student Enrollment by Discipline

	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Agricultural Science	7	5	6	11	16
Biology	22	20	26	35	45
Chemistry	13	16	17	13	14
Mathematics	17	16	22	17	20
Physics	8	7	6	7	6

Engineering	157	159	156	162	185
Computer Science	71	68	64	61	65
Technology	86	93	97	82	97

Undergraduate Student Enrollment by Discipline

|	1998-1999	1999-2000	2000-2001	2001-2002	2002-2003
Agricultural Science	184	231	281	309	358
Biology	217	196	200	213	253
Chemistry	61	57	52	50	62
Mathematics	63	52	43	46	61
Physics	21	22	22	29	30
Engineering	1028	993	991	992	1224
Computer Science	300	302	323	348	319
Technology	726	707	778	851	937

The enrollment and degrees conferred data show that the pool of sciences, engineering, technology, and mathematics students is clearly adequate to support a master's program in computational science and engineering of an average of ten students *per* year for the first five years. Computational Science and Engineering Master's Program will no doubt improve the recruitment of graduate students from other institutions in North Carolina and local industry and business, since currently there is no formal CSE master's program in the State of North Carolina as well as any other related program within a 50-mile perimeter of NCA&T.

A-3: Societal Needs

The proposed computational science and engineering program is a rapidly growing interdisciplinary endeavor with connections to the sciences, engineering, technology, mathematics and computer science. CSE involves the use of computational architecture to develop numerical algorithms or methods to study scientific or engineering problems.

CSE has emerged as a powerful and indispensable method to analyze a variety of problems in research, production and process development, and manufacturing. Computational modeling and simulation is being accepted as a third methodology in scientific discovery processing and engineering design, complementing the traditional approaches of theory and experiment. Many experiments and investigations that have traditionally been performed in a laboratory or the field are being augmented or replaced by computational modeling and simulation. Examples include weather and climate modeling [1], fossil fuel combustion simulation [2], engine and vehicle design [3], materials development [4], aircraft design [5], electronic design automation [5], and drug design and development [6]. Scientific visualization is another primary element of CSE, and has become an essential tool for the preprocessing of data sets and the investigation of massive amounts of computational results, as increasingly evident in bioinformatics, finance, and the mining of huge data sets [7]. Computational modeling, simulation, and visualization are immensely useful for studying things that are otherwise too big, too small, too expensive, too scarce, or too inaccessible to study.

Even though CSE makes use of the techniques of applied mathematics and computer science for the development of numerical algorithms and computing tools to the study of scientific and engineering problems, it is by no means a subfield or extension of applied mathematics or computer science, nor is it a discipline where a scientist or engineer simply uses a canned code to simulate data and visualize results. "CSE is a legitimate and important academic enterprise," as noted in a comprehensive report [5] published by the SIAM Workgroup on CSE on Graduate Education in CSE. "Although it includes elements from computer science, applied mathematics, engineering and science, CSE focuses on the integration of knowledge and methodologies from all these disciplines, and as such is a subject which is distinct from any of them." The following figure, which has been widely accepted in the CSE community, reflects the view that besides connecting the sciences, engineering, mathematics, and computer science, CSE also has its own
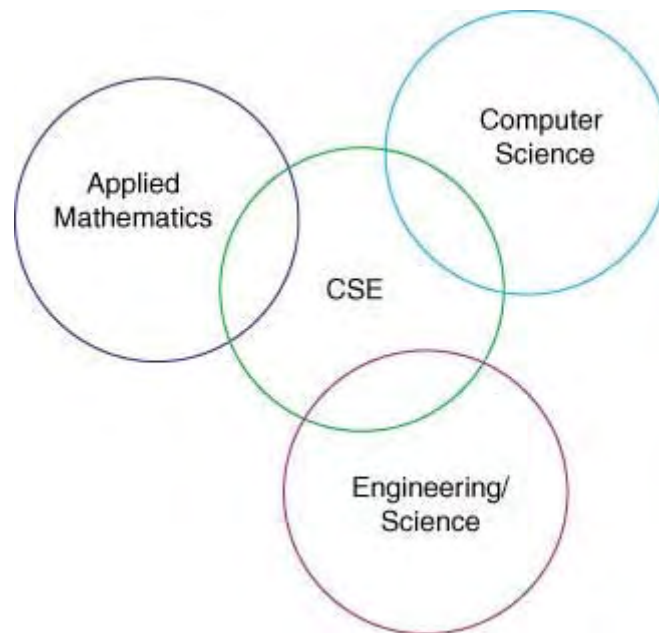
core of elements that draws together and bridges all these disciplines. Such a CSE core is made up of a collection of computationally intensive problem-solving methodologies and robust tools which constitute the building blocks for the study of scientific and engineering problems of ever increasing complexity and realism.

As suggested by Yasar and Landau [8], CSE education has been evolving in three stages. The first stage, dating back to the 1980's and infused by the 1982 Lax report [9], was recognition of the paradigm shift in which computation was accepted as a third methodology, joining theory and experiment as the basic techniques of scientific research and engineering design. The second stage of CSE occurred in the 1990's and marked its infancy [10-12]. During this period of time, a few CSE courses or experimenting curricula, primarily at doctoral level, started to be offered by those who were familiar with CSE ideas from their research and recognized the importance of integrating CSE research into education to meet the demand of computational professionals in this emerging interdisciplinary area. Commencement of the DOE Computational Science Graduate Fellowship Program [13] and issuance of the President's Information Technology Advisory Committee Report [14] were two of the milestones in this stage. The third stage, which began in 2000 and is expected to extend to 2010, is considered as early growth [15-16]. This

current and ongoing stage is going to be characterized by a number of CSE courses and curricula being designed and implemented by various institutions at baccalaureate, master's and doctoral levels.

The 2001 SIAM report [5] and a recent Krell Institute report [17] by Swanson in November 2003 entailed the progress in CSE program development. However, the majority of these programs were established by major research universities, either at doctoral level or affiliated with doctoral programs. Even though there are a few smaller universities or liberal arts colleges that made the Krell Institute list, their programs are primarily at undergraduate level, and are mostly offered as a minor or concentration in computational science. Furthermore, no single HBCU (Historically Black College and University) makes either list. To meet the demand for computational science and engineering professionals, it is imperative that the participation of master's-focused institutions and HBCUs in computational science and engineering workforce preparation be included. HBCUs will prove essential in graduating minority students to help fill the gap in the area of CSE, and North Carolina Agricultural and Technical State University, a leading producer of minority baccalaureate degrees in sciences, mathematics, engineering, and technology programs in the nation, is well positioned to assist in addressing this concern.

Information and computational technology has been recognized as one of the engines of economic growth during the last decade, as evident by the President's Information Technology Advisory Committee's (PITAC) report [14]. The PITAC predicated a need of approximately one million people in information and computational technology, a need that cannot be met solely by current academic programs in science, technology, engineering and mathematics (STEM). The National Science and Technology Council has repeatedly reported the concerns of industry and national laboratories that the growing needs for well trained computational scientists, engineers and technologies are not being satisfactorily met. We have seen that this nation has relied overly on people trained in information and computational technology from foreign countries. In addition, government initiatives such as the Presidential Information Technology Initiative, NSF's Information Technology Research (ITR) and Computational Neuroscience programs, and the DOE's Advanced Simulation and Computing (ASCI) and Scientific Discovery through Advanced Computing (SciDAC), and NIH's National Centers for Biomedical Computing and Centers for Bioinformatics and Computational Biology programs rely on people with scientific as well as computing knowledge and expertise. The demand for well trained computational scientists, engineers and technologies is significant.

The rapid growth of information and computational technology and its applications in the job market have created a need for multi-skilled workers at all levels, including the master's. The obvious preference of many employers to hire people with education in multiple disciplines suggests that having multiple skills and majors improve one's marketability and employment survival time. However, attaining multiple degrees is both costly and time-consuming. As an alternative, an interdisciplinary CSE education program can save time and money for those who desire to pursue multiple courses of study in the computational science and engineering arena. It will also offer students a coherent and consistent education with less duplication, and immerse them into interdisciplinary endeavor and a teamwork environment.

A-4: Impact on Existing Academic Programs

The proposed MS degree program in CSE builds upon the current University's curricular strength and research capability in science, engineering, mathematics, technology, and business. It is a result of interdisciplinary collaboration among the College of Arts and Sciences, College of Engineering, School of Agriculture and Environmental Sciences, School of Business and Economics, and the School of Technology. It will enhance and supplement current graduate research and education programs in science, engineering, mathematics, technology and business, and further the fertilizing and nurturing of cross-disciplinary interaction and collaboration in CSE among faculty and graduate students. As the first stand-alone CSE graduate degree program in the State of North Carolina and among HBCUs in the nation, the

proposed program will increase the eminence of North Carolina A&T State University in this keen technological area.

The proposed graduate MS program in CSE will strengthen the other graduate and undergraduate programs in engineering, sciences, technology and business. Students in these programs will benefit from the new computational science and engineering courses. Computational methods have become an accepted and widely used solution methodology joining analytical and experimental techniques as the basic techniques in scientific, engineering research, design and applications. The new program along with the faculty, infrastructure resources and new courses will strengthen the undergraduate education and training by providing the undergraduate students access and experiences with these resources, research and educational activities. This exposure will influence and attract undergraduate students into this and other graduate programs in the University. The faculty and administration of the NCA&T feel strongly about the importance and effectiveness of undergraduate education. New interdisciplinary programs and research activities will further strengthen the undergraduate education and improve the quality and accreditation of undergraduate the undergraduate programs in engineering, science, technology and business. An established interdisciplinary Masters program should help recruit additional well qualified faculty and students, simulate and enhance access to federal research funds. In turn, this will encourage our brightest and best undergraduates, as well as undergraduate students from other universities to consider our graduate programs.

The proposed CES Masters program is built upon our existing and new resources and dovetails of our FUTURES vision to promote an interdisciplinary learning and interactions across disciplines that the new and complex problems require. Many new emerging fields require interactions and expertise from multiple fields (for example: new developments in material sciences need understanding of both chemistry based atomistic material configurations and the associate mechanics and properties for the continuum level; bio-informatics need understanding of genetics and computer science). The proposed leverages the existing resources and expertise to build a new interdisciplinary arena that strengthens, contributes and enhances the existing resources. The present graduate masters programs in engineering and sciences have the required enrollment and graduation rate that meets the productivity criteria. The interdisciplinary CSE graduate program will further enhance the productivity and graduate education in the university.

- . **Discuss potential program duplication and program competitiveness.**

0. 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.
1. 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.

B-1: Identify similar programs offered elsewhere in North Carolina

There are no other formal, interdisciplinary, graduate masters programs in computational science and engineering as proposed to establish in this proposal elsewhere in North Carolina. The only other related academic programs in computational science and engineering are:

Duke University - *Graduate Certificate Program in CSE.*
Duke's graduate certificate program is designed for Ph.D. students who have been admitted to one of the participating departments, though applications from terminal M.S. students who are pursuing a thesis option will be accepted. Students will be expected to take credit for three CSE courses. Additionally, some component of a student's dissertation or thesis research is expected to involve significant computation, and at least one member of the CSE-affiliated faculty will serve on the student's dissertation or thesis committee. Participation in CSE seminars will be encouraged and expected, and internships or other off-site work experiences at industrial or government labs will be encouraged and facilitated. Duke University, a private institution in Durham, NC is about 60 miles from NCA&T.

NC State University – *Graduate CES Minor Program*
NC State Computational Engineering and Sciences Minor Program includes faculty from twelve departments in the College of Engineering and the College of Physical and Mathematical Sciences. Graduate students pursuing graduate study toward a master's or Ph.D. degree in one of the participating science or engineering departments may elect this program in place of the traditional minor. To complete the program requirements, a student must successfully complete a sequence of graduate-level applied mathematics and computer science courses and, if a research dissertation is required, utilize advanced computational techniques in the course of conducting the research. Typical courses that may be selected to satisfy this program's requirements include advanced calculus, numerical analysis, numerical linear algebra for parallel architectures, stochastic simulation, computer operating systems, digital systems architecture, computer graphics, compiler construction, software engineering, and design and analysis of algorithms. NC State is located in Raleigh and is about 60 miles from NCA&T.

B-2: Relation to other UNC programs

The proposed graduate masters program in computational science and engineering is a full fledged interdisciplinary graduate program. No other equivalent program exists in the university. The program is a new, unique program and does not duplicate any academic CES programs (as noted above) at a UNC or a private institution in North Carolina. The proposed CSE master's program will be interdisciplinary in nature, drawing courses, research, faculty and students from two colleges - Arts and Sciences, and Engineering, and three schools - Agriculture and Environmental Sciences, Business and Economics, and Technology. It will enhance and supplement current graduate research and education programs in science, engineering, mathematics, technology and business, and further the fertilizing and nurturing of cross-disciplinary interaction and collaboration in CSE among faculty and graduate students. As the first stand-alone CSE graduate degree program in the State of North Carolina and among HBCUs in the nation, the proposed program will increase the eminence of North Carolina A&T State University in this keen technological area.

C. Enrollment

Headcount Enrollment: There are no other formal, interdisciplinary, graduate masters programs in computational science and engineering as proposed to establish in this proposal elsewhere in North Carolina. The CES minor programs in Duke and NC State are not similar to the proposed program and would not provide an equivalent comparison of headcount enrollment.

Projected Enrollment in the Proposed Program: The enrollment and degrees conferred at NCA&T in various disciplines presented in an earlier section shows that the pools of engineering, sciences, and mathematics students is clearly adequate to support the master's program in computational science and engineering at an average of ten or more students per year for the first four years. It is expected that at least 9 full time and 3 part time students will be enrolled in the program during the first years of operation. The enrollment projection for the first four years is shown next.

	Year 1 (2004 - 2005)	Year 2 (2005 - 2006)	Year 3 (2006 - 2007)	Year 4 (2007 - 2008)
Full-time	9	12	15	18
Part-time	3	4	5	6
TOTALS	**12**	**16**	**20**	**24**

The projected enrollments are based on our prior enrollment and graduation rate in various programs and the increasing external research funding and infrastructure that has gone up significantly over the past few years and expected to attract graduate students and faculty. Moreover, Computational Science and Engineering Master's Program will no doubt improve the recruitment of graduate students from other institutions in North Carolina and local industry and business, since currently there is no CSE master's program within a 50-mile perimeter of NCA&T.

The anticipated steady-state headcount enrollment after four years:
Full-time _____20_____   Part-time _____7_____   Total _____27_____

> SCH production (upper division program majors, juniors and seniors *only*, for baccalaureate programs).
> 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).

Year 1	Student Credit Hours		
Program Category	**UG**	**Masters**	**Doctoral**
Category I			
Category II			
Category III		180	
Category IV			

Year 2	Student Credit Hours		
Program Category	**UG**	**Masters**	**Doctoral**
Category I			
Category II			
Category III		240	
Category IV			

Year 3	Student Credit Hours		
Program Category	**UG**	**Masters**	**Doctoral**
Category I			
Category II			
Category III		300	
Category IV			

Year 4	Student Credit Hours		
Program Category	**UG**	**Masters**	**Doctoral**
Category I			
Category II			
Category III		360	
Category IV			

III.   Program Requirements and Curriculum

A. Program Planning

In an effort to favorably impact local and regional technical workforce needs in CSE, in March 2002 the College of Arts and Sciences along with the Computer Science Department in the College of Engineering at North Carolina A&T State University (NCA&T) proposed to the Council of Graduate Schools to conduct a feasibility study of transforming its master's programs in applied mathematics, physics, and chemistry into an interdisciplinary computational science program. These efforts also concentrated on the development of course and curriculum for computational tracks within each of the existing master's programs in applied mathematics, biology, chemistry, computer science and physics, with approvals for curriculum, and tracks from the participating departments, colleges and the University. These courses would be part of the proposed CSE program. The plan to establish a graduate level, interdisciplinary program started with the formation of a university wide computational science and engineering (CSE) master's degree program planning committee was formed in August 2003. The committee is led by Dr. N. Radhakrishnan, Vice Chancellor for Research and Economic Development, and is composed of three members each from the College of Arts and Sciences, College of Engineering, and the School of Technology; and one member each from the School of Agriculture and Environmental Sciences, School of Business and Economics, and the School of Graduate Studies. The charges of the University Committee are (a) to review the CSE initiatives at NC A&T; (b) to study currently existing as well as "failed" CSE programs at other institutions; (c) to study the major CSE initiatives in the Federal Government; (d) to develop a curriculum for a MS degree program in CSE; and (e) to develop a plan for adequate high performance computing facilities to support the CSE program. The committee met regularly in Fall 2003 and has completed these tasks. The committee also reviewed courses and curricula developed through the UNC GA Academic Program Development Grant in Computational Science for possible adoption/adaptation for the expanded CSE masters program. The present proposal to establish is a collective work of the committee, and is a continuation and expansion of the efforts supported by the UNC GA Academic Program Development Grant in Computational Science.

The CSE planning committee studied the various graduate (masters, doctoral) and some undergraduate program offering in universities across the US and abroad. At least 60 universities with some form of formal academic program in computational science and engineering were identified. The various programs ranged from Masters and Doctoral programs in computational science and engineering; graduate minors in computational engineering and sciences to undergraduate minors in computational sciences. Most of the programs were interdisciplinary among various departments with faculties across various disciplines. There were also few focused programs such as computational mathematics through mathematics departments, computation and neural systems at California Institute of Technology (joint program between Biology, Engineering and Applied Science, Physics and Mathematics) and computational biosciences at Arizona State University. Several universities with CES based formal educational programs also had their own large-scale high performance computing infrastructure with the availability of multi-processor computing systems. Several graduate programs also offered degrees in scientific computing, Scientific Computation, or scientific and engineering computation, or similar categories such as the New York University, and University of Minnesota.

0. *List the names of institutions with similar offerings regarded as high quality programs by the developers of the proposed program.*

From the various CSE program offerings studied, the following have been identified as high quality programs. Though Masters and Doctoral programs existed in most institutions, only universities with a masters program are listed here, and include:

- Mississippi State University: MS in Computational Engineering
- University of Michigan, Ann Arbor: MS in Scientific Computing
- Stanford University: MS in Scientific Computing/Computational Mathematics
- University of Texas at Austin: MS in Computational Engineering and Science
- University of Minnesota: MS in Scientific Computation
- University of Mississippi: MS in Computational Engineering Science
- San Diego State University: MS in Computational Science
- State University of New York at Brockport: MS in Computational Science
- New York University: MS in Scientific Computing
- George Mason University: MS in Computational Science
- University of Maryland: MS in Scientific Computation
- University of Massachusetts – Lowell: MS in Scientific Computation
- Rice University: Professional Masters in Computational Science and Engineering
- University of Utah: MS in Computational Engineering and Science

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.

No specific institutions were visited. The CSE committee and program developers have prior experience and exposure to the various programs in computational sciences and engineering. The study was primarily through the available information in the program and university internet sources, program structure and catalog. The Council of Graduate Schools conducted feasibility study of transforming its master's programs in applied mathematics, physics, and chemistry into an interdisciplinary computational science program also provided the base for developing the program plan.

B. Admission.

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

The present specific policies, procedures and guidelines for admission to graduate masters program in engineering will be used for evaluating an applicant's success in the CSE masters program. Admission decisions will reflect an evaluation of the applicant's potential to engage in graduate coursework, thesis and project research in the CSE program. The placement in the three tracks of the CSE graduate program as discussed earlier will be based on the undergraduate degree discipline and other experience of the applicant. It will also be possible for the students to apply and be admitted in tracks other than their undergraduate field track. Generally, the requests for admission will be submitted and considered by the program director. Once the admission committee reviews the application, an admission recommendation is forwarded to the Dean of the School of Graduate Studies. Admission is granted for a specific semester or summer term, and any change in the admission date must be requested in writing and approved by the School of Graduate Studies. Admission to the program will be decided by a committee consisting of the faculty associated with the CSE program, and major domain area of the student's Bachelor degree.

To be considered for admission to the Master of Computational Science and Engineering, an applicant must satisfy the following requirements.

- Must have a Bachelors degree in engineering, physics, computer science, or mathematics from an accredited program with a minimum cumulative GPA of 3.0/4.0 for computational science and engineering track

- Must have a Bachelors degree in Chemistry, Biology, Business and Agricultural Sciences with a minimum cumulative GPA of 3.0/4/0 for computational science track
- Must have a Bachelors degree in Technology or related field with a minimum cumulative GPA of 3.0/4.0 for the computational technology track
- Applicants considered should have a GRE verbal score of at least 400 and GRE quantitative score of at least 650
- Applicants with their highest degree from non-English speaking countries must present an official score report for the Test of English as a Foreign Language (TOEFL) with the score of at least 550 (written test) or 230 (computer based test). This requirement may be waived if the candidate has completed at least four years of academic work on a full time basis at a university level institution in the United States or in a country where English is recognized as the official and academic language.
- General prerequisites are: (1) Calculus through differential equations for computational science and engineering track, (2) college chemistry, physics (3) elementary numerical analysis, (4) one semester of linear algebra for the computational science and engineering track. These are in addition to the courses in their principal Bachelor degree discipline. Programming and working knowledge of at least one high level programming language such as Fortran, C++, Java is also required for computational science and engineering track, and recommended for other tracks depending on the student's area of interest, there may be additional recommended or required pre-requisites specific to that area.

2. *Documents to be submitted for admission*

The following documents are to be submitted by the applicants for admission to the M.S. program in computational science and engineering.

7. Official transcripts of all college-level academic work.
8. Three letters of recommendation from former college professors or supervisors. Note: two of the three recommendation letters must be from a university professor.
9. Official copy of GRE score mailed directly to the university.
10. Official copy of TOEFL score mailed directly to the university (if required).
11. Completed application form and application fee stipulated by School of Graduate Studies at NCA&T.
12. A "Statement of Purpose" in the context of pursuing the M.S. degree in Computational Science and Engineering.

Applicants not qualifying for regular or provisional status because of poor undergraduate records or test scores may be afforded an opportunity to qualify for admission, if other indicators, such as professional experience, seem to predict success at the graduate level. Such students may be admitted in PBS Status, and must complete 3 assigned graduate and upper level undergraduate courses with a minimum GPA of 3.5 in order to qualify for Regular Status. No credits earned while in PBS status may be used towards the master's degree in CSE.

C. Degree Requirements

1. *Total Hours Required, Major, Minor:*
The credit hours required for the program will be 34 credit hours beyond the B. S. degree. There are 12 hours of 4 core courses, 12 hours of 4 domain area courses (mechanical engineering, physics, biology, business, etc., based on the domain area of the student), 3 credit hours (1 course) of interdisciplinary elective for students with thesis option, 6 credit hours (2 courses) of interdisciplinary elective for students

with a project option, 6 credit hours of thesis for students selecting a thesis option, 3 credit hours of project for students with a project option, 1 hour of seminar credit (S/U).

2. Proportion of courses only open to graduate students to be required in the program:

Students must satisfy the course requirements for their chosen track and major domain area, which includes courses at the 700 and 800 levels that are open only to graduate students. No specific minimum number of credit hours at 700 level is stipulated. The course requirements vary across the tracks.

3. Grades Required:

Students must obtain a cumulative GPA of 3.0 or above on a 4.0 scale.

4. Amount of Transfer Credit Accepted:

Up to 6 credit hours of the 27 – 30 hours of course requirements may be accepted for transfer by the program director on recommendation of the faculty advisor and committee. The courses considered for transfer must have been completed as a part of Masters Degree or above in a program higher than a Bachelor's degree program. Decisions on the transfer credit will be determined by the course requirements of the track and the major domain area chosen by the student.

5. Other Requirements (e.g. residence, comprehensive exams, thesis, dissertation, clinical or filed experience, "second major" etc.).

The course requirements for the CSE program consist of the following elements:

Core Courses: 12 credit courses (selective required courses for the students in the program. These can vary based on the track).

Domain Area Courses: 12 credit hours (These are graduate level courses in the selected primary domain area of the student. This will vary across the tracks and depending on the selected domain area (for example, mechanical engineering, computer science, mathematics, physics, business, biology, etc, based on student's undergraduate background, track and experience).

Interdisciplinary Elective: 6 credit hours (project option) or 3 credit hours (thesis option). Students should take these elective from courses that are not in their major domain areas. For example, students from mechanical engineering could take electives in computational chemistry, computational biology, etc, while a student from Physics can take a computational fluid mechanics course from engineering).

Graduate CSE Seminar: 1 credit hour (1 semester of S/U graded seminar) is required for all students.

Thesis Research: 6 credit hours (Thesis option). Thesis should be relevant and should have a computational focus and theme.

Project Research: 3 credit hours (Project). The project should be relevant and should have a computational focus and theme.

Training Classes: In addition to the academic curriculum courses, students will also be required to take short term, skill development classes in computational engineering and science areas. These short classes would be generally about half or one day duration to include topics such as Unix Operating System, Scientific Visualization Tools, Program Debugging and Profiling Tools, specifics of the use of HPC systems, analysis, visualization software, etc. The objective of these classes is to provide skills and introductory background to the students and new users, and vary based on the requirements and needs, in both hardware and software aspects.

Major Advisor: The track coordinator for each of the tracks will serve as an academic advisor for all new students entering the program. Each student in the CSE program is expected to select a major advisor by the beginning of the second semester with approval from the track coordinator and program director. The major advisor must be a member of graduate faculty.

Thesis/Project Committee: Thesis/Project committee will consist of a minimum of 3 graduate faculty with major advisor as the chair person. The thesis committee will be recommended by the major advisor, with input from the student to the Director of the CSE program for approval by the Dean of Graduate Studies. Upon the student's selection of domain area, the committee will review prior transcripts, and

prepare a program of study for the student. The committee will review the thesis or project, and finally recommend the awarding of the degree.

Thesis/Project Oral Examination*:* The final oral examination is scheduled after the thesis/project work is completed except for such revisions as may be necessary as a result of the thesis/project oral examination. A unanimous vote of approval of the advisory committee is required for passing the thesis/project oral examination. Approval may be conditional, however, on the student's meeting of specific requirements described by the examination committee.

6. Language and/or research requirements:
There are no language requirements.

7. Any time limits of completion
Normal time limits of completion of master's degree program will apply.

D. List existing course by title and number and indicate (*) those that are required. Include an explanation of numbering systems. List and describe new courses proposed.

The program courses include both the existing courses and new courses that will be developed and offered. Each course listed three letter department and program prefix. Specific CSE courses will have a prefix CSE XXX. These would include both current to be cross-listed courses and planned courses to be offered through the CSE program.

Core Courses: Four of these core courses are required for all students in the computational science and engineering program, irrespective of their major field of study and the domain department. Some courses are open only to students in computational science and computational technology tracks.

CSE 701* Computational Techniques for Modeling and Simulations 3 credit hours (Proposed New Course)
This would cover computational techniques for solving deterministic physical models in engineering and sciences, as well as computational techniques for non-deterministic models in business, economics, informatics, statistics, etc. The course purpose is to introduce to the student the computational approaches, and highlight the use and benefit of computational models to solve problems in various fields.

CSE 702* Computer Architecture 3 credit hours (May be cross listed with other equivalent courses, Proposed new course)
This would cover the architectural configuration of various computing systems ranging from single processor systems to scalable multi-processor, and high performance computing environments. It would also educate the students on the architectural aspects of cache, primary, secondary memories, networking, processing configurations, etc, that influence the performance of computational solutions and applications.

CSE 703* Numerical Linear and Non-Linear Algebra, 3 credit hours (May be cross listed with other equivalent courses, Proposed new course)
This would introduce to the student approaches for solving linear and non-linear system of equations that arise in various computational applications. The focus would not only be on the solution techniques, as well as on the use of linear solver libraries, both in single processor and multi-processor systems in their own applications.

CSE 704* Parallel/Scalable Computing (May be cross listed with other equivalent courses)
This would focus on the parallel programming approaches, algorithms, and models, including the analysis of scalability, speed-up, of the parallel algorithms.

CSE 705* Scientific Visualization 3 credit hours (May be cross listed with other equivalent courses)
This course would involve a detailed study of visualization, analysis and interpretation techniques useful in analysis of numerical data in both deterministic and non-deterministic disciplines, as well as visualization and interpretation software tools. Topics would include study of physical and computational data in various disciplines, two and higher dimensional data types, visual representation for scalar, vector, and tensor data, isosurface and volume visualization methods, data mining, visual monitoring and interactive steering.

The following core courses are intended only for students in computational science and computational technology tracks.

CSE 706*Introductory Applied Mathematics 3 credit hours (may be cross listed)
This would be an intermediate course in various aspects of applied mathematics as relevant to computational sciences. This course covers matrix theory, system of linear equations, linear ODES, PDES and their solution techniques. Introduction to differential equations employed in various disciplines and their solution techniques. The course is aimed to provide additional background in applied mathematics.
CSE 707* Numerical Analysis: A Comprehensive Introduction 3 credit hours (may be cross listed)
This would provide a comprehensive introduction to numerical methods for the solution of equation systems both in deterministic and non-deterministic problems. Both numerical solution techniques for differential equations, linear systems, data analysis, optimization, regression, Monte Carlo methods, forecast models, etc. will be covered.
CSE 708* Data Structures, Software Principles and Programming Languages, 3 credit hours (may be cross listed)
This course would introduce the concepts, principles and use of computer data structures, and programming languages for chemistry, biology, agricultural sciences and business majors.
BUAD 715 Quantitative Business Analysis 3 credit hours
This course familiarizes students with basic quantitative techniques for decision-making in all business functions. Specific topics will include data collection and presentation; basic descriptive statistics and probability; discrete and continuous probability distributions; confidence intervals; hypothesis testing; business forecasting; linear and multiple regression models; linear, integer, and non linear programming; and computer simulation. Emphasis will be on the application of these techniques for managerial decision-making. Prerequisite: ACCT 708.
BUAD 713 Business Applications Development 3 credit hours
This course focuses on application development and tools for business solutions. Concepts associated with the design, creation, and implementation of computer programs are studied. Application algorithms are designed using supportive software tools such as flowcharts, pseudocode, and hierarchy charts. Emphasis is placed on the development of applications using systems methods, top-down design, testing, debugging, modularity, and structured techniques to be implemented and maintained in a variety of business environments. This course uses an object-oriented programming language

Domain Area Courses: These domain area courses will be graduate level courses in the student's domain field of study. This includes the graduate level courses in all the possible domain areas of computational science and engineering. The students will take only courses in their declared major domain area. For example, a student with a declared major domain area of mechanical engineering will take courses in mechanical engineering, while a student with a declared domain area of Business will take graduate level courses in business. Selective listing of domain area courses in various disciplines are listed next.

Mechanical Engineering

MEEN 655 Computational Fluid Dynamics 3 credit hours
This course provides an introduction to numerical methods for solving exact equations of fluid dynamics. Finite difference methods are emphasized as applied to viscous and inviscid flows over objects. Students are introduced to modern computational fluid dynamics computational code. *In addition, CSE students will be required to develop and implement computer codes to solve simple fluid mechanics problems.* Pre-requisites: Math 332 and MEEN 415 or MEEN 416.
MEEN 716 Finite Element Methods 3 credit hours
This course covers fundamental concepts of the finite element method for linear stress and deformation analysis of mechanical components. Topics include the development of truss, beam, frame, plane stress, plane strain, axisymmetric, isoparametric, solid, thermal, and fluid elements. ANSYS and NASTRAN software will be used for practical problems. *In addition, CSE students will be required to develop and implement computer codes to solve simple problems in linear elasticity.* Prerequisites: Consent of Instructor.
MEEN 719 Advanced Computer-Aided Design 3 credit hours
This course covers important methods and techniques for using computers to aid the design process. Simulation and optimization methods are applied to the design of practical systems. Prerequisites: Consent of Instructor.
MEEN 618 Numerical Analysis for Engineers 3 credit hours
Scientific programming, error analysis, matrix algebra, eigenvalue problems, curve-fitting approximations, interpolation, numerical differentiation and integration, solutions to simultaneous equations, and numerical solutions of differential equations. Prerequisite; MEEN 210 or equivalent. This course presents a potential to modify and adapt to one of the core courses.

The domain area courses in mechanical engineering would also include traditional graduate courses in fluid mechanics, heat transfer, processing and transport phenomena, solid and continuum mechanics, etc. These currently available courses within the mechanical engineering curriculum and are not listed here.

Civil Engineering

The suggested domain field courses for civil engineering include:

CIEN 614 Stream Water Quality Modeling 3 credit hours
Mathematical modeling of water quality in receiving streams with topics that include the generation of point and non-point sources of pollutants; the modeling and prediction of reaction, transport and fate of pollutants in the stream; and the formulation and solution of simulation models. Prerequisites: CIEN 510 or Graduate Student Standing.
CIEN 668 Subsurface Hydrology 3 credit hours
This is an introductory course in subsurface hydrology including principles of fluid (water) in saturated and unsaturated materials, well hydraulics, and various methods of subsurface water flow systems, infiltration theory, and schemes for ground water basin management.

The domain area courses would also include other graduate courses approved for civil engineering. These currently available courses within the civil engineering curriculum are not listed here.

Industrial Engineering

The suggested courses for industrial engineering would include:

INEN 665   Human-Machine Systems 3 credit hours
This course emphasizes the application of perceptual, cognitive, and physical ergonomics principles to the design of human-machine systems. Topics covered include physiological limitations, cognitive and perceptual issues, task complexity and the demands on physical/cognitive resources, human-machine system integration, usability and evaluation methods. Design projects are required.   Prerequisites: Senior/Graduate Standing in ISE or Consent of Instructor.

INEN 721   Systems Engineering Models   3 credit hours
This course presents an overview of modern quantitative and computational techniques for system modeling, design and control. Topics include fuzzy set theory, neural network, control theory, optimization search methods, Petri-nets, and knowledge-based systems. Prerequisites: Graduate Standing.

INEN 742   Linear and Integer Programming 3 credit hours
This course addresses solution techniques for linear and integer programming problems. Topics addressed include initial basic feasible solutions, large scale linear programs, column generations, scaling, Dantzig-Wolfe decomposition, Interior point methods, integer programming models, and branch and bound approaches for solving integer programming models.   Prerequisites: Graduate Standing and Consent of Instructor

INEN 813   Cognitive Systems Engineering 3 credit hours
Cognitive Systems Engineering 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. Prerequisite: Graduate Standing and Consent of Instructor

INEN 814   Advanced Topics in Human-Machine Systems 3 credit hours
This course examines advanced topics in human-machine systems. Topics covered include supervisory control, human aspects of fixed and programmable automation, theories and models of complex systems, collaborative work support systems, human attention and cognitive control of dynamic actions, and tele-operations. Applications include supervisory control in transportation, process, space operations, waste and hazardous handling, manufacturing, and other applications of automated systems. Prerequisite: Graduate Standing and Consent of Instructor.

INEN 822   Advanced Systems Simulation 3 credit hours
This course discusses advanced statistical issues in the design of simulation experiments: variance reduction, regeneration methods, performance optimization and run sampling. Continuous simulation models are introduced. High fidelity simulation software and high-level architecture for constructing large simulation models is introduced. Prerequisite: Graduate Standing and Consent of Instructor.

INEN 841   Linear and Nonlinear Optimization 3 credit hours
This course addresses solution techniques for linear and integer programming problems, and nonlinear optimization. Topics addressed include initial basic feasible solutions, large scale linear programs, column generation, scaling, Dantzig-Wolfe decomposition, interior point methods, integer programming models, branch and bound approaches, unconstrained multivariate optimization, and penalty methods. Applications to engineering and economic systems are discussed. Prerequisite: Graduate Standing.

INEN 843   Queuing Theory 3 credit hours
This course presents stochastic models and solution techniques for such models. Specific topics include elements of queuing systems, measures of performance, arrival processes, steady state analysis, stationary arrivals, controlling service processes, priority queues, and queuing networks. Prerequisite: Graduate Standing and Consent of Instructor.

INEN 844   Reliability and Maintenance 3 credit hours
This course reviews the statistical concepts and methods underlying procedures used in reliability engineering. Topics include the nature of reliability and maintenance, life failure and repair distributions, life test strategies, and complex system reliability including: series/parallel/standby components with preventive maintenance philosophy. Analytical models are emphasized. Prerequisite: Graduate Standing and Consent of Instructor

INEN 853   Enterprise Integration   3 credit hours
This course is directed toward development and contribution to the advancement of a unified framework for conceptualizing, designing, modeling, and operating advanced integrated manufacturing systems. It builds upon emerging developments in computer and communications technologies and conceptual breakthroughs regarding the nature and behavior of integrated enterprises. Prerequisites: Graduate Standing and Consent of Instructor.

Computer Science

Suggested domain field courses from the affiliated computer science faculty include:

COMP 732 Advanced Software Tools 3 credit hours
The software tools utilized in the high performance and massively parallel computing environments are indispensable to the practicing computer scientist. Message passing, profiling, languages, compilers, porting, system library usage, cache optimization, and in-lining are the topics of this course. Prerequisite: Graduate standing.

COMP 733 Parallel Computing Applications 3 credit hours
Many problems in computing can be solved more efficiently on a parallel computer. The parallel computing paradigm is the main focus of this course. The applicability of Amdahl's law, PRAM models, matrix by vector transforms, matrix by matrix graphics and visualization computations will be discussed. Prerequisite: Graduate standing.

COMP 753 Performance Modeling and Evaluation 3 credit hours
Common techniques and current results in the performance evaluation of computer systems are studied in this course. Background material in probability theory, queuing theory, simulation, and discrete mathematics is reviewed so that a performance evaluation of resource management algorithms for operating systems and database management systems in parallel and distributed environments may be developed. Prerequisite: COMP-755.

COMP 755 Advanced Operating Systems   3 credit hours
This course centers on operating systems for multi-processing environments: concurrent processes, mutual exclusion, job scheduling, memory, storage hierarchy, file systems, security, and distributed processing. Also discussed are virtual resource management strategies. A design project involving the construction of operating facilities is produced. Prerequisite: Graduate standing.

COMP 770 Computer Organization and Programming for Scientific Computing Computer programming in the High Performance Computing environment is unlike that of the common workstation or desktop computing platform. Programming parallel computers with regard to data transfer (MPI), data storage and process execution are the main focus of this course. The architecture and organization of various parallel computing platforms are examined. Prerequisite: Graduate standing.

COMP 785 Advanced Design and Analysis of Algorithms 3 credit hours
This course discusses the design and analysis of efficient algorithms and algorithmic paradigms. Applications include sorting, searching dynamic structures, graph algorithms, computationally hard problems, and NP completeness. Prerequisite: Graduate standing.

Physics

Suggested domain field courses from affiliated Physics faculty would include:

PHYS 735 Atomic & Molecular Physics 3 credit hours
An advanced study of atomic and molecular systems. Topics include many-electron atoms, Hartree-Fock and self-consistent field methods, interaction of many-electron atoms with electromagnetic fields; diatomic molecules, Born-Opeenheimer approximation, rotation and vibration and electron spectra of diatomic molecules, polyatomic systems, laser spectroscopy, and molecular dynamics. Prerequisite: Physics 465 or Graduate standing.

PHYS 445 Introduction to Computations in Physics 3 credit hours
This course will introduce and use computational techniques to analyze and solve physical problems. Techniques to be used include visual programming language, graphing package, spread sheet, symbolic packages, and other applications. Prerequisites: PHYS 241, PHYS 242, and a course in programming.

PHYS 530 Computational Techniques in Physics 3 credit hours
This course is an application of numerical methods to solve problems in physics. It includes root finding, systems of equations, integration, differentiation, boundary-value problems, and Monte Carlo methods. Prerequisite: PHYS 405

PHYS 605 Mathematical Methods 3 credit hours
Covers topics in mathematical physics, vector calculus, complex variables, Fourier theory, special functions and boundary value problems, variational methods, Greens functions. Prerequisite: Graduate standing or Consent of Instructor.

PHYS 737 Physics of Solids, 3 credit hours
An advanced study of solids with applications to metals, semiconductors, and insulators. Topics include electronic structures, dynamics of electrons in solids, transport properties, optical properties, magnetic properties, and superconductivity. Prerequisite: Graduate standing or consent of the instructor.

PHYS 738 Nuclear Physics 3 credit hours
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 3 credit hours
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. Prerequisites: PHYS 738 or Graduate standing.

PHYS 743 Experimental Methods 3 credit hours
Theory and techniques of measurement in experimental physics; experimental design, detector development, signal processing techniques, data acquisition, error analysis, statistics and treatment of experimental data. Prerequisite: Graduate standing or consent of the instructor.

PHYS 750 Relativistic Quantum Mechanics I 3 credit hours
Along with PHYS 751 covers the Dirac equation and elementary mass renormalization, propagator theory, second quantization, the quantization of the electromagnetic field, Feynman graphs, calculations in quantum electrodynamics and quantum chromodynamics, gauge theories, models of electromagnetic, weak and strong interactions. Prerequisite: Physics 720 or Graduate standing.

PHYS 751 Relativistic Quantum Mechanics II 3 credit hours
A continuation of PHYS 750. Prerequisite: PHYS 750

Mathematics

Suggested domain courses from mathematics and statistics include:

MATH 608 Methods of Applied Statistics 3 credit hours
This course introduces SAS programming language, and uses it in the analysis of variance, both single and multifactor. It includes various methods of hypothesis testing and constructing confidence intervals. The course covers simple and multiple linear regression, including model building and variable selection techniques. Elements of time series and categorical data analysis are covered. Prerequisite: MATH 224.
MATH 652 Methods of Applied Mathematics 3 credit hours
This course covers matrix theory, systems of linear equations, vector spaces, eigenvalue problems and its applications to systems of linear ODEs and mechanical vibrations, the simplest problems of calculus of variations, Euler equations, boundary conditions, extensions of Euler equations, Hamilton's principles, constraints, and Lagrange multipliers, introduction to integral equations, and solutions in iterative and other methods. Prerequisites: MATH 331 and MATH 332.
MATH 706 Categorical Data Analysis, 3 credit hours
This course will include the following two topics: Two way Contingency Table Inference for Two Way Table, Models for binary response variables, log-linear models, testing in log-linear models, multinomial response models and estimation theory for parametric models, and computer analysis of categorical data. Prerequisite: MATH 624
MATH 624 Theory and Methods of Statistics 3 credits hours
This course introduces methods of statistical estimation and inference including the following topics: sufficient statistics, confidence sets, hypothesis tests, and maximum likelihood methods. The theory of uniformly most powerful tests and Neyman-Pearson Lemma are covered. Other topics include least squares estimation, the linear model, and Bayesian methods.
MATH 712 Numerical Linear Algebra 3 credit hours
Numerical analysis for solution of linear systems, approximation methods for eigenvalues and eigenvectors, least squares solutions, ill-posed and ill-conditioned systems and error analysis are covered. Prerequisite: One programming language, MATH 450 or equivalent.
MATH 723 Advanced Topics in Applied Mathematics 3 credit hours

Chemistry

The present suggested courses in the chemistry include:

CHEM 651 General Biochemistry 3 credit hours
This course emphasizes chemical kinetics and energies associated with biological reactions and include a study of carbohydrates, lipids, proteins, vitamins, nucleic acids, hormones, photosynthesis, and respiration. Prerequisites: CHEM 431 and 442
CHEM 652 General Biochemistry Lab 3 credit hours
This is a companion laboratory to CHEM 651. Experimentation will include isolation and characterization of biochemical substances and studies of physical properties. Students will be introduced to a variety of techniques including high performance liquid chromatography, electrophoresis, and centrifugation. Prerequisite: CHEM 651
CHEM 643 Introduction to Quantum Mechanics 3 credit hours
Non-relativistic wave mechanics and its application to simple systems by means of the operator formulation. Prerequisites: CHEM 442 and PHYS 222; Co-requisite: MATH 231
CHEM 772 Advanced Organic Chemistry 3 credit hours
Recent developments in the areas of structural theory, stereochemistry, molecular arrangement and mechanism of reactions of selected classes of organic compounds. Pre-requisite: One year of organic chemistry, or Chemistry 721.

CHEM 741 Principles of Physical Chemistry I 3 credit hours
A review of fundamental principles of physical chemistry, including the derivation of the most important equations and their application to the solution of problems. Prerequisites: MATH 606 or MATH 622
CHEM 742 Principles of Physical Chemistry II 3 credit hours
A continuation of CHEM 741. May be taken concurrently with CHEM 741
CHEM 745 Special Problems in Physical Chemistry 1 credit hours
A laboratory course designed to introduce the student to the techniques of chemical research by solving minor problems in physical chemistry.
CHEM 746 Special Topics in Physical Chemistry 3 credit hours
CHEM 755 Special Problems in Bio-Chemistry 1 credit hours
CHEM 756 Selected Topics in Bio-Chemistry 3 credit hours

Agribusiness, Applied Economics and Agriscience Education

Suggested courses from Agribusiness, Applied Economics and Agriscience Education include:

AGEC-638. Special Problems in Agricultural Economics Credit 3(3-0)
 This course is designed for students who desire to work out special problems in the field of agricultural economics; problem definition, formulation and investigation will be emphasized. Prerequisite: Consent of the Department Chairperson. (F).
AGEC-675.ComputerApplications in Agricultural Economics Credit 3(3-0)
This course is designed to provide students with the tools to utilize computers for agricultural decision-making. Emphasis will be placed on utilizing existing software packages for microcomputers and mainframe computers to make financial, economic and quantitative analysis of farm and agribusiness-related problems. Prerequisites: Ag. Econ. 330 or Econ. 330.
AGEC-705. Statistical Methods in Agricultural Economics Credit 3(3-0)
Advanced topics on analysis of variance, regression, correlation, multistage sampling and probability are covered in depth. Prerequisite: Ag. Econ. 646.
AGEC-708.Econometrics Credit, 3(3-0)
This course focuses on the application of econometric techniques to agricultural economic problems, theory and estimation of structural economic parameters. Prerequisite: Ag. Econ. 705.
AGEC-740. Production Economics, Credit 3(3-0)
This course focuses specifically on production economics theory in a quantitative framework. Technical and economic factor- product, factor-factor, and product-product relationships in single and multi-product firms under conditions of perfect and imperfect competition in both factor and product markets are topical areas.
AGEC-756. Agricultural Price Analysis, Credit 3(3-0)
The use of price information in the decision-making process is the essence of this course. The relation of supply and demand in determining agricultural prices and the relation of prices to grade, time, location, and stages of processing in the marketing system are considered. The course also includes advanced methods of price analysis, the concept of parity and the role of price support programs in agricultural decisions. Prerequisite: Consent of instructor.

Animal Sciences

ANSC-614. Animal Breeding Credit 3 (3-0)
Application of genetic and breeding principles to livestock production and improvement. Phenotypic and genotypic effects of selection methods; mating systems. Prerequisites: ANSC 211 and ANSC 214.

ANSC-637. Environmental Toxicology Credit 3 (2-3)
Sources, distribution, and toxicity of chemicals which are hazardous to the environments of man and animals. Prerequisite: LASC 636 or permission of instructor. Prerequisite: Three advanced courses in Poultry Science.

ANSC-665. Techniques in Biotechnology Credit 3 (2-2)
Basic principles and laboratory experiences in biotechnology. Concepts of DNA structure, function, related applications in biotechnology. Prerequisites: ANSC 214, CHEM 251, BIOL 466 or permission of instructor.

ANSC-771. Bioinformatics and Genome Analysis Credit 3 (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.

ANSC-782. Cellular Pathobiology Credit 3 (3-0)
Current concepts of the structure, function and pathobiology of the cell. Methodologies used to study the cell and its processes. Prerequisite: CHEM 651 or permission of instructor, advisor.

Human Environment and Family Sciences

HEFS-653. Food Biotechnology Credit 3(1-4)
This course covers the impact of biotechnology on food production. It covers classical to modern day food biotechnology and beyond. Modern day genetic tools, as applied to food biotechnology will be examined. A major focus will be on the improvement of microbes used in food production by modern biotechnological approaches. Prerequisites: BIOL 220.

Natural Resources and Environmental Design

SLSC632 Soil Physics, Credits 3 (2-2)
This course is a study of fundamental physical principles and laws that govern the behavior of soils. Physical constitution of soil water, soil air, and the relationship of soil physical conditions to plant growth and engineering usage will also be studied. Prerequisites: SLSC338, CHEM102, MATH113, and consent of instructor.

NARS610 Applied Spatial Statistics and GIS, 3 credits
This course introduces spatial statistical analysis techniques, which provide the students with the opportunity to conduct exploratory spatial data analysis with ArcView GIS, S-PLUS/SpatialStats and the SAS/GIS Software. The focus of this course is an effective application of spatial data analysis in GIS environment, MATH 224 and GIS software or consent of instructor.

AGRI604 Experimental Methods in Research, 3 credits
Experimental design, methods and techniques of experimentation, application of experimental design to plant, animal and food research, and interpretation of experimental data will be included in the course.

Biology

Suggested course listing from Biology include:

BIOL 630 Molecular Genetics 3 credit hours
DNA and RNA structure, function and processing in prokaryotic and eukaryotic systems. Various aspects of recombinant DNA technology will be examined. Prerequisites: BIOL 201 and BIOL 466.

BIOL 642 Special Problems in Biology 3 credit hours
Research projects on specific problems in biology for advanced students. Prerequisites: BIOL 462 or 466 or permission of the instructor.

BIOL 665 Evolution 3 credit hours
This course will emphasize the genetics of the population and sources of genetic variation; causes of genetic change in populations including natural selection, speciation, and the evolutionary history of life on earth. Prerequisites: BIOL 310, BIOL 466

BIOL 700 Environmental Biology 3 credit hours
The scientific study of human living and non-living environment. This course emphasizes how our technologies and cultures impact the earth's ability to sustain both human civilization and earth's bio-diversity.

BIOL 703 Experimental Methods in Biology 3 credit hours
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.

BIOL 704 Cell and Molecular Biology 3 credit hours
A course that integrates the most recent advances in molecular biology of structure and function in cells. Prerequisite: BIOL 462.

Business and Economics

BUAD 712 Foundations of Enterprise Management 3 credit hours
This course provides an understanding of key themes related to successful enterprise management, and discussions of the interpersonal and intellectual skills necessary to contribute to a highly competitive and globalized business environment. Topics include the globalization of commerce, marketing and market systems, competitive strategy, perspectives on legal and ethical business conduct, information technology, and the elements of quality. Individual and team competencies are developed using materials that involve interpersonal skills, problem-solving, and case analysis.

ECON 706 Seminar in Economics   3 credit hours
This course introduces basic microeconomic principles and their applications in business. Basic economic concepts, including marginal analysis of consumer and firm decisions, will be covered along with macroeconomic theories that support managers' understanding of the global economic environment and the economic policies affecting that environment.

ACCT 708 Seminar in Financial Concepts   3 credit hours
The course will examine basic concepts and tools to provide integrative coverage of accounting and finance. Accounting topics include the interpretation, and analysis and use of accounting information, including basic accounting procedures, budgeting, cost tracking and cost/profit analysis. Finance topics include concepts and techniques for planning and managing the acquisition and allocation of financial resources, including cost of capital, capital structure and capital budgeting. Coverage of these areas will be integrated by examining the basic contributions of each area to the decision processes for raising and allocating funds and the purposes they serve in assisting lenders and investors in assessing financial capacity and performance.

ACCT 714 Managerial Accounting and Finance 3 credit hours
The course focuses on the role of management accounting information systems in planning, controlling, evaluating performance and decision-making. The course covers traditional and contemporary concepts and techniques of product and service costing, budgeting and interpretation of internal reported information. Emphasizes is also given to the application of concepts and decision tools for financial decision-making. Financial resources are essential for the survival of corporations. The course, therefore, will also cover the planning process, financial markets and instruments, how financial resources are acquired and allocated, and how decisions in finance may affect non-financial areas. The course will use case studies and computer-bases analysis for an integrative application of finance and managerial accounting concepts. Prerequisite: ACCT 708 or Equivalent Course(s).

BUAD 730 Human Resources Management 3 credit hours
This course provides an overview of the design, administration and evaluation of the human resources function. It looks at conceptual issues, policies and practices used by organizations to attract, develop and retain human resources; and the role of human resources management in organizational effectiveness. Topics include an introduction to the activities of the human resource function: staffing, training and development, performance appraisal, compensation and benefits, employee relations, and legal environment of human resources management, and special issues and challenges in international human resources management. Theories relating to human motivation and behavior are discussed. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD 731 Staffing   3 credit hours
This course looks at theory and application methods used in the recruitment and selection of employees. Course topics include job analysis, interviewing and testing methods, selection techniques, legal issues in recruitment and selection, internal and external selection processes including performance appraisal and management, staffing philosophies for international operations, and expatriate repatriation. Prerequisite: BUAD 730

BUAD 732 Training and Development 3 credit hours
This course explores the theory and practice used for training and developing human resources in organizations. Course content includes identifying training needs, designing and implementing training programs to satisfy individual and organizational goals, and evaluating training program effectiveness. Workforce diversity, theories of organizational and individual learning, career development, change theory and training for international operations are also discussed. Prerequisite: BUAD 730.

BUAD 733 Compensation and Benefits 3 credit hours
This course examines theory and practice in designing and managing compensation and benefit systems in organizations. Issues considered include compensation and benefit systems as fit systems in organizations. Issues considered include compensation and benefit systems as vehicles for attracting, motivating, and retaining employees; designing individual and group incentive plans; structuring pension plans; determining wage levels and structures; legal issues and considerations in compensation and benefit administration; and expatriate compensation. Prerequisite: BUAD 730

BUAD 734 Employee Relations 3 credit hours
This course examines the policies and practices used to promote equitable treatment of employees. Topics include employee health and safety, employee communication, equal opportunity and affirmative action, workforce diversity, employee rights, conflict resolution, industrial relations, and international labor relations. Also includes legal aspects of employee relations. Prerequisite: BUAD 730.

BUAD 735 Contemporary Issues in Human Resources Management 3 credit hours
This course considers important issues affecting the acquisition and utilization of human resources in a dynamic global environment. Topics vary and depend on the current HRM environment. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD736 Human Resources Management Strategy 3 credit hours
This course focuses on the formulation and implementation of human resources management strategies. Emphasis is placed on the strategic dimensions of recruitment, selection, development and retention of a workforce needed to accomplish organizational strategic objectives. Prerequisites: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD 719 Information Systems Planning and Design 3 credit hours
This course provides students with an understanding of the concepts of planning, analysis, design, and implementation of modern information systems. Techniques used in this course are project tracking, structured analysis and design, prototyping, and techniques for incorporating human factors considerations. These project planning and design issues will be discussed both in terms of the traditional systems development life cycle and in terms of business tools, Business Process Reengineering (BPR) and Project Tracking (GANTT network diagrams, task tracking) tools in their project work.

BUAD740 Management and Implementation of Enterprise Information Systems 3 credit hours

This is an applied course in concepts and techniques used in the design, development, and implementation of management information systems and decision support systems using systems design concepts and software development tools for web enabled applications. The implementation issues of organizational fit and organizational diffusion will be discussed along with security and ethics. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD 742 Telecommunications Systems Management 3 credit hours

This course provides in-depth coverage of data communications applications and the management of telecommunications hardware and software. Emphasis is on analysis and design of networking applications, management of telecommunications networks, and evaluation of connectivity options. Topics to be covered include: telecommunications devices, media systems, network hardware and software, network configuration, network applications, cost-benefit analysis, topologies and reliability. Prerequisite: ACCT 708, BUAD 705, BUAD 712 and ECON 706.

BUAD 744 Enterprise Data Modeling 3 credit hours

From a business perspective, this course will analyze databases to facilitate surveillance and scanning for reverse competitive intelligence and for gathering data on customers and competitors. From an information perspective it will cover distributed databases, database integrity and security, data warehousing, data modeling tools, data dictionaries, and query language. Students will make extensive use of database systems. Prerequisite: BUAD 740 or BUAD 742.

BUAD 746 E-Business and E-Commerce Management 3 credit hours

This course is a comprehensive overview of building and managing an e-business. Topics examined include: the decision to bring a business online, choosing a business model, developing a business plan, accepting payments, marketing strategies, and security. A complete web-based e-business storefront will be designed and developed based on a viable business model and marketing plan. Prerequisite: BUAD 740 or BUAD 742.

BUAD 748 MIS Projects 3 credit hours

This course requires an applied project designed to provide students with the necessary skills to manage the development of technology-based solutions for opportunities faced by organizations today. Students gain practical experience in enabling change through the use of information technology. Students work in faculty-supervised teams with sponsoring businesses. Project deliverables include: analysis and evaluation of existing business processes, evaluation of alternatives for improvement, potential for IT work process improvement, demonstration of feasibility, and an implementation plan. Prerequisite: BUAD 740, BUAD 742 and BUAD 744 or BUAD 746.

TRAN 701 Strategic Logistics Management 3 credit hours

This course is designed to introduce students to the critical role of logistics in the achievement of strategic objectives. This approach involves all activities associated with moving raw materials, inventory, and finished goods from the point of origin to the point of use or consumption. The course addresses logistics strategy, planning, customer service goals, transportation fundamentals and decision-making, transportation strategy, inventory and location strategies, organization and control.

TRAN 720. Analysis and Design of Supply Chain Systems 3 credit hours

This logistics modeling course deals with various ways of modeling logistics forecasts to facilitate supply chain management, mode selection, distribution planning, facility location, net-model logistics and supply chain applications.

TRAN 725 Purchasing and Materials Management 3 credit hours

This course focuses on purchasing as the integration of long-term materials planning with corporate strategic planning process. The increasingly strategic role played by the purchasing professional in an organization is also examined. Areas receiving special attention include collaborative participation in the identification and procurement of key material requirements, determination and application of supplier qualification and selection activities, implementation of supplier development programs, relationship building programs, and participation in supply chain development decisions.

TRAN 727 Global Supply Chain Management 3 credit hours

This course addresses issues in global supply chain management. Some topics addressed are international sourcing, evaluating international suppliers, outsourcing, financial management issues, relationship management, information management, and selecting international carriers. The course relies on cases to understand and solve problems in global supply chain management.

TRAN 730 Transportation Planning 3 credit hours
This course addresses the transportation planning process and related activities. Topics of special focus are modal classifications, data requirements, transportation demand analysis, methods of evaluation (GIS, cost-benefit analysis, internal rate of return, payback period, etc). Others are multiple criteria evaluation method, post-project evaluation, finance, transportation demand management, and issues in intelligent transportation systems.

Technology

Electronics and Computer Technology and Manufacturing Systems

ECT 600 Electromechanical Systems Analysis
This course deals with the fundamentals of electrical and mechanical dynamical systems. Frequency and time domain analysis techniques are utilized. Electrical and mechanical applications of first and second order linear differential and difference equations are examined through transform techniques. Specialized applications software packages are examined.

ITT 634 Electronic Instrumentation for Remote Sensing Applications
ECT 634 Electronic Instrumentation for Telemetry Applications 3(2-2)
This course will provide practical knowledge of the operation of electronics instruments used in the applications of telemetry, remote sensing and detection. Possible electronic systems that will be discussed include RADAR, SONAR, LIDAR, and SODAR.

ECT 635 Analysis and Design of Mechatronic Systems
This course deals with the principles of analyzing and designing mechatronics systems. This course includes a review of logic gates, microprocessor architecture, sensors and actuators, A/D and D/A conversion techniques, real-time multi-tasking programming concepts, and direct digital control implementation. The course includes "hands-on" experiences through several laboratory assignments and a final team project.

ITT 650 Wireless Communication Systems
This course covers fundamental theory and design of high capacity wireless communication systems. Topics include trunking, propagation effects, frequency reuse, modulation methods, coding and equalization. Emerging cellular and next generation personal communication systems will also be analyzed.

ITT 665 Wireless Geo-location Systems
This course will describe the basic concepts and mechanics of Global Positioning Systems (GPS) and Inertial Navigation Systems (INS). Practical applications of GPS, INS and GPS/INS will be covered.

ITT 670 Communication Circuit Development Laboratory
This course studies advanced methods of analysis of communication circuits including oscillators, radio frequency amplifiers, matching networks, modulators, mixers, and detectors for HF through UHF frequency range using Y- and S- parameter methods.

ITT 680 Radio Wave and Optical Signal Propagation
This courses models the behavior of unguided electromagnetic and optical waves in the atmosphere, space, urban and indoor environments. The course will also discuss path, frequency and antenna selection for practical radio wave communication systems.

ECT 765 Wireless Geo-location Systems II 3(2-2)
This course will provide integrated practical examples, in-depth case studies and guidelines for building GPS systems. The course will review in-depth implementation techniques for position location systems.

ECT 770 Communication Circuit Development Laboratory II 3(1-4)
This course is a continuation of ECT 670. The course will study practical methods of building a complete high frequency or ultra high frequency communication system at the discrete component level.

MFG 651 – Principles of Robotics
This course emphasizes the study of robotics principles and logic control manipulators towards the total integration into a flexible manufacturing system.

MFG 674 – Study of Automation and Control System
This course emphasizes the study of automation and control system to include application of PLC, CAD, CAM, CNC, sensors and robotics to simulate a total computer integrated manufacturing (CIM) environment.

MFG 710 – Manufacturing Materials
This course surveys the materials commonly used to manufacture products. It explores the way these materials are formed. Covered are traditional metals and plastics as well as emerging high-tech materials. The practical applications of these materials are emphasized. Prerequisite: MFG 471 or equivalent or consent of instructor.

MFG 760 – Advanced Manufacturing Process / Computer Numerical Control (CNC)
This course explores applications in advanced Computer Numerically Controlled (CNC) machine tool technology with precision work performed on lathe, mill, Electrostatic Discharge Machining (EDM), and surface drilling work stations. Prerequisite: MFG 472 or consent of instructor.

CSE 7X1 – Nano-Scale Science and Engineering
Nano-scale science, engineering, and technology is collectively referred to nano-scale technology, the study of the unique properties of matter that occur at extremely small scales (about in the length scale of 1-100 nano-mater range). Based upon NSF's definition, nano-scale technology can be divided into two categories: nano-scale science and engineering, and the nano-scale technology. This course explores the fundamental understanding and resulting technological advances arising from the exploitation of new physical, chemical, and biological properties of systems that are intermediate in size between isolated atoms and molecules and bulk materials.

CSE 7X2 – Nano-Scale Technology
Nano-scale science, engineering, and technology is collectively referred to nano-scale technology, the study of the unique properties of matter that occur at extremely small scales (about in the length scale of 1-100 nano-mater range). Based upon NSF's definition, nano-scale technology can be divided into two categories: nano-scale science and engineering, and the nano-scale technology. This course explores the creation and utilization of functional materials, devices, and systems with novel properties and functions that are achieved through the control of matter, atom-by-atom, molecule-by-molecule, or at the macro-molecular level. Nano-scale manufacturing and fabrication requires an entirely new approach: invention of new instruments, measuring tools, models, methods, and standards to characterize nano-scale materials and processes.

Interdisciplinary Elective Courses

Several courses will be designated as interdisciplinary courses. Some new courses that would require faculty expertise from two or more fields and interactions, and taught by multiple faculty will also be developed. These courses are to provide an insight to the student into other areas of computer applications that are not in a student's declared domain area field. For example, a student with a domain area of mechanical engineering would take a course in computational physics and a student with a domain area of physics would take a course in computational mechanics. A short list of potential courses is listed here.

PHYS 746 Computational Physics 3 credit hours
This course will provide an in-depth coverage on the theoretical and computational methods used in the computational physics. It covers 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.

PHYS 745 Introduction to Computational Methods in Biological and Physical Sciences 3 credit hours

This course will offer an introduction to computational methods used in the study of computational physics, chemistry and biology. Programming skills 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 dynamics, energy minimization, Monte Carlo and molecular dynamics simulations, structure of proteins, RNA/DNA, sequence search and pattern recognition.

CHEM 7X2 Computational Chemistry 3 credit hours

This course is a continuation of CHEM 7X1 and will provide in-depth coverage on the theoretical and computational methods used in computational chemistry. This includes the introduction of numerical methods in quantum chemistry, Hatree-Fock, electron correlation, density functional theory, numerical methods in statistical mechanics, energy minimization, conformational search, Monte Carlo and molecular dynamics. Programming skills are needed.

BIOL 705 Introduction to Computational Methods in Biology 3 credit hours

This course will offer an introduction to computational methods used in biology. Programming skill is not required. The course will survey and provides hands-on experience with the computational methods used in the analysis and modeling of biological data and phenomena.

BIOL 706 Computational Biology 3 credit hours

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.

MEEN 655 Computational Fluid Dynamics 3 credit hours

This course provides an introduction to numerical methods for solving the exact equations of fluid dynamics. Finite difference methods are emphasized as applied to viscous and inviscid flow over bodies. Students are introduced to a modern computational fluid dynamics computer code. *In addition, CSE students will be required to develop and implement computer codes to solve simple fluid mechanics problems.* Prerequisites: MATH 332, MEEN 415 or MEEN 416.

MEEN 716 Finite Element Methods

This course covers fundamental concepts of the finite element method for linear stress and deformation analysis of mechanical components. Topics include the development of truss, beam, frame, plane stress, plane strain, axisymmetric isoparametric, solid, thermal, and fluid elements. ANSYS and NASTRAN software will be used for solving practical stress analysis problems. *In addition, CSE students will be required to develop and implement computer codes to solve simple problems in linear elasticity.* Prerequisite: Consent of instructor.

PHYS 791 ENGG7X1 CHEM7X1 BIO7X1 MATH791 COMP7X1 Interdisciplinary Computational Science Group Project, 3 credit hours (May be repeated)

Students will work on two or three projects to develop software tools and programs for scientific and engineering applications in a high performance computing environment. Project topics are normally chosen from engineering and scientific applications and involve areas across disciplines, including aspects of scientific visualization, code optimization, etc. The objective is also to develop a cross disciplinary environment and a group approach in successfully developing, implementing and optimizing a scientific and engineering application in a modern, scalable computing environment. Lectures will be given on available computational environments, code development, and implementation of parallel algorithms, and software maturity models. The emphasis is going through a complete software development and maturation cycle in a scalable computing environment. Project reports and oral presentations will be required.

Graduate Seminar in CSE

<u>CSE XXX 1 credit hour (new)</u>
Student will also be required to take one credit seminar course (based on the CES seminar series) for graduation. This will be a cross listed seminar course with one credit hour on S/U basis.
CSE Thesis: <u>CSE XXX (3 – 6 credit hours</u>) (may be repeated)
A total of 6 thesis credit hours are required for graduation. This will be a cross listed thesis credit.
CSE Project: CSE XXXX 3 credit hours (may be repeated)
A total of 3 project credit hours are required for the project option. This will be a cross listed project credit.

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.

    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.

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

    D. Explain how the program will affect faculty activity, including course load, public service activity, and scholarly research.

A. Following faculty members will be involved in the proposed program. The detailed resumes are attached in Appendix A.

    Dr. Ajit Kelkar
    Dr. Guoquin Tang
    Dr. Ram Mohan
    Dr. Vinayak Kabadi
    Dr. Anna Yu
    Dr. Derrek Dunn
    Dr. Ji Y. Shen
    Dr. Marlow Hinton
    Dr. Millie Worku
    Dr. Roger Gagnon
    Dr. Solomon Bililign
    Dr. Radhakrishnan

B. It is estimated that additional two faculty members will be needed for the proposed program over the first four years. The teaching responsibilities for the proposed program will be absorbed in part by the present faculty. Most of the courses offered in the proposed program are already taught by the faulty from various departments listed above. Only difference is the courses taught by them will be cross-listed under the proposed program. The two new faculties will teach some of the new proposed courses planned.

C. The employment of two new faculties requires additional funds and provost has agreed to provide two new faculty positions for the proposed program.

D. The proposed program will have almost no effect on the current faculty activity, including course load, public service activity, and scholarly research. It is expected that the proposed program will attract additional research funds and in turn there will be additional release time that will be available to hire adjunct faculty members and post doctoral fellows.

V.   **Library**

A. Provide a statement as to the adequacy of present library holdings for the proposed program.
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?
C. Discuss the use of other institutional libraries.

The Ferdinand Douglass Bluford Library is named for the fifth President of the institution. The four level building contains 153,428 square feet. The costs for additional library holdings will also be absorbed by the five participating college/school library purchase allowances. The NC A&T library resources accessible to graduate students exceed 600,000 volumes. The current holdings include more than 390,000 bound volumes, 2,000 serial subscriptions, and, as a selected depository in North Carolina for United State government documents, the library contains a collection of over 211,800 official government publications. In addition, the library contains a superior collection in videotapes, microfilms and other audiovisuals. Graduate students can also check out books or obtain copies of articles from other University of North Carolina System libraries through interlibrary loan. Individual research groups can purchase additional reference books and subscribe to professional journals through their external funding, and personal subscriptions.

VI   Facilities and Equipment

A. Describe facilities available for the proposed program.
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.
C. Discuss any information technology services needed and/or available.
D. Discuss sources of financial support for any new facilities and equipment.

The facilities needed for this program are mainly faculty and student offices, computer labs and high performance parallel and scalable computing facilities, all of which are reasonably available on campus. Additional office space needs due to the growth of student population and the addition of faculty will be provided by the University through its building plan via the bond program.

University-wide computing equipment and software purchase and/or upgrade costs are covered by state appropriation and student fees. College, school and department level computing facilities are normally set up and maintained through external grants. The five participating colleges/schools and almost all science, engineering, mathematics, technology and business departments all have their own computer laboratories for undergraduate and graduate education and research and have network access to the University, and state-wide computing facilities. All computers are linked using Ethernet running TCP/IP. In addition, faculty have networked personal computers running Windows 2000/XP and/or Linux, Sun, IBM, or SGI Workstations for research and instruction needs. In addition, there are a large variety of software systems and tools available on various platforms such as main frame UNIX computers, DEC SGI or SUN file servers or workstations, and PCs operated and maintained by the University's Information Technology & Telecommunications (IIT). All campus buildings currently are fully wired with 10/100 Mb/s coaxial or 1 Gb/s fiber optic network. The University has 22 personal computer laboratories in 12 buildings across the campus, which is wired to the Internet and is for student use. ITT provides client services, systems and software networking and instructional and research computing services to the University. All of these computing facilities provide the basis on which to integrate scientific computation with graduate instructional and research programs in science, engineering, and technology.

The following research and high performance computing facilities offer additional resources to the infrastructure of the proposed CSE program.
- Engineering Computer Center-McNair Hall
- Arts and Sciences Computational Science Laboratory-Marteena Hall
- 18-node 36-processor IBM Linux cluster-Fort IRC
- 32-processor SGI 3900 shared memory system-Fort IRC
- Center for Composite Materials Research-Fort IRC
- Center for Advanced Materials and Smart Structures-Fort IRC
- Institute for Human-Machine Studies-McNair Hall
- Center for Autonomous Control and Information Technology-Fort IRC
- National Institute of Aerospace-Fort IRC
- Center for Electronics Manufacturing-Smith Hall
- Geographic Information System Laboratories-Sockwell Hall and Carver Hall
- Applied Geophysical Science Laboratories-Wendover Building
- Physical Laser Laboratory-Fort IRC
- Bioinformatics Learning Facility, School of Agriculture
- Microarray Facility, School of Agriculture

The program capitalizes on its collaborative relationships with university partners, such as DOD and DOE national labs, NASA research centers, the high performance computing industry including IBM, Cray,

SGI, and Sun Microsystems, and the National Center for Supercomputing Applications. Other equipment needs will also be supplemented through proposals for major instrumentation grants to NSF, DOD and other agencies.

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 Management

The proposed program management is structured as follows:

Program Director

A Program Director (PD) will be appointed to manage the program. The Provost in consultation with the Dean of Graduate Studies and the other academic deans will make the initial appointment. The PD reports directly to the Dean of Graduate Studies. The PD will have similar responsibilities to a department chair and manage the budget and resources, including faculty positions assigned to the interdisciplinary master's program. The PD in concert with the faculty, track coordinators, as well as with input from the Program Steering Committee, will make teaching assignments for the program.

Program Steering Committee

The Program Steering Committee (PSC) will consist of faculty appointed by the deans of Graduate Studies, Agricultural and Environmental Sciences, Arts and Sciences, Business and Economics, Engineering, and Technology. The Program Steering Committee will be chaired by the PD. The PSC will provide leadership and program development as well as administrative and fiscal oversight.

Program External Advisory Board

An External Advisory Board will be established to provide advice on program development and implementation as well as to promote the program. The composition of the board membership will have a broad representation in academia, industry, community organizations, and national labs. The board will offer guidelines to the design and implementation of this program to ensure the value of our graduates to industry and national labs, and keep the faculty aware of future changes in the workplace that might influence the needs and potential of our graduates. The board will be chaired by the Vice Chancellor for Research and Economic Development and is expected to meet at least once a year.

Track Coordinators

A coordinator will be appointed for each CSE track. A track coordinator will assist the PD to facilitate administrative matters such as course and curriculum revision, program promotion, resource allocation, teaching assignment, and student supervision arrangement for the track he or she chairs.

Recruitment and Outreach Coordinator

A recruitment and outreach coordinator (ROC) for the CSE program will be appointed by the Dean of Graduate Studies, and will be responsible for student recruitment, retention, and placement, and keeping track of graduates and networking with them. In addition, the ROC will be responsible for industry and community outreach, and maintain contact with other graduate programs in computational and engineering science, and funding agencies. The ROC will serve as the executive secretary for the Program External Advisory Board.

Program Faculty

The program faculty will have joint appointments with the proposed interdisciplinary master's program with the School of Graduate Studies and a disciplinary department. In accordance with the NC A&T Faculty Senate's newly-approved Guidelines for Joint Appointments, faculty holding these joint appointments have the opportunity and the mechanism to progress through tenure and promotion through the academic ranks. The PD and the PSC will provide input from the interdisciplinary program for any discussions of promotion and tenure.

Program Courses

The curricula for the proposed interdisciplinary CSE master's program will include selected existing courses from established programs and new courses to be established for the interdisciplinary program. The new courses will carry a prefix consistent with the proposed master's program name; existing courses will be cross-listed. Student credit hours associated with the new courses will be used to establish faculty positions and other budgets. Sample curricula consistent with the Program Description are under development and will be included in the Implementation Proposal.

Program Budget

The initiation of the CSE interdisciplinary program is a substantial undertaking requiring careful planning. It is a serious task that will require the best of coordination and articulation between administration and faculty. In addition, a substantial commitment must be made in several categories of resources and substantial efforts will have to be made in attracting new students and in retaining greater numbers of current students who have the potential to complete CSE graduate degrees. The burden of implementing a CSE program must include a detailed schedule and plan for resources for new faculty positions, graduate assistantships, library holdings, travel and supply funds, laboratory and computer development funds, graduate student office space, and graduate student tuition waivers especially to attract American citizens into the program. The first page of the budget provides the number of new faculty positions, the number of graduate teaching assistantships, and the projected budget for travel, supplies, laboratory and computer equipment, and library holdings to meet program requirements for the first operational year. These funds represent new allotments for the first year, second year, and third year for the CSE program $180,000, $220,000, and $260,000, respectively. As indicated, substantial support is anticipated by enrollment increases and through other sources, primarily through various businesses. Enrollment increases anticipated by the university are in keeping with increases in recent years for the University as a whole and reallocations from other academic programs are not anticipated. While the initiation of the CSE program carries a substantial financial burden both to initiate and to sustain, it is of enormous intrinsic value to the state and nation in providing educational enhancement opportunities for students and in stimulating contributions to public technological development.

In addition, there is a prospect for increased research in other programs, particularly those related to CSE, due to the synergistic actions and activities of the CSE program, different research centers and interdisciplinary faculty. The University will be enhanced in other ways as well. While the needs and resource commitments are formidable, more support is expected from sources outside the university as well. An additional source of strength to North Carolina A&T State University has been the ability to attract corporate personnel to serve as visiting faculty for teaching, administrative and technical support. Both anticipate continued success in acquiring personnel support to serve this program.

Visiting faculty could be of enormous assistance in one of two general roles, a) covering lower level courses so that current faculty can devote time to administrative needs such as final planning and implementation activities required to initiate the CSE program, and b) initiating new graduate courses such as those required for CSE program execution. Visiting faculty can also be useful in areas where

their specific research interests and talents can assist in research projects. It is anticipated that corporate personnel support may be extended further with the increasing emphasis in industry of promoting community service and early retirements.

Other potential corporate personnel support includes visiting technicians who could provide assistance in maintaining current computational facilities and in developing new research laboratories which support master level research work.

It is also possible that corporate support can be sustained for an endowed research chair within the priority areas related to CSE. Such a position would be of great benefit in attracting additional faculty with national and international reputations to join our faculty either permanently or as part of a faculty interchange and external sabbatical program. Such persons would provide substantial leadership to research endeavors and in charting new research and academic initiatives.

A final source of potential support from corporate benefactors is scientific equipment. Such gifts greatly assist faculty in executing quality research. In addition, such grants help satisfy cost-sharing requirements of some agencies for research and developmental purposes. Computer equipment also helps supplement sometimes scarce funds in state budgets. Both the University through its Division of Research and the research centers through their contacts will work to secure additional contract research and industrial support and subscriptions. The University will further assist the program by providing a substantially larger return on contract research overhead to the colleges/schools and departments. In addition, teaching loads for participating faculty will be reduced to stimulate additional contract and grant research and to compensate for teaching loads and dissertation direction in support of the Ph.D. program. Faculty will also engage additional research associates and post-doctoral fellows to assist further in the execution of larger projects.

With an enrollment of up to 20 annually, there will be an enormous indirect cost in accommodating such a number of students. A series of offices for CSE students will be needed in stages of about ten new ones each year for the first four years of operation. This burden must be met with the university through its building program. Federal research funds, the principal source of support for most CSE programs, routinely are not available for such overhead items. The University will also furnish additional offices for three new faculties

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.

North Carolina A&T State University is already accredited by SACS to offer Masters Program. There are no other accrediting agencies that accredit programs at this level.

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?

The subject matter fields in college of engineering, college of arts and sciences, schools of technology, business and agricultural sciences are necessary and valuable in support of the proposed interdisciplinary program. The proposed program will greatly improve through new faculty in computational science and engineering areas in these colleges and schools. Faculty with expertise, experience and exposure to the domain areas and computational sciences with prior experience in high end and scalable computing will greatly benefit the proposed program. The proposed interdisciplinary program will involve faculty associated with different departments. The enhancement of computational science and engineering emphasis and addition of new faculty will greatly benefit this program. The University in its Futures vision areas of computational sciences and engineering areas has been investing in high performance computing infrastructure, along with plans for focused hiring including faculty associated with multiple departments to develop a truly collaborative and interdisciplinary environment that would support the university mission focus and the proposed program.

X   Additional Information

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

The capacity of NC A&T to offer the Master's in Computational Science and Engineering is excellent, and the need for such a graduate degree program is great. As a HBCU, North Carolina A&T State University has played a unique role in North Carolina by providing underserved and underprivileged populations with access to higher education. NC A&T enrolls the largest number of African Americans in the University of North Carolina System and has consistently produced the highest number of minority baccalaureate degrees in the sciences, mathematics, engineering, and technology in North Carolina [18], and the third highest number in the nation [19]. Establishing a Computational Science and Engineering Master's Degree Program at NC A&T will significantly increase access to and enhance the quality of CSE graduate education to minority students to help fill the gap in the growing area of CSE. The program will educate, train and graduate under-represented professionals in computational science and engineering, especially African Americans. As the first standalone CSE graduate degree program in the State of North Carolina and among HBCUs in the nation, this new CSE master's program will enhance the presence of the University in the areas of computational science and engineering.

University Benefits

The University will benefit in many ways from this new degree program. It will provide research and professional development opportunities for its faculty with collaboration with CSE master's students, CSE programs at other institutions, national labs and research centers, and high performance supercomputing community and industry. The program will attract students from a variety of disciplines with experience in industry, business, education, and government. The CSE program will also encourage enrollment of women and minority students such as Hispanics, Caucasians, Asian and Native Americans. The planning and development of the computational science and engineering program and the enrollment of diversified student populations are directly linked to the University's Enrollment Plan to increase the population of graduate students, nontraditional students and working professionals, to increase participation of women in pursuing degree studies and career paths in science, engineering and technology, and to increase the presence of minority students on campus.

Geographical Benefits

North Carolina A&T State University is located in central North Carolina with easy access from interstates I85 and I40 and national highways. It is physically in the center of the state and can be reached by students from all areas in North Carolina in a few hours.

XI   Budget

Provide estimates (using the attached form) of the <u>additional costs</u> 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 <u>unusual</u> 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.

SUMMARY OF ESTIMATED ADDITIONAL COSTS FOR PROPOSED PROGRAM/TRACK

INSTITUTION _____ *DATE* _____
Program (API #, Name, Level) _____
Degree(s) to be Granted _____ *Program Year* _____

ADDITIONAL FUNDS REQUIRED - BY SOURCE

	Reallocation of Present Institutional Resources	Enrollment Increase Funds	Federal Other (Identify)	New Allocations	Total
101 Regular Term Instruction					
1210 SPA Regular Salaries (Identify positions)	$_____	$_____	$_____	$_____	$_____
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
1310 EPA Academic Salaries	$_____	$_____	$_____	$_____	$_____
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
1810 Social Security	$_____	$_____	$_____	$_____	$_____
1820 State Retirement	$_____	$_____	$_____	$_____	$_____
1830 Medical Insurance	$_____	$_____	$_____	$_____	$_____
2000 Supplies and Materials (Identify)	$_____	$_____	$_____	$_____	$_____
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
3000 Current Services (Identify)	$_____	$_____	$_____	$_____	$_____
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)
4000 Fixed Charges (Identify)	$_____	$_____	$_____	$_____	$_____
	(_____)	(_____)	(_____)	(_____)	(_____)
	(_____)	(_____)	(_____)	(_____)	(_____)

	( )	( )	( )	( )	( )
5000 Capital Outlay (Equipment) (Identify)	$_____	$_____	$_____	$_____	$_____
	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )
	( )	( )	( )	( )	( )
TOTAL - Regular Term Instruction	$_____	$_____	$_____	$_____	$_____
151 Libraries					
(Identify accounts)	$_____	$_____	$_____	$_____	$_____
	_____	_____	_____	_____	_____
	_____	_____	_____	_____	_____
	_____	_____	_____	_____	_____
	_____	_____	_____	_____	_____
TOTAL - Libraries	$_____	$_____	$_____	$_____	$_____
TOTAL ADDITIONAL COSTS . . .	$_____	$_____	$_____	$_____	$_____

NOTE: Accounts may be added or deleted as required.

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.

Program Evaluation Format

    .   Criteria to be used to evaluate the proposed program and
    .   Measures to be used to evaluate the program:

Several criteria will be used to evaluate the proposed program. First one is the retention rate and the graduation rate. At the end of the two years of the program percentage of the number of students graduating as compared to the number of students entered two years prior will be calculated. Also typical length of average graduation time will be evaluated. The second criterion that will be used is the research productivity and scholarly work. The number of refereed publications and number of research proposal submitted and funded will be monitored. Furthermore how many of the graduate students who finished Masters program at A&T got accepted for doctoral program at other institutions will be monitored. Lastly the graduating students employment after they get MSE Master's degree will be monitored. In particular whether the employment is in the filed of MSE or closely related area will be monitored.

C. Projected productivity levels (number of graduates):

Level	Year 1	Year 2	Year 3	Year 4	TOTALS
B					
M		7	12	15	34
I/P					
D					

(Key: B-Bachelor's, M-Master's, I/P-Intermediate or Professional, D-Doctoral)

D. Recommended consultant/reviewers: Names, titles, addresses, e-mail addresses, and telephone numbers. May not be employees of the University of North Carolina.

An external committee will oversee and provide guidance on the proposed M.S. graduate program in computational science and engineering. This committee consists of members from federal agencies, university faculty and computing industry. The currently identified members of this external computational science and engineering committee are:

- Dr. Geoffrey Fox, Professor, Department of Compute Science, Indiana University
- Dr. Mary Wheeler, Professor, Computational Sciences, University of Texas at Austin
- Dr. Satya Atluri, Professor, Department of Mechanical Engineering, University of California at Irvine.
- Dr. Thomas Zachariah, Associate Laboratory Director, Computing and Computational Sciences Directorate, Oak Ridge National Laboratory

- Dr. I. S. Raju, Senior Technologist, Structures and Materials Competency, NASA Langley Research Center.
- Dr. Andrew Mark, Program Manager, Common High Performance Computing Software Support Initiative, Department of Defense High Performance Computing Modernization Program

E. Plan for evaluation prior to fifth operational year.

At the end of the first four years of the program external reviewers will be invited to evaluate the strength and weaknesses of the program.

APPENDIX A

Participating Faculty Resume

AJIT D. KELKAR
Mechanical Engineering Department
North Carolina A&T State University,
Greensboro, NC 27411
(336) 334-7620 x 324, E-mail: **kelkar@ ncat.edu**

EDUCATION:

Ph.D., Engineering Mechanics	Old Dominion University, Norfolk, Virginia	1985
M.S., Mechanical Engineering	South Dakota State University, South Dakota	1981
B.S., Mechanical Engineering	Poona University, Poona, India	1975

ACADEMIC EXPERIENCE:

Associate Director, Center for Advanced Materials and Smart Structures	May 2003-present
Professor, NC A&T State University	July 1996-present
Associate Professor, NC A&T State University	July 1989-June 1996
Assistant Professor, NC A&T State University	August 1985-June 1989
NASA Doctoral Research Fellow, NASA Langley Research Center	August 1981-July1985
Graduate Research Assistant, South Dakota State University	August1980-July 1981
Graduate Teaching Assistant, South Dakota State University	August1979-July 1980

INDUSTRIAL EXPERIENCE:

Quality Control Engineer, TELCO, Poona, India	February 1979 - July 1979
Sales/Application Engineer, Cummins Diesel Sales and Service	January 1977-January 1979
Assembly Manager, Kirloskar Cummins Limited, Poona, India	September 1975-December 1977

CONSULTING EXPERIENCE:

Safety Systems Inc., Salisbury, NC
Volvo, Greensboro, NC
CRS Technologies, Greensboro, NC
Aqualine Inc., Winston-Salem, NC
Thomas Built Buses, High Point, NC
Swanson Analysis Systems Inc. (ANSYS), Pittsburgh
CASI, Inc, Urbana, Illinois
North State Pyrophyllite Inc., Greensboro, NC
Turner Woodworks Inc., NC
Actinic Inc., Greensboro, NC
University of Illinois, Computer Science Department, Illinois
Sherwin Williams, Greensboro, NC
Purolator, Greensboro, NC
Tensar Corporation, Atlanta
Concave Research Center, Montreal, Canada

RESEARCH AREAS:

Low Cost Composite Manufacturing (VARTM Processing)
Mechanical Characterization of Materials including Metals, Polymeric Composites (Tape and Textile), Ceramics and Ceramic Composites.
Computer Aided Design and Modeling, Finite Element and Finite Difference Modeling, Numerical Analysis
Fatigue and Impact Modeling and Testing of Polymeric Composites, Ceramic Composites, Textile composites
Micromechanics Modeling and Testing, Single Fiber Modeling and Testing
Atomistic Modeling and Nano Engineered Materials, Thin Film Coatings

COURSES TAUGHT:

MEEN 335 - Statics	MEEN 336 - Strength of Materials
MEEN 337 - Dynamics	MEEN 346 - Strength of Material Lab
MEEN 564 - Engineering Design	MEEN 574 - Senior Design Project
MEEN 612 - Composite Materials	MEEN 602 - Advanced Strength of Materials
MEEN 614 - Engineering Modeling	MEEN 716 - Introduction to Finite Element Method
MEEN 618 - Numerical Analysis	MEEN 789 - Theory of Plates and Shells
MEEN 574 - Senior Design Project	MEEN 885.01 - Advanced Finite Element Method

MEEN 885.02 - Computational Methods In Mechanics

RESEARCH PROJECT PARTICIPATION :

- "Analysis of Structural Materials using Semi-atomistic Modeling", NASA Langley Research Center, $50,000, 6/2003-5/2004, **Kelkar, Ajit D. (PI)** and Craft, W. J. (Co-PI)

- "Feasibility Study of Airbag for Vehicular Impact, Phase 1", Safety Systems Inc., NC, $15,000, 10/2002-3/2003, **Kelkar, Ajit D. (PI)**

- "Sensor Network Architectures for distributed Information Extraction, Interpretation and Decision Making", CREST-NSF, $750,000, 3/03-3/07, Sankar, J. (PI) and **Kelkar, Ajit D., et al (Co-PI)**

- "Multifunctional Materials, Structures and Sensors for Homeland Security", Army Research Office, $1,895000, 4/03-3/08, Sankar, J. (PI) and **Kelkar, Ajit D., et al (Co-PI)**

- "Characterization of Structural Behavior and Properties of Braided Composites", FAA, $606,633 9/2001-8/2004, **Kelkar, Ajit D. (PI)**

- "Performance Evaluation and Modeling of Affordable Damage Tolerant Composites", NASA Headquarters, $300,000, 4/2002-3/2005, **Kelkar, Ajit D. (PI)**

- "Effect of Temperature on Fatigue Behavior of Riveted Joints and Adhesively Bonded Joints", Thomas Built Buses, $15,500, 5/02-8/03, **Kelkar, Ajit D. (PI)**

- "Aircraft Survivability of Affordable Composites", Air Force Research Laboratory, $150,000, 11/99-12/02, **Kelkar, Ajit D. (PI) and** Sankar, J. (Co-PI)

- "Center for Advanced Materials and Smart Structures"; CREST-NSF; $3,750,000; 5/02-5/07, Sankar, J. (PI) and **Kelkar, Ajit D., et al (Co-PI)**

- **"**Structural Performance of Affordable Composites for Stealthy Naval Ships"; Office of Naval Research, $1,660,000, 8/02-7/05, Shivakumar, K. (PI) and **Kelkar, Ajit D., et al (Co-PI)**

- **"**High Temperature Mechanical and Micro structural Characteristics of Ceramic Materials"**,** Lockheed Martin Energy Systems, 10/01-9/02**,** Sankar, J. (PI) and **Kelkar, Ajit D., et al (Co-PI)**

- A Pulsed Laser Deposition Facility for The Synthesis Of Novel Surface Engineered And Electronic Ceramic Materials, Army Research Office, $200,000, 06/00, Sankar, J. (PI), and **Kelkar, Ajit D. et al (Co-Pis)**

- "An Experimental and Analytical Investigation of Continuous Fiber Matrix Composites Coated for High survivability," Air Force Research Laboratory, $247,552, 11/99 – 08/02, (PI: D. Pai, Co-PIs: J. Sankar & **Kelkar, Ajit D.**)

- "Comparative Study of Riveted Joints vs Adhesively Bonded Joints", Thomas Built Buses, $26,500, 9/99-8/02, **Kelkar, Ajit D. (PI)**

- "NASA Research Into Undergraduate Education"; NASA Headquarters; $2,500,000; 7/98-6/03; Monroe, J. (PI), **Kelkar, Ajit D.** (Research Co-PI) and Cheek Eric (Education-Co-PI)

- "Intelligent Resin Transfer Molding for Integral Armor Applications"; DoD U. S. Dept. of Army; $800,000; DAAH04; 9/95-9/01, **Kelkar, Ajit D., (PI),** and Sankar J. (Co-PI)

- "Center for Advanced Materials and Smart Structures"; CREST-NSF; $5,000,000; 9/97-8/01, **Sankar, J. (PI) and Kelkar, Ajit D., et al (Co-PI)**

- "Analysis of Composites Subjected to Low Velocity Impact Loading"; Wright Laboratories, WPAB; $504,084; F33615-90-C-3207; 9/91-12/97, **Kelkar, Ajit D., (PI),** and Sankar J. (Co-PI)

- "Tensile Test Development for the High Performance Geotextile Reinforcements"; Tensar Corp.; Morrow, GA; $6,000; 9/96-12/97, **Kelkar, Ajit D., (PI),** and Sankar J. (Co-PI)

- "The Effect of Sample Test Volume and Geometry on the Tensile Characteristics of Continuous Fiber Ceramic Composites"; Department of Energy; $100,000; DE-FG-5-930R22119; Sankar J., (PI), and **Kelkar A. D., (Co-PI).**

- "High Temperature Mechanical and Microstructural Characteristics of Ceramic Materials"; Lockheed Martin Energy Systems; Oak Ridge, TN; $500,000; 19X-89687C; 10/95-12/97; Sankar J., (PI), and **Kelkar A. D., (Co-PI).**

- "A New Mechanistic Constitutive Model for High Temperature CMC's Under Monotonic and Cyclic Loading"; NASA-Lewis RC; Cleveland, OH; $50,000;NAS3-27767; 10/95-12/96; Sankar J., (PI), and **Kelkar A. D., (Co-PI).**

- "A New Mechanistic Constitutive Model for High Temperature CMC's Under Monotonic and Cyclic Loading"; NASA-Lewis RC; Cleveland, OH; $60,000;NAS3-96055;11/96-11/97; Sankar J., (PI), and **Kelkar A. D., (Co-PI).**

- "Development of Frontal Barrier and Moving Frontal Barrier Finite Element Models," National Highway Traffic Safety Administration, Washington D. C., September 1994-

October 1996; $75,000; DTNH22-94-G-0740; **Kelkar, Ajit D. (PI),** and Mark Schulz (Co-PI)

- "Finite Element Analysis of School Bus Seat," Thomas Built Buses, High Point, North Carolina, July 1992 to July 1993; $ 6,538; **Kelkar, Ajit D. (PI),** Craft, W. J., and Lai, H. (Co-PI)

- "3-D Micromechanical Finite Element Analysis of Composites," North Carolina Supercomputing Center, MCNC, Research Triangle Park, NC, February 1993 - February 1994, 100 Cray Y-MP hours; **Kelkar Ajit D. (PI)**

- "Analysis of Composite Laminates Subjected to Low Velocity Impact Loading," North Carolina Supercomputing Center, MCNC, Research Triangle Park, NC, October 15 1993 - December 31, 1993, 50 Cray Y-MP hours; **Kelkar Ajit D. (PI)**

- "Fracture Toughness Studies of High Strength Materials," Martin Marietta Energy Systems, Inc., February 1989 to January 1992; $100,000; 19Y-HB686C; **Kelkar, Ajit D., (PI),** and Sankar J. (Co-PI)

- Travel Grant for 1991 ASEE Conference, New Orleans, Minority Institute Research Travel, Oak Ridge Associate Universities, U. S. Department of Energy, 1991, $ 1,116; **Kelkar, Ajit D. (PI)**

- "Investigation of Micro-Damage in Composites by Ultrasound," Battelle Pacific Northwest Laboratories, July 1988 to June 1989; $20,000; Contract No. B-U5868-A-N; **Kelkar, Ajit D. (PI)** and Dayal, Vinay (Co-PI)

- "A New Mechanistic Constitutive Model For High Temperature CMCs Under Monotonic and Cyclic Loading", NASA Lewis Research Center, October 1995-September 1996, $100,000, NRA-95-LeRC1; Sankar, J. (PI), and **Kelkar, Ajit D. (Co-PI)**

- "Mechanical Properties Testing of Ceramic Fiber-Ceramic Matrix Composites"; Martin Marietta Energy Systems, Inc.; Department of Energy; March, 1989 to December, 1993; $200,000; 19X-SC423V; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "High Temperature Fatigue-Creep Tension Characteristics of Silicon Nitride; "Martin Marietta Energy Systems, Inc.; Department of Energy; November, 1990 to September, 1994; $400,000, 19X-89687C; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "Testing and Mechanical Properties Characterization of New High Temperature Materials," Naval Air Development Center; Department of Navy, PA; September, 1990 to August, 1994; $330,270, N62269-90-C-0268; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "High Temperature Creep and Cyclic Behavior of PY6-Silicon Nitride at Elevated Temperature, Martin Marietta Energy Systems; Department of Energy; October, 1993 to September, 1994; $200,000; 19X-89687C; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "Effect of Sample Size and Finish on the Tensile Characteristics of Continuous Filament Ceramic Composite'; U.S. Department of Energy; September, 1993 to September, 1995; $200,000, DE-FG05-930R22119; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "Mechanical Behavior Investigation of Advanced Ceramic Matrix Composite Materials"; U.S. Air Force Office of Scientific Research (AFOSR); September 1993, to September 1994; $139,410; F49620-93-1-0573; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**.

- "High Temperature Uniaxial Creep of Silicon Nitride Materials" Martin Marietta Energy Systems, Inc., Department of Energy, November 1989 - October 1990; $200,000; 19x89687C; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "Mechanical Properties Testing of Ceramic Fiber-Ceramic Matrix Composites," Martin Marietta Energy Systems, Inc., Department of Energy, March 1989 to December 1993; $200,000; 19X-SC423V; Sankar, J. (PI) and **Kelkar, Ajit D., (Co-PI)**

- "Testing and Evaluation of Dynamic Tensile Properties of Magnesium Based Metal Matrix Composite Materials," Battelle, Pacific Northwest Laboratories, February 1987 to September 1987; $25,000; B-Q7260-A-P; Sankar, J. (PI), Avva, V. S., and **Kelkar, Ajit D., (Co-PI)**

- "Micro/Macro Studies of Fiber-Reinforced Composite Materials," Office of Naval Research/URIP, September 1986 to September 1991, $2,207,337, N00014-86-K-0682; Avva, V. S. (PI), Filatovs, J., Kabadi, V., **Kelkar, Ajit D.,** Sadler, R, and Sankar, J. (Co-PI)

- "Room Temperature and High Temperature Tension Characteristics of Silicon Nitride," Martin Marietta Energy Systems, Inc., November 1987 to October 1988; $200,000; 19X-89687C; Sankar, J. (PI), Avva, V. S., and **Kelkar, Ajit D., (Co-PI)**

- "Uniaxial Elevated Temperature Behavior of SNW-1000 Si_3N_4 Ceramic System" Martin Marietta Energy Systems Inc., Department of Energy, October 1988 - October 1989; $200,000; 19x-89687-C; Sankar, J. (PI), Avva, V. S., and **Kelkar, Ajit D., (Co-PIs)**

PRINCIPAL PUBLICATIONS:

- Jitendra S. Tate, **Ajit D. Kelkar** and John Rice, "Feasibility Study of VARTM Manufacturing of Carbon Biaxial Braided Composites using EPON 9504 Epoxy Resin System", JISSE-8, proceedings of the 8th International SAMPE Symposium & Exhibition, Tokyo, 18-21 November 2003
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- **Kelkar, Ajit D.,** Sankar, J., Raju, I. S., Vaidyanathan, K. R.; "Analysis of Ceramic Matrix Composites Using a Plain Weave Classical Laminate Theory," *First Canadian International Composites Conference*., Montreal, pp. 578-585, September 1992, Elsevier Publishers.

- Pai, D. M., and **Kelkar, Ajit D.,** "Hygrothermal Behavior of Paper, "*Proceedings of ASEE Annual Conference*, Vol. 1, pp. 248-251, New Orleans, LA, June 1991.

- **Kelkar, Ajit D.**, Bo, Z., and Sankar, J., "Effect of Delaminations on the Flexural Behavior of Circular Quasi-Isotropic Laminates Under Point Loading," Proceedings of the International Conference on Advances in Structural Testing, Analysis and Design, Vol. 1, pp. 17-22, Bangalore, India 1990.

- **Kelkar, Ajit D.,** Sadler, R. L. and Sankar, J., "Introduction to Fabrication, Processing and Testing of Fiberglass Composites in Undergrad. Mech. Eng. Curriculum.", 1990, *ASEE SE Section Proceedings*, Charlotte, N.C., 56-58, 1990.

- Sankar, J., **Kelkar, Ajit D.,** and Vaidyanathan, K. R.; "Mechanical Properties and Testing of Ceramic Fiber-Ceramic Matrix Composites, *Proceedings of the 5th Annual Conference on Fossil Energy Materials*, published by ASM, pp. 85-95, (1991).

- **Kelkar, Ajit D.** and Sankar, J., "Large Deflection Behavior of Circular Composite Plates Using Quasi Linearization Technique," *Proceedings of the 1988 ASME International Computers in Engineering Conference*, Vol. 3, August 1988, pp. 13-18.

- **Kelkar, Ajit D.,** Sankar, J., Avva, V. S. and Sinha, A., "Nonlinear Flexural response of Graphite Fiber Reinforced Glass Matrix Composite Beams*," Analytical and Testing Methodologies for Design with Advanced Materials*, G. C. Sih, J. T. Pindera, and S. V. Hoa, Editors, Elsevier Science Publishers, pp. 261-269, 1988.

- Avva, V. S., Sankar, J., **Kelkar, Ajit D.,** and Chander, P., "Effect of Fatigue Loading on Graphite Fiber-Reinforced Glass Matrix Composite Material," *Analytical and Testing Methodologies for Design with Advanced Materials*, G. C. Sih, J. T. Pindera, and S. V. Hoa, Editors, Elsevier Science Publishers B. V. (North-Holland), pp. 161-171, 1988.

- **Kelkar, Ajit D.,** Hooks, L. E., and Knofzynski, C., "Comparative Study of Methanol, Ethanol, Isopropanol, and Butanol as Motor Fuels, Either Pure or Blended with Gasoline," *Proceedings of the 23rd Intersociety Energy Conversion Engineering Conference*, Vol. 4, August 1988, pp. 381-386, ASME Paper No. 889358.

- Sankar, J., **Kelkar, Ajit D.,** Sinha, A., and Vaidyanathan R., "Room and Elevated Temperature Fractography of Si3N4 Tested Under Pure Tension*," Proceedings of the International Symposium on Testing and Failure Analysis*, ISTFA 1988., ASM Paper, pp. 343-353.

- **Kelkar, Ajit D.,** and Chandraiah, V. B., "Large Deflection of Thin Rectangular Plates Using Quasi Linearization Finite Element Technique," Published by Society of Engineering Sciences, Inc., Paper No. ESP 24.87031, pp. 1-10, 1987.

- Sankar, J., **Kelkar, Ajit D.,** Sinha, A., and Liu, K. C., "Strength and Fatigue of Silicon Nitride in Uniaxial Tension," *Proceedings of the 26th Automotive Technology Development Contractors Coordination Meeting, Dearborn Michigan,* October 1988, pp. 173-186

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- **Kelkar, Ajit D.,** Elber, W., and Raju, I. S., "Large Deflection Behavior of Circular Quasi-Isotropic Laminates Under Point Loading," AIAA Journal, Vol. 25, No. 1, 1987, pp. 99-106.

- **Kelkar, Ajit D.**, Elber, W., and Raju, I.S., "Large Deflections of Circular Isotropic Membranes Subjected to Arbitrary Axisymmetric Loading, " *Journal of Computers and Structures*, Vol. 21, 1985, pp. 413-421.

- **Kelkar, Ajit D.,** Elber, W., and Raju, I. S., "Large Deflections of Circular Isotropic Membranes Subjected to Arbitrary Axisymmetric Loading", *NASA Technical Memorandum 86271*, August 1984.

PUBLICATIONS – OTHER:

- Kelkar, Ajit D., " Finite Element Analysis of School Bus Seat Structures", Final Report, Thomas Built Buses Inc., 1993
- Kelkar, Ajit D., " Analysis of Composite Laminates Subjected to Low velocity Impact Loading", Technical Report, Wright Laboratories, Wright Patterson AFB, Ohio, 1992
- Kelkar, Ajit D., " Fracture Toughness Studies of High Strength Materials", Final Report, Subcontract Number 19Y-HB686C, 1992
- Kelkar, Ajit D., " Investigation of Micro Damage in Composites by Ultrasound", Final Report, Contract Number 045868-A-A1, Battelle, Pacific Northwest Laboratories, October 1989
- Sankar J., Kelkar Ajit D. and S. Krishnaraj; "Testing and Evaluation of Advanced Ceramics at High Temperature in Uniaxial Tension", Ceramic Technology for Advanced Heat Engines; ORNL/TM-12363; pp. 332-339, 1993; NTIS; Dept. of Commerce Publication.
- Sankar J., Kelkar Ajit D. and R. Vaidyanathan; "Investigation of SiC/SiC Ceramic Matrix Composites Fabricated Through Forced and Isothermal CVI Processes"; The Department of Energy and Oak Ridge National Laboratory; Publication ORNL/Sub/88-SC423/01; NTIS; Alexandria, VA; 216 pages; 1993.
- Sankar J., Kelkar Ajit D. and S. Krishnaraj, "Testing and Evaluation of Advanced Ceramics at High Temperature in Uniaxial Tension," Ceramic Technology for Advanced Heat Engines, ORNL/TM-11859, pp 424-427, 1991.
- Sankar J., Kelkar Ajit D., V. S. Avva and Jun Gao, "Testing and Evaluation of Advanced Ceramics at High Temperature in Uniaxial Tension," Ceramic Technology for Advanced Heat Engines, ORNL/TM 11489, pp 433-439, 1990, Also published by NTIS, Dept. of Commerce.
- Sankar J., Kelkar Ajit D., V. S. Avva and Jun Gao, "Testing and Evaluation of Advanced Ceramics at High Temperature in Uniaxial Tension, " Ceramic Technology for Advanced Heat Engines, ORNL/TM-11586, pp 440-446, 1990, Also published by NTIS, Dept. of Commerce.
- Sankar J., Kelkar Ajit D., V. S. Avva and Jun Gao, "Testing and Evaluation of Advanced Ceramics at High Temperature in Uniaxial Tension," Ceramic Technology for Advanced Heat Engines, ORNL/TM-11719, pp 396-403, 1990, Also published by NTIS, Dept. of Commerce.
- Sankar, J. and Kelkar, A.D., Eight (8) Published Major Reports by DOE/ORNL Publication and through NTIS Publication Related to Advanced High Temperature Materials. ORNL/TM-11116, 11239, 11489, 11586, 11719, 11859, ORNL/FMP-89/2,90/2.
- Sankar, J., Avva, V. S., and Kelkar, Ajit D., " Testing and Evaluation of Dynamic Tensile Properties of Magnesium Based Metal Matrix Composite Materials", Final Report, Battelle Pacific Northwest Laboratories, 1987.
- Kelkar, Ajit D., " Analyses of Quasi-Isotropic Composite Plates Under Quasi-Static Point Loads Simulating Low-Velocity Impact", NASA Report Number NASA-CR-176485, 1984

SCIENTIFIC AND PROFESSIONAL SOCIETIES OF WHICH A MEMBER:

The American Society of Mechanical Engineers (ASME)
American Society for Aeronautics and Astronautics (AIAA)

American Society for Engineering Education (ASEE)
Society for Experimental Mechanics (SEM)
The American Society for Composites (ASC)
American Society of Metals (ASM)
Pi-Tau-Sigma The Mechanical Engineering Honor Society
Sigma-Xi The Scientific Research Society

HONORS AND AWARDS:

Session Chairman, 44th AIAA/ASME/ASCE/AHS/ASC SDM Conference, Norfolk VA, April 2003
Reviewer IMECE2003-Pressure Vessel and Piping Division, April 2003
Appointment on Material Technical Committee, AIAA, April 2003
Appointment as a Liaison for Materials TC between AIAA and ASME, April 2002
Reviewer North Carolina Super Computing Center, March 2003
Reviewer North Carolina Space Grant Competition Proposal, February 2003
Reviewer for Journal of Composites Science and Technology, January 2003
Reviewer for International Journal for Numerical Methods in Engineering, 2002
Reviewer for ASME Journal of Materials and Technology, May 2002
Second Place Award for NASA Pair Undergraduate Research, November 2002
Session Chairman, International Congress on Fatigue, Sweden, June 2002
Session Chairman 20th IMTDR, Ranchi India, December 2002
Book Reviewer for MECHANICS OF MATERIALS, 3/e, Beer, Johnston and DeWolf, McGraw Hill, 2001
Reviewer for Journal of Composites Science and Technology 01,02
Reviewer for Journal of Composite Technology and Research, 99,00,01,02
Reviewer for Journal of Engineering Materials and Technology, 00,01,02
Reviewer for ASME Journal of Pressure vessel and Technology, 98, 99, 01
Reviewer for International Journal for Numerical Methods in Engineering, 99, 00, 02
Reviewer for Prentice Hall Book - Fundamentals of Mechanical Engineering, 2000
Reviewer, AIAA Journal, 2002
Reviewer for ASTM STP 1379, 2000
Reviewer for Special Issue of Composites A (ACUN-2 Special Publications), 1999
Reviewer for ICCM-13, Beijing, China, 2001
Reviewer for Army Research Laboratory, RTP, North Carolina, 1998
Reviewer for ASME 1997 International Mechanical Engineering Congress, Dallas
Reviewer, The International Mechanical Engineering Congress and Exposition, 1994-2001
Session Chairman ICCM-13, Beijing, China, 2001
Session Chairman, The International Mechanical Engineering Congress and Exposition, 1994-2001
Member, International Advisory Board of the Fourth International Conference on Composite Engineering (ICCE/4), Hawaii, 1999
Session Organizer/Chairman for 10th ICMCM, BOSTON, 1995
Session Chairman for ASME Winter Annual Meeting, Chicago, 1994
Session Chairman, ASME Winter Annual Meeting, Anaheim, California, 1992
Session Chairman for ASME Computers in Engineering Conference, 1988.

Reviewer, Journal of Experimental Mechanics
Reviewer, Journal of Numerical Methods in Computational Mechanics
Reviewer, ASME Winter Annual Meeting, San Francisco, November, 1995
Reviewer, Journal of Experimental Mechanics, 1994
Reviewer, ASME Winter Annual Meeting, Chicago, 1994
Reviewer, ASME Winter Annual Meeting, New Orleans, 1993
Reviewer, ASME Winter Annual Meeting, Anaheim, California, 1992
Reviewer for WVU Energy Research Center, 1986.
Reviewer for ASME Twelfth Biennial Conference on Mechanical Vibrations and Noise, 1989.
North Carolina Supercomputing Center, Allocation Committee Member, NCSC, 1994-2002
Executive Committee Member, ASM, 1994
Excellence in Research Award, Mechanical Engineering department, 1993
Member, Technical Program Committee, The Canadian Society for Mechanical Engineers, 1992
Who's Who in Mechanics of Composite Materials Directory, published by Wright-Patterson Air Force Base, Ohio, 1986.
Participating faculty, in National Center for Composite Material Research, University of Illinois, Urbana Champaign, 1987.
Member of the Pentagon (DoD/ONR) University Research Program, 1986.
Member Sigma-Xi Scientific Research Society
Member Pi Tau Sigma, National Mechanical Engineering Honor Society
Recipient of NASA Langley Research Center Aero program Award for Doctoral Studies, 1981.
Certificate of Merit from Mechanical Engineering Students Assoc., 1974.
Who's Who in Micro Electronic Center of North Carolina, MCNC

GRADUATE STUDENTS SUPERVISED:

(Completed MSME degree)

B. Holakare	J. D'Costa	Chandraiyah	N. Dayananda
Ghotabi-Taheri	M. Takale	Robert Brown	S. Sankar
Z. Bo	D. Craford	S. Khaled	Jian Sun
A. Roberts	L. Dandy	R. Krishnan	S. Shenoy
R. Bollick	B. Blount		

(Completed Ph.D. degree)

J. Mussai
P. Chaphalkar
C. Grace
R. Vaidyanathan   (Ph. D. -Co-Advisor)
J. Lang   (Ph. D. -Co-Advisor)
L. Russell   (Ph. D. -Co-Advisor)

<u>Present Doctoral Students:</u>

Ron Bolick
Jitendra Tate
Dave Carmon
K. Francis
Rahul Gupta

<u>Present MSME Students:</u>

Arlene Williams
Vijay Krishnan
John Rice
John Shelton (Co-Advisor)

GUOQING TANG

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North Carolina A&T State University
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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 computational geophysics, scientific computing, and mathematical modeling in environmental assessment and control

Selected Publications

(with H.J. Sussmann) "Shortest paths for the Reeds-Shepp car: a worked out example of the use of geometric techniques in nonlinear optimal control," accepted for publication in *SIAM J. Control and Opt.*

Clemence, D. P. and G. Tang, editors (***In preparation** for AMS Contemporary Mathematics Series*) *Analytical and Numerical Approaches in Nonlinear Wave Propagation*

(with D. Clemence, C.R. Jackson, Q. Lin, V. Burbach and L. Emmanwori) "Modeling of Seismic Wave Propagation," to appear in *Analytical and Numerical Approaches in Nonlinear Wave Propagation,* D.P. Clemence and G. Tang Eds., AMS Publisher

(with A. Kong, F. Njikam and V. Burbach) "Geophysical characterization of an abandoned goldmine," in the *Proc. Symposium on the Application of Geophysics to Environmental and Engineering Problems*, San Antonio, TX, April 2003

(with Z. Wang and X. Chen) "Robust controller design for uncertain linear systems with circular pole constraints," *Int. J. Control,* **65** (6) (1996), pp. 1045-1053

6. (with Z. Wang) "Robust H_∞-control for uncertain linear discrete-time systems with variance constraints," *Control Theory and Applications*, **15** (1) (1998), pp. 39-47

1. (with Z. Wang) "Studies on multi-objective state-feedback control for linear continuous-time systems with variance constraints," *Control Theory and* Applications, **14** (2) (1997), pp. 276-282

"On the structure of optimal oscillatory trajectories for two-input driftless smooth systems in dimension three," in *Nonlinear Control Systems Design 1995,* A.J. Krener and D.Q. Mayne Eds., Pergamon, Oxford, 1995, pp. 323-328

"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,
  pp. 3400-3404

"Existence of an optimal feedback control law for time-optimal control of two-input analytic
  nilpotent systems in dimension three," in *Proc. 30th IEEE Southeastern Symposium on Systems
  Theory*, Morgantown, WV, March, 1998, pp. 275-279

(with D. Sherrill) "On the construction of an optimal feedback control law for time-optimal control
  problem for a class of two-input three-dimensional nilpotent systems," in *Proc. 33rd IEEE
  Southeastern Symposium on Systems Theory*, Athens, OH, March, 2001, pp. 245-259

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

2002-05: "A testing facility for theoretical and experimental physical acoustics," with C. Jackson and
  D. Clemence, U.S. Department of Education, $297,097

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

1999-04: "Talent 21: Gateway Advancing Science and Mathematics Talent," with C. Jackson, A. Titus,
  and A. Mohammed, National Science Foundation, $2,999,934

Invited Talks/Lectures

1. *Computer Networking and Introduction to E-Commerce*, Invited Ten-Day Lecture Series,
  Changzhou Teachers College of Technology, Chanzhou, Jiangsu, PRC, July 22-August 1, 2001

2. *Characterization of Optimal Trajectories of Control Systems on Lie Groups of Dimension
  Three,* Invited Mini-Symposium Speaker, 1999 SIAM Annual Conference, Atlanta, GA,
  May, 1999

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

6. *On the existence of a generalized optimal synthesis for linear quadratic singular optimal control
  problems with a fixed terminal point,* the 28th IEEE Southeastern Symposium on System Theory,
  Baton Rouge, Louisiana, April, 1996

Professional Affiliations

Society of Applied and Industrial Mathematics
Society of Exploration Geophysicists
American Society of Engineering Education

Graduate Student Supervised
David Sherrill, Adrian Copland, and Andrew Williams

Dr. Ram V. Mohan
Research Scientist, Center for Advanced Materials and Smart Structures
Department of Mechanical Engineering
North Carolina A&T State University

Professional and Research Interests

Composite and Nano Materials – Processing, Mechanics and Material Science, Composite manufacturing. Nano composite materials and their processing. Manufacturing simulations and virtual manufacturing. Process modeling simulations and process optimizations, experimental investigations, sensors and control for intelligent composite processing. Processing, property influences in composites. Computational multi-physics, multi-scale, multi-material physical modeling in engineering and physical applications during material processing, manufacturing, concurrent engineering process and product design. Innovative materials and materials by design, High-Performance and large-scale scientific computing. Finite element based numerical methodologies and their development. Computational engineering science and engineering Education. Project leadership and technology management.

Education

Ph. D. (Mechanical Engineering)
University of Minnesota, 1997
M. S. (Theoretical and Applied Mechanics)
University of Illinois at Urbana-Champaign, 1990
M. S. M. E. (Mechanical Engineering)
West Virginia University, 1987
B. S. with honors (Mechanical Engineering)
University of Madras, India, 1984

Current Position (August 2003 – Present)

Research Scientist, Center for Advanced Materials and Smart Structures
Department of Mechanical Engineering
North Carolina A&T State University
1601 E Market Street, Suite 242
Greensboro, NC 27411
Phone: 336-256-1151, Extn. 2272
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Email: rvmohan@ncat.edu; rvmohan@camss.ncat.edu

Courses Developed and Taught

University of New Orleans

1. Composite Manufacturing Principles II, Spring 2003. Graduate level. Developed and offered for the first time.
2. Composites Manufacturing Principles I, Fall 2002. Graduate level, On-Site and offered off-site as a real-time, distance learning, video broadcasted course.
3. Composites Manufacturing Principles I, Spring 2002. Graduate level. Developed and offered for the first time. Spring 2002.

4. Can teach undergraduate and graduate level courses in finite element methods (Introductory, Intermediate and Advanced), polymer and composite materials and processing, other traditional mechanical engineering, mechanics and material science courses. Complete listing of courses that can be developed and offered is available upon request.

Other Teaching Experience
- Undergraduate courses in Mechanical Engineering: Mechanics of Materials, Statics, Dynamics, Fluid Mechanics Laboratory, Heat Transfer at West Virginia University and University of Illinois

Graduate Students Advisement
Masters: 3, Doctoral: 1 (at University of New Orleans)
Doctoral: 1, Masters: 2 (incoming) (North Carolina A&T State University)

Educational Program Development
North Carolina A&T State University: Graduate masters program in computational science and engineering, Member, Computational Science and Engineering Committee, Working to initiate an inter-disciplinary graduate program in computational engineering and science with the computational science and engineering committee, Vice-Chancellor for Research and Economic Development, University administration, faculty and researchers in various engineering, science, technology, business and agriculture departments. Completed and submitted program planning and plan to establish a graduate masters program in computational science and engineering to University of North Carolina.

Laboratories Initiated
University of New Orleans:
26. Computational Engineering and Science Laboratory
    - Hardware and Software include: SGI Fuel V10, SGI O2+, 2 Desktop PCs, B&W and Color HP Laser Printer, Educational versions of ProE, MSC Patran, MSC Nastran, MSC Marc, Fluent, PolyFlow, FIDAP, Gambit, Tecplot, Programming and Graphical Language Compilers.
27. Composites Manufacturing Laboratory
    - Focus on Liquid Composite Molding Process. Experimental Investigations and Validations for Process Modeling and Simulation Developments. Laboratory Equipment include: Brookfield Programmable DV-II+ Digital Viscometer, Complete National Instruments Data Acquisition Hardware and Software, Dell Optiplex desktop computer for data acquisition, 2 Vacuum pumps for vacuum based LCM processes, Digital pressure controller, Pressure pots, Acculab electronic balance, SMARTweave Resin Flow Analysis System, Rotary Gear Pump, Air compressor, Digital camera recorders, Omega Industries Pressure Transducers, Dynisco Pressure Transducer, Flow Meters, Yokogawa Digital Multimeter, Vacuum Generator/Pressure Regulator, Temperature Thermocouples, Other laboratory equipment and material needed for experimental investigation of various processing related issues in liquid composite molding processes. Discussions on donation of prototype fiber preforming equipment to the laboratory from Global Composites are in progress.

Research Funding
- Scalable Computations for Non-Isothermal Composite Materials Process Modeling and Simulations of the Army Future Combat Systems Platforms, High Performance Computing Division, U. S. Army Research Laboratory, Oct. 02 – FY05. (Funded).
- Virtual Prototyping and Testing of Polymer Composite Components for Application to Future Combat Systems, U. S. Army Research Laboratory, Oct. 01 – June 03 (Funded).
- Composite Manufacturing Laboratory (funding support from Louisiana Economic Development Board).
- Investigation of Next Generation Nonlinear Numerical Solvers Approaches, Battele Scientific Services Program. (Funded).
- Integrated Composite Technologies, Office of Naval Research, Center for Nanoscience and Nanomaterials (with A. Kelkar, J. Sankar, Funded)

Proposals submitted and under review
- Acquisition of High Performance Computing Resources in Support of the Consortium for Computational Chemistry and Materials Sciences (Co-PI, with East Carolina University) NSF, MRI Program, January 2004.
- Acquisition of Scientific and Virtual Immersive Visualization System (Co-PI), NSF, MRI Program, January 2004.
- Computational Engineering Science Education and Research (CESER), Co-PI, University of North Carolina, February 2004.
- Development of Multilayered Smart Flexible Extremities Protection System, in preparation in response to ARO BAA on FY2004 HBCU/MI Centers of Excellence for Battlefield Capability Enhancements, April 2004.

Prior Professional Experience

University of New Orleans   Sept. 2001 – Aug. 2003
Assistant Professor – Research, Department of Mechanical Engineering
Composite Materials Expert, National Center for Advanced Manufacturing – Louisiana Partnership.

U.S. Army Research Laboratory/University of Minnesota
Computational Sciences and Engineering Branch, Computational and Information Sciences Directorate.
Process and Properties Branch, Weapons and Materials Research Directorate.
Aberdeen Proving Ground, MD
Research Scientist (employed through Univ. of Minnesota)   1998 – Sept. 2001
Graduate Doctoral Research Fellow   July 1994 – Dec. 1997

Army High Performance Computing Research Center
Minneapolis, MN
Research Assistant   Jan. 1991 – June 1994

Laser Sciences Inc.
Urbana, Illinois
Research Scientist   May 1990 – Dec. 1990

Dept. of Theoretical and Applied Mechanics
University of Illinois at Urbana-Champaign
Graduate Teaching Assistant   Aug. 1987 - May 1990

Department of Mechanical and Aerospace Engineering
West Virginia University
Graduate Research and Teaching Assistant   Aug. 1985 – Aug. 1987

Project Engineer, Bouruka Steel Industries, Bangalore, India   Jan. '85--Aug. '85
Magneto-hydrodynamics (MHD) Division, BHEL, India   Jan. '84--Dec. '84
National Aerospace Laboratories, Bangalore, India   Jan. '83--Feb. '83

Industrial Interactions
- Lockheed Martin Tactical Aircraft Systems, Fort Worth, Texas, 1996 – 1997.
- The Boeing Company, St. Louis, MO, 1998 – 1999.
- Lockheed Martin Skunk Works, Palmdale, CA; Sikorsky, CT, 1999.
- The Boeing Company, Mesa, AZ, 1999 – 2001 (Process modeling for RWSTD composite structural components).
- Boeing Helicopters, Philadelphia, 2001, 2002, 2003.
- Northrop Grumman, CA, 2000.
- Sikorsky Helicopters, CT, 2001, 2002.

DOD High Performance Computing Modernization Office CHSSI Initiatives
- Co-Principal Investigator, High Performance Computing in Concurrent Engineering, Modeling and Testing, Integrated Modeling and Testing Environments, 1998 – Present.
- Co-Principal Investigator, Dynamic Environments for Virtual Testing, Scalable Software Suite for Virtual Prototyping and Accelerated Testing of Systems, CHSSI initiative in System of Systems Portfolio, 2001 – Present.

Honors and Scholarships
- Reviewer and referee for International Journals:
  – Polymer Composites
  – Polymer Engineering and Science
  – Numerical Heat Transfer
  – International Journal of Heat and Mass Transfer
  – Journal of Heat and Fluid Flow
  – International Journal of Numerical Methods in Engineering
  – Computational Modeling in Engineering Sciences
  – Composites – Part A: applied science and manufacturing
  – International Journal for Numerical Methods in Fluids
  – Journal of Porous Media

- Review Panel, Rotary Wing Structures Technology Demonstration Program, Critical Design Review, October 2000.
  - Review Panel, Rotary Wing Structures Technology Demonstration Program, Preliminary Design Review, Boeing, Mesa, May 2000.
- Organizer and Reviewer, Symposium on High-Performance and Massively Parallel Computing in Integrated Modeling and Testing Analysis Environments, 1999 International Conference on Parallel and Distributed Processing Techniques and Applications, June 1999.
- Program Committee, 2000 International Conference on Parallel and Distributed Processing Techniques and Applications, June 2000.
  - Co-Chairman and Technical Reviewer, Symposium on Composites Manufacturing, ASME Winter Annual Meeting, 1996.
- Technical Reviewer, Symposium on Process Modeling and Manufacturing of Composites, International Conference on Numerical Methods in Thermal Problems, 1995.
- Associate Member, American Society for Mechanical Engineers (ASME).
- Member, American Helicopter Society (AHS).
- Graduate Research Assistantship (full-time) (Research Scholar at U.S. Army Research Laboratory), Department of Mechanical Engineering, University of Minnesota, 1995-1997.
- Graduate Research Assistantship, Army High Performance Computing Research Center, University of Minnesota, 1991-1995.
- Graduate Research and Teaching Assistantships, University of Illinois at Urbana-Champaign, 1987-1990.
- Graduate Research and Teaching Assistantships, West Virginia University, 1985-1987.
- Member, Resin Transfer Molding Working Group, Center for Composite Materials, University of Delaware.
- Advisor, Summer Institute in High Performance Computing, Army High Performance Computing Research Center, University of Minnesota, 1992-1993.
- National Merit Scholar, Government of India.

Publications

Journal Articles
- Experimental and Numerical Analysis of Flow Behavior in the FASTRAC Liquid Composite Manufacturing Process, Polymer Composites, (accepted), 2003 (with M. Allende and S. Walsh).
- A Composite Manufacturing Process Simulation Environment (COMPOSE) Utilizing Parallel Processing and Object-Oriented Techniques, J. Parallel and Distributed Computing Practice, (accepted), 2003 (with B. J. Henz, D. R. Shires).
- Optimization and Performance of a Fortran 90 MPI – Based Unstructured Code on Large Scale Parallel Systems, Journal of Supercomputing, 2003 (in press, with D. R. Shires).
- An Evaluation of HPF and MPI Approaches and Performance in Unstructured Finite Element Simulations, Journal of Mathematical Modeling and Algorithms I, pp. 153 – 167, 2002 (with D. R. Shires).
- Multi-Disciplinary Flow/Thermal and Induced Stresses in Convectively Cooled Structures, J. of Thermal Stresses, Vol. 25, pp. 319 – 339, 2002 (with W. Poon, R, Kanapady, K. Tamma).

- R. V. Mohan, N. D. Ngo and K. K. Tamma, "On a Pure Finite Element Methodology for Resin Transfer Mold Filling Simulations," Polymer Engineering and Science, Volume 39, No. 1, pp. 26 - 43, January 1999.
- S. Bickerton, R. V. Mohan, S. G. Advani and D. R. Shires, "Experimental Analysis and Numerical Modeling of Flow Channel Effects in Resin Transfer Molding," Polymer Composites, Vol. 21, No. 1, 2000.
- R. V. Mohan, D. R. Shires, A. Mark and K. K. Tamma, "Advanced Manufacturing of Large Scale Composite Structures: Process Modeling, Manufacturing Simulations and Massively Parallel Computing Platforms," Advances in Engineering Software, Volume 29, No. 3 - 6, pp. 249 - 264, Elsevier, UK, 1998.
- R. V. Mohan, D. R. Shires, K. K. Tamma and N. D. Ngo, "Flow Channels and Fiber Impregnation Studies for the Process Modeling/Analysis of Complex Engineering Structures Manufactured by Resin Transfer Molding," Polymer Composites, Vol. 19, No. 5, pp. 527 – 542, October 1998.
- N. D. Ngo, R. V. Mohan, P. W. Chung, K. K. Tamma and D. R. Shires, "Recent Developments Encompassing Non-Isothermal/Isothermal Liquid Composite Molding Process Modeling/Analysis: Physically Accurate, Computationally Effective and Affordable Simulations and Validations," Journal of Thermoplastic Composites - Special Issue on Affordable Composites, Volume 11, pp. 493 - 532, November, 1998.
- R. V. Mohan, N. D. Ngo, K. K. Tamma, D. R. Shires, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Implicit Tracking of Moving Fronts for Thick, Geometrically Complex Composites Manufacturing Applications - Part 2," Numerical Heat Transfer - Part A, Applications, Vol. 35, no. 8, pp. 839 - 858, 1999.
- R. V. Mohan, N. D. Ngo and K. K. Tamma, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Explicit Tracking of Moving Fronts for Developments for Thick, Geometrically Complex Composites Manufacturing Applications - Part 1," Numerical Heat Transfer - Part A, Applications, Vol. 35, no. 8, pp. 815 - 838, 1999.
- R. V. Mohan, A. F. Avila and K. K. Tamma, "Flux-Based Finite Volume Formulations and Adaptive Time Stepping Strategies for Modeling of Re-entry Thermal Protection Systems," Numerical Heat Transfer - Part B, Vol. 30, no. 2, pp. 117 - 136, 1996.
- R. V. Mohan, A. F. Avila, K. K. Tamma and R. R. Namburu, "Three-Dimensional Transient Thermal Analysis with Explicit Finite Element Representations - Parallel Implementations and Performance Studies: The Connection Machine (CM-5)," Numerical Heat Transfer - Part B, Vol. 28, pp. 277 - 291, 1995.
- Y. Mei, R. V. Mohan and K. K. Tamma, "Evaluation and Applicability of a New Explicit Time Integral Methodology for Transient Thermal Problems - Finite Volume Formulations," Numerical Heat Transfer - Part B, Vol. 26, pp. 313 - 333, 1994.
- X. Chen, R. V. Mohan and K. K. Tamma, "Instantaneous Response of Elastic Thin-Walled Structures to Rapid Heating," International Journal for Numerical Methods in Engineering, Vol. 37, pp. 2389 - 2408, 1994.
- R. V. Mohan and K. K. Tamma, "Finite Element/Finite Volume Approaches with Adaptive Time Stepping Strategies for Transient Thermal Problems," Sadhana - Academy Proceedings in Engineering Sciences, Vol. 19, part 5, pp. 765 - 783, 1994.

Refereed Conference Proceedings and Symposia with Presentations
1. A Parallel Computational Environment for Modeling the Resin Transfer Molding Process, 8th International Conference on Numerical Methods in Industrial Forming Processes, June 2004 (with B. Henz, D. Shires).
2. Development and Integration of Parallel Multidisciplinary Computational Software for Modeling a Modern Manufacturing Process, 6th International Meeting on High Performance Computing for Computational Science, June 2004 (with B. Henz, D. Shires).
3. Process Model Optimizations and Simulations for Net-Shape Rotary Composite Structural Components, American Society of Materials Conference, Pittsburgh, 2003, (with B. Henz and D. Shires).
4. Characterization and Analysis of Flow Behavior in the FASTRAC Process for the Manufacture of Sandwich and Core Composite Structures, SAMPE 2003, Long Beach, 2003. (with M.Allende).
5. Analysis of the Effect of Induced Distribution Network in New Resin Infusion Process Developments, 10th International Conference on Composites Engineering, 2003. (with M. Allende, S. Walsh).
6. Optimization of Resin Transfer Molding Processes with a Hybrid Global – Local Approach, 10th International Conference on Composites Engineering, 2003. (with B. Henz, D. R. Shires).
7. Process Model Optimizations and Simulations for Net-Shape Rotary Composite Structural Components, National Space and Missiles Materials Symposium, San Diego, June 2003. (with B. Henz, D. R. Shires).
8. A Composite Manufacturing Process Simulation Environment (COMPOSE) Utilizing Parallel Processing and Object – Oriented Techniques, International Conference on Parallel Processing, Vancouver, Canada, August 2002. (with B. Henz, D. R. Shires).
9. Operating System Independent Interfaces for Process Simulation Visualization and Remote Interaction, Proceedings of the 2002 International Conference on Parallel and Distributed Processing Techniques and Applications, June 2002. (with B. Henz, D. R. Shires).
10. Architecture Driven Communication Improvements for Domain Decompositions, Proceedings of the 2002 International Conference on Parallel and Distributed Processing Techniques and Applications, June 2002. (with D. R. Shires and B. Henz).
11. Experimental and Numerical Analysis of Flow Behavior in FASTRAC Liquid Composite Manufacturing Process, National Space and Missiles Materials Symposium, Colorado Springs, June 2002. (with M. Allende).
12. Development and Application of a Cross-Platform Analysis and Visualization Interface for Liquid Composite Process Modeling Simulations, National Space and Missiles Materials Symposium, Colorado Springs, June 2002. (with B. Henz, D. R. Shires).
13. The Application of Liquid Molding Simulation Tools to Structural Rotorcraft Components: Challenges and Opportunities, 9th International Conference on Composites Engineering, San Diego, July 2002. (with B. Henz, D. R. Shires, S. Walsh).
14. A Composite Manufacturing Process Simulation Environment Utilizing Parallel Processing and Object Oriented Techniques, International Conference on Parallel Processing, Vancouver, Canada, August 2002. (with B. Henz, D. R. Shires).
15. R. V. Mohan, D. R. Shires, A. Mark, W. Roy, S. Walsh, and J. Sen, "The Application of Process Simulation Tools to Reduce Risks in Liquid Molding of Composites," Proceedings of the 57th Annual Forum of American Helicopter Society, Washington, D. C., May 2001.

16. R. V. Mohan, D. R. Shires, and A. Mark, "Scalable Large Scale Process Modeling and Simulations in Liquid Composite Molding," Proceedings of the 2001 International Conference on Computational Science, Springer-Verlag Lecture Notes in Computer Science, San Francisco, May 2001.

17. D. R. Shires, R. V. Mohan, and A. Mark, "An Evaluation of HPF and MPI Approaches and Performance in Unstructured Finite Element Simulations," Proceedings of the 2001 International Conference on Parallel and Distributed Processing Techniques and Applications, June 2001.

18. D. R. Shires, R. V. Mohan, and A. Mark, "Optimization and Performance of an MPI-Based Unstructured Grid Code on Large Scale Parallel Systems," Proceedings of the 2001 International Conference on Parallel and Distributed Processing Techniques and Applications, June 2001.

19. D. R. Shires, R. V. Mohan, and A. Mark, "Improving Data Locality and Expanding the Use of HPF in Parallel FEM Implementations." Proceedings of the 2000 International Conference on Parallel and Distributed Processing Techniques and Applications (PDPTA), June 2000.

20. S. M. Walsh and R. V. Mohan, "Sensor-Based Control of Flow Fronts in Vacuum-Assisted RTM," Plastics Engineering, Vol. LV, No. 10, 1999.

21. S. M. Walsh and R. V. Mohan, "Study of Staggered Flow Fronts with Applications to Sensor-Based Control," 57th Annual Technical Meeting of the Society of Plastic Engineers, Vol. 2, pp. 2681--2685, May 1999.

22. M. Rooney, P. J. Biermann, B. G. Carkhuff, D. R. Shires and R. V. Mohan, "Development of in-process RTM Sensors for Thick Composite Sections," 1998 American Control Conference, Philadelphia, PA, June 1998.

23. K. K. Tamma, R. V. Mohan, N. D. Ngo and P. W. Chung, "Finite Element Methods and Flow/Thermal Modeling and Analysis: Process Modeling and Porous Media Effects in Composites Manufacturing," Proceedings of the 10th International Conference on Finite Elements in Fluids, Tucson, AZ, January 1998.

24. R. V. Mohan, S. Bickerton, D. R. Shires, S. G. Advani and K. K. Tamma, "Analysis and Characterization of Flow Channels During Manufacturing of Composites by Resin Transfer Molding," Proceedings of the 55th Annual Technical Meeting of the Society of Plastic Engineers: ANTEC 97, Vol. 2, pp. 2388 - 2400, Toronto, Canada, April 1997.

25. R. V. Mohan, N. D. Ngo, K. K. Tamma, D. R. Shires and K. D. Fickie, "Process Modeling and Implicit Tracking of Moving Fronts for Three-Dimensional Thick Composites Manufacturing," AIAA-96-0725, 34th Aerospace Sciences Meeting, Reno, NV, January 1996.

26. R. V. Mohan, D. R. Shires, K. K. Tamma and N. D. Ngo, "Flow Channels and Fiber Impregnation Studies for the Process Modeling/Analysis of Complex Engineering Structures Manufactured by Resin Transfer Molding," ASME 96-WA/AMD-5, Proceedings of the 1996 ASME International Mechanical Engineering Congress & Exhibition, Atlanta, GA, November 1996.

27. R. V. Mohan, N. D. Ngo, K. K. Tamma and K. D. Fickie, "On a Pure Finite Element Methodology for Resin Transfer Mold Filling Simulations," Session on Process Modeling and Manufacturing of Composites, Proc. of Numerical Methods in Thermal Problems, Vol. IX, pp. 1287-1310, Pineridge Press, Swansea, England, July 1995.

28. R. V. Mohan, N. D. Ngo, K. K. Tamma and K. D. Fickie, "Data Parallel Finite Element Computations for Resin Transfer Mold Filling Manufacturing Simulations on the Connection Machine System," Proceedings of the special session on process modeling and manufacturing of composites at the Symposium for Numerical Methods for Thermal Problems, Vol. IX, pp. 1361 - 1377, Pineridge Press, July 1995.

29. R. V. Mohan, Y. Mei and K. K. Tamma, "An Explicit Unconditionally Stable Adaptive Time Stepping Strategy with Applications to Finite Volume Based Thermal Analysis Formulations," Proceedings of the ASME-JSME Thermal Engineering Joint Conference, Vol. 1, pp. 531-540, ASME, New York, 1995.

30. R. V. Mohan, R. R. Namburu and K. K. Tamma, "A Data Parallel Explicit Sub-Cycling Time Integration Strategy for Computational Heat Transfer," 93-WA/HT-82, ASME Winter Annual Meeting, New Orleans, November 1993.

31. R. V. Mohan and K. K. Tamma, "Flux Based Finite Volume Representations for Thermal Problems," AIAA 93-2770, AIAA 28th Thermophysics Conference, Orlando, FL, July 1993.

32. R. R. Namburu, R. V. Mohan, F. Rostam-Abadi and K. K. Tamma, "Data Parallel Multi-Time-Step Time Integration for Computational Heat Transfer," AIAA 28th Thermophysics Conference, Orlando, FL, July 1993.

33. R. V. Mohan and K. K. Tamma, "Finite Element/Finite Volume Approaches with Adaptive Time Stepping Strategies for Transient Thermal Problems," AIAA 93-0593, AIAA 31st Aerospace Sciences Meeting, Reno, NV, January 1993.

34. X. Chen, R. V. Mohan and K. K. Tamma, "Instantaneous Response of Elastic Thin-Walled Structures with Arbitrary Open Cross Sections to Rapid Heating," AIAA 92-2544, AIAA 33rd Structures, Structural Dynamics and Materials Conference, Dallas, TX, April 1992.

Government Publications and Presentations

1. Optimizing the resin transfer molding process with sensitivity analysis and genetic algorithms, Army Science Conference, 2002, Orlando, FL. (with B. Henz and D. R. Shires).

2. Coupled Flow-Thermal Scalable Software Developments for Liquid Composite Molding Processes: Preliminary Results, DOD High Performance Computing Users Group Conference, Seattle, June 2003. (with B. Henz, D. R. Shires).

3. Parallel Computing Enables Streamlined Acquisition for Composite Materials, DOD Mission Success Stories from High Performance Computing, DOD High Performance Computing Modernization Office, 2002. (with B. Henz, D. R. Shires).

4. Scalable Performance and Application of CHSSI software COMPOSE for composite material processing, High Performance Computing Users Group Conference, 2002. (with D. R. Shires and B. Henz).

5. R. V. Mohan, et al., "Resin Impregnation Process Simulations Joint Strike Fighter (JSF) Aerospace," DOD Mission Success Stories from High Performance Computing, Report by the DOD High Performance Computing Modernization Office, Director of Defense Research and Engineering, Office of Secretary of Defense, 2000.

6. D. R. Shires, R. V. Mohan, and A. Mark, "Strategies and Experiences Using High Performance Fortran," U. S. Army Research Laboratory Technical Report, ARL-TR-2437, March 2001.

7. R. V. Mohan, D. R. Shires, S. Walsh, A. Mark, and W. Roy, "Application of Process Modeling and Simulations in Army Rotary Wing Composite Structural Developments,"

Proceedings of the 2001 DOD High Performance Computing User Group Conference, Biloxi, MS, June 2001.

8. D. R. Shires, R. V. Mohan and A. Mark, "A Discussion of Optimization Strategies and Performance for Unstructured Computations in Parallel HPC Platforms," Proceedings of the 2001 DOD High Performance Computing User Group Conference, Biloxi, MS, June 2001.

9. D. R. Shires, R. V. Mohan, and A. Mark, "A Study of Parallel Software Development using HPF and MPI for Composite Process Modeling Simulations and their Applications to Composites Affordability." Proceedings of the 2000 DOD High Performance Computing User's Group Conference, Albuquerque NM, June 2000.

10. D. R. Shires, R. V. Mohan, et al., "Computational Techniques and Parallel Software Development for Large-Scale Composite Manufacturing Simulations," Proceedings of DOD HPC Modernization Office Meeting, Monterey, CA, June 1999.

11. A. Mark, R. V. Mohan, and K. K. Tamma, "Integrated Modeling Technology for Process Simulation and Modeling of Large Composite Structures," DOD Mission Success Stories from High Performance Computing - Report by the DOD High Performance Computing Modernization Office, Office of the Secretary of Defense, Director of Defense Research and Engineering, 1998.

12. R. V. Mohan, D. R. Shires, A. Mark and K. K. Tamma, "Manufacturing Process Flow Modeling of Large Scale Complex Composite Army Structures: Computational Techniques and Applications," 21st Army Science Conference - Science & Technology for Army After Next, presented at the conference, proceedings pp. 211 - 216, 1998.

13. N. D. Ngo, R. V. Mohan, K. K. Tamma and D. R. Shires, "Finite Element Techniques for the Analysis of Transport Phenomena During Composites Manufacturing," 21st Army Science Conference - Science & Technology for Army After Next, presented at the conference, proceedings pp. 711 - 716, 1998.

14. A. Mark, R. Kanapady, R. V. Mohan, and K. K. Tamma, "Computational Strategies and Approaches for Integrated Modeling Technology on High Performance Computing Platforms: Process Modeling Simulations," 21st Army Science Conference - Science & Technology for Army After Next, presented at the conference, proceedings pp. 199 - 204, 1998.

15. D. R. Shires, R. S. Fink and R. V. Mohan, "Scientific Visualization and User Interfaces in Composite Manufacturing Simulations," U. S. Army Research Laboratory Technical Report, ARL-TR-1790, September 1998.

16. A. Mark, R. V. Mohan, and K. K. Tamma, "An Integrated Modeling Technology for Process Simulation of Structural Composites on HPC Environments," Proceedings of DOD HPC Modernization Meeting, San Diego, CA, June 1997.

17. R. V. Mohan, N. D. Ngo, K. K. Tamma and K. D. Fickie, "On a Pure Finite Element Based Methodology for Resin Transfer Mold Filling Simulations," U. S. Army Research Laboratory Technical Report, ARL-TR-975, March 1996.

18. R. V. Mohan, N. D. Ngo, K. K. Tamma and K. D. Fickie, "Three-Dimensional Resin Transfer Molding Process: Developments for Thick Composites Manufacturing Applications," U. S. Army Research Laboratory Technical Report, ARL-TR-1050, April 1996.

Technical Reports
1. R. V. Mohan, N. D. Ngo and K. K. Tamma, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Explicit Tracking of Moving Fronts for Thick Geometrically Complex Composites Manufacturing Applications – Part 1," University of Minnesota Supercomputing Institute Research Report, UMSI 98/184, November, 1998.
2. R. V. Mohan, N. D. Ngo, K. K. Tamma and D. R. Shires, "Three-Dimensional Resin Transfer Molding: Isothermal Process Modeling and Implicit Tracking of Moving Fronts for Thick Geometrically Complex Composites Manufacturing Applications – Part 2," University of Minnesota Supercomputing Institute Research Report, UMSI 98/185, November, 1998.
3. N. D. Ngo, R. V. Mohan, P. W. Chung, K. K. Tamma and D. R. Shires, "Developments Encompassing Non-Isothermal/Isothermal Liquid Composite Process Modeling/Analysis: Computationally Effective and Affordable Simulations and Validations," University of Minnesota Supercomputing Institute Research Report, UMSI 97/205, October, 1997.
4. R. V. Mohan, A. F. Avila and K. K. Tamma, "Flux-Based Finite Volume Formulations and Adaptive Time Stepping Strategies for Modeling of Re-entry Thermal Protections Systems," University of Minnesota Supercomputing Institute Research Report, UMSI 96/203, October 1996.
5. X. Chen, R. V. Mohan, and K. K. Tamma, "Instantaneous Response of Elastic Thin-Walled Structures with Arbitrary Open Cross Sections to Rapid Heating," University of Minnesota Supercomputing Institute Research Report, UMSI 93/79, 1993; Army High Performance Computing Research Center, Preprint 93-0250.

Invited Presentations, Talks and Lectures
1. Scalable Computing Applications on NC Grid, MCNC, February 2004.
2. SOS-3 Alpha Review, Department of Defense High Performance Computing Modernization Office, U. S. Army Research Laboratory, May 2003.
3. "Scalable Process Modeling and Simulation in Liquid Composite Molding," Department of Mechanical Engineering, University of Vermont, April 2003.
4. SOS-3 SAT Review, Department of Defense High Performance Computing Modernization Office, U. S. Army Research Laboratory, July 2002.
5. IMT-4 Compose Beta Review, Department of Defense High Performance Computing Modernization Office, U. S. Army Research Laboratory, October 2001.
6. "Net-Shape Composite Process Modeling and Intelligent Processing," College of Engineering, University of New Orleans, November 2000.
7. "Process Modeling and Intelligent Processing for Net-Shape Composite Structures," Computational and Informational Sciences Directorate, U. S. Army Research Laboratory, September 2000.
8. "Process Modeling and Intelligent Processing for Net-Shape Structural Composite Manufacturing," Materials Division, Air-Force Research Laboratory, Wright-Paterson Air-Force Base, Dayton, Ohio, May 2000.
9. "Intelligent Net-Shape Composite Processing," PSG College of Technology, India, January 2000.
10. "Net-Shape Structural Composite Processing," Indian Institution of Engineers, Indian Institute of Metals, BHEL, India, December 1999.

11. "High Performance Computing Applications in Integrated Modeling and Testing Within Simulation Based Acquisition," 5th US National Congress on Computational Mechanics, Boulder, CO, August 1999.
12. "Mid-Laminate In-Process Pressure Sensing in RTM/VARTM Applications," Invited presentation at International Conference on On-Line Sensing and Control for Liquid Molding of Composite Structures, Annapolis, MD, April 1999.
13. Invited participant, "Workshop on Graph Partitioning and Applications: Current and Future Directions," AHPCRC, Minneapolis, October, 1999
14. " Large Scale Resin Transfer Molding (RTM) Process Flow Simulations and Massively Parallel Processing (MPP) Platforms," RTM Focus Group Meeting, Center for Composite Materials, University of Delaware, 1997.
15. " Resin Transfer Molding - A pure finite element methodology for flow modeling" and "Effect of Channels in RTM Molds," RTM Focus Group Meeting, Center for Composite Materials, University of Delaware, 1995.

Conference Presentations
1. R. V. Mohan, D. R. Shires, and A. Mark, "Large Scale Composite Manufacturing Process Modeling Simulations on Parallel Computers: Data parallel versus MPI based approaches for parallel software development." Extended abstract, 5th National Symposium on Large-Scale Analysis, Design, and Intelligent Synthesis Environments, Williamsburg VA, October 13, 1999.
2. A. Mark, R. V. Mohan and D. R. Shires, "Integrated Modeling and Testing in a Simulation Based Environment," Invited presentation at the Workshop on Recent Advances in Computational Structural Mechanics and High Performance Computing, U. S. Army Corps of Engineers, Waterways Experiment Station (CEWES), Vicksburg, MS, November, 1998.
3. R. V. Mohan, D. R. Shires, A. Mark and K. K. Tamma, "Advanced Manufacturing of Large Scale Composite Structures: Process Modeling, Manufacturing Simulations and Massively Parallel Computing Platforms," 4th NASA National Symposium on Large Scale Analysis and Design on High Performance Computers and Workstations, Williamsburg, VA, October, 1997.
4. N. D. Ngo, R. V. Mohan, P. W. Chung, K. K. Tamma and D. R. Shires, "Developments Encompassing Non-Isothermal/Isothermal Liquid Composite Molding Process Modeling/Analysis: Computationally Effective and Affordable Simulations and Validations," 1997 ASME International Mechanical Engineering Congress and Exposition, Dallas, TX, November, 1997.
5. R. V. Mohan, A. F. Avila and K. K. Tamma, "Flux-Based Finite Volume Formulations and Adaptive Time Stepping Strategies for Modeling of Re-entry Thermal Protection Systems, AIAA 94-0246, AIAA 32nd Aerospace Sciences Meeting, Reno, NV, January, 1994.
6. R. V. Mohan, A. F. Avila, K. K. Tamma and R. R. Namburu, "Three-Dimensional Transient Thermal Analysis with Explicit Finite Element Representations – Parallel Implementations and Performance Studies: The Connection Machine (CM-5)," AIAA 94-2000, 6th AIAA/ASME Joint Thermophysics and Heat Transfer Conference, Colorado Springs, June, 1994.
7. Y. Mei, R. V. Mohan and K. K. Tamma, "Evaluation and Applicability of a New Explicit Time Integral Methodology for Transient Thermal Problems – Finite Volume Formulations, AIAA 94-0127, AIAA 32nd Aerospace Sciences Meeting, Reno, NV, January, 1994.

8. R. V. Mohan, N. D. Ngo, K. K. Tamma and K. D. Fickie. "Three-Dimensional Resin Transfer Molding Process Simulations: Computational Developments and Issues," Third U.S. National Congress on Computational Mechanics, Dallas, June 1995.

9. R. R. Namburu, R. V. Mohan and K. K. Tamma. "Recent Experiences and Trends in Computational Structural Dynamics Applications to the CM-5," 2nd US Congress on Computational Mechanics, Washington, D.C., August 1993.

10. R. R. Namburu, R. V. Mohan, K. K. Tamma, R. Beck and R. Garcia, "Partitioned and Adaptive Self-Starting Explicit Strategies for Computational Structural Dynamics (CSD): Data Parallel Implementation," AIAA 93-1329, AIAA/ASME/ASCE/AHS 34th Structures, Structural Dynamics, Materials Conference, La Jolla, CA, April 1993.

Government, Industry Presentations and Technical Shows

1. COMPOSE Demonstration, Defense Manufacturing Conference, November 2002.

2. COMPOSE Demonstration, Defense Manufacturing Conference, November 2001.

3. Composite Process Modeling Simulations and Applications, Boeing Helicopters, Philadelphia, September 2001.

4. R. V. Mohan, "Composite Process Modeling – An Overview and Recent Applications," Sikorsky Helicopters Technical Exchange Visit, April 2001.

5. "Composite Process Modeling – High Performance Computing and Applications," Contributed Presentation to Basic Research Director for DDR&E, April 2001.

6. Principal Investigator and Contributor, Composite Process Modeling, Manufacturing Technology Objective (MTO) initiative.

7. "Process Modeling Applications to Rotary Wings Structures Technology Demonstration Program (RWSTD)," Contributed Presentation to manufacturing technology MANTECH Program Review, April 2001.

8. R. V. Mohan, "Composite Process Modeling," Visiting Research Panel from South Dakota School of Mines and Technology, ARL, October 2000.

9. D. R. Shires, R. V. Mohan and A. Mark, "Large Scale Composite Manufacturing Process Simulations for Parallel Computers," ARL MSRC, TARDEC DC, ARDEC Workshop on High Performance Computing, November 30, 1999.

10. R. V. Mohan and D. R. Shires, "Process Flow Modeling of Keel Head Geometry." White paper prepared for the Boeing Company, St. Louis, June 1999.

11. "Resin Impregnation Process Modeling for Boeing RWSTD Components," Draft Report for Boeing, Mesa and AMRDEC, October 2000.

12. D. R. Shires, R. V. Mohan and A. Mark, "Parallel Software Development using HPF: Experiences and Techniques in Using the Language and Compilers on HPC Systems." 1999 DOD High Performance Computing User's Group Conference, Monterey CA, June 1999.

13. R. V. Mohan, "Overview of Resin Impregnation Process Simulations in Resin Transfer Molding Processes and Applications to Lockheed Risk Reduction Article," Technical presentation to Lockheed Martin Skunk Works, CA, August 1999.

14. "U. S. Army Research Laboratory: Research Efforts in Intelligent Composite Processing," Work featured and presented for Process and Properties Branch, Weapons and Materials Research Directorate, U. S. Army Research Laboratory at the Defense Manufacturing Conference, New Orleans, December 1998.

15. Technical Presentation to Boeing-Sikorsky on composite process modeling capabilities in support of Rotary Wings Structural Technology Demonstration Program and Manufacturing Technology Objective Initiatives, November 1998, March 1999.
16. Composite Process Modeling of RAH-66 Comanche, RTM Process Simulations of Thick Composites Applications to CAV, Supercomputing 98, Orlando, FL.
17. High Performance Computing in Integrated Modeling and Test Environments: Composite Process Modeling Applications, AIAA 37th Aerospace Sciences Meeting and Exhibit, Reno, NV, January 1999.
18. Technical discussion and presentation to Concurrent Engineering Corporation, Johnstown, PA, August 1998.
19. S. M. Walsh, W. O. Ballata and R. V. Mohan, "Affordable Fabrication of Multi-functional Composite Materiel," Defense Manufacturing Conference, December 1997.
20. "Resin Transfer Molding Process Simulations," Technology Transfer Initiative investigations with Lockheed-Martin Tactical Aircraft Systems, Fort Worth, Texas, September 1997.
21. "Composite Manufacturing Process Simulations: Overview of the Research and Development Program at the U. S. Army Research Laboratory", Presented to Boeing-Sikorsky and United Technologies Composite Manufacturing Team, Boeing-Sikorsky Helicopter Division, Stamford, Connecticut, March 1997.
22. "Virtual Manufacturing Simulations for Composite Material Processing," Briefing to The Technical Coordination Program (TTCP) international review panel Committee consisting of NATO participating countries.
23. "U. S. Army Research Laboratory: Research Efforts in Composite Process Modeling, Work featured and presented for Process and Properties Branch, Weapons and Materials Research Directorate, U. S. Army Research Laboratory at the Defense Manufacturing Conference, Miami Beach, Miami, December, 1996.
24. "U. S. Army Research Laboratory: Research Efforts in Resin Transfer Molding," Represented Advanced Simulation and High Performance Computing Directorate, U. S. Army Research Laboratory at the Defense Manufacturing Conference, Dallas, Texas, November 1995.
25. "Virtual Manufacturing: Streamlined Acquisition," Represented Advanced Simulation and High Performance Computing Directorate, U. S. Army Research Laboratory at Association of U. S. Army Conference (AUSA), Washington, D.C., October, 1995.
26. Numerous technical and program review briefings to the senior scientists, engineers and senior management at U. S. Army Research Laboratory and to other visiting personnel.

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(i) Professional Preparation:
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

(ii) Appointments:
July 2002 to July, 2003: NRC Senior Research Associate, U.S. Army Research
                                         Laboratory, Aberdeen, Maryland
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 (under Prof. William
       A. Steele)

(iv) Synergistic Activities:
(a) Played a major role in the initiation and development of B.S. and M.S. chemical engineering
      programs at NCA&T.
(b) Have conducted numerous funded research projects for a total funding of over $5 million, with a
      very high success ratio of proposals funded to proposals submitted.
(c) Served as the project director of a major $3.5 million project (FAST Center) funded by the Air Force
      Office of Scientific Research (AFOSR).
(d) Have published over thirty papers in refereed journals in the area of fundamental and applied
      thermodynamics and computer simulations of chemical systems

(v) Collaborators and Affiliations:
(e) Collaborators and co-editors:
Dr. Betsy M. Rice, Research chemist, Weapons and Materials Research Directorate, ARL (NRC
      supervisor July, 2002 to July, 2003)
Dr. G. A. Uzochukwu, co-editor, Proceedings of the 2002 National Conference on
      Environmental Science and Technology, Greensboro, NC, September, 2002, Battelle Press.
(f) Graduate and post-doctoral advisors:
Dr. William Gill, M.S. thesis advisor, SUNY, Buffalo.
Dr. Ronald P. Danner, Ph.D. thesis co-advisor, Penn State University
Dr. William Steele, Ph.D. thesis co-advisor and post-doctoral supervisor, Penn State University
(c) Thesis advisor for 27 M.S. ChE students, 8 of which were minority students,
      involved 20 undergraduate students in research, including 18 minority students.

Vinayak N. Kabadi (Detailed Record of Performance)

RESEARCH PROPOSALS FUNDED:

1. **V.N. Kabadi** (PI), "Thermodynamics of Heavy Coal Liquids", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22-86PC90541, $ 154,835, 9/1986- 8/1989.

2. V.S. Avva, G.J. Filatovs, Y. Goswami, **V.N. Kabadi** (Co-PI), A. Kelkar, Y. Klimkowski, Ray, R.L. Sadler, J. Sankar, "Micro/Macro Studies of Fiber Reinforced Composite Materials", Of- fice of Naval Research, Grant No. N00014-86-K-0682, $2.25 million, 9/1986-8/1991.

3. T. Bardakci, F.G. King, T. Faley, **V.N. Kabadi** (Co-PI 9/1988-8/1990, PI 9/1990-2/1993), "Experimental and Theoretical Investigation of Diffusion Through Porous Media", National Science Foundation - RIMI program, Grant No. HRD-8804227,$ 297,371, 9/1988 - 2/1993.

4. **V.N. Kabadi** (PI), "A Thermodynamic Model for Calorimetric and Phase Coexistence Prop- erties of Coal Derived Fluids", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22-89PC89762, $ 100,000, 9/1989 - 3/1992.

5. **V.N. Kabadi** (PI), "Characterization Studies of Coal Derived Liquids", U.S. Department of Energy, Subcontract from Clark Atlanta University, Grant No. DE-FG22-89PC89793, $ 8,880, 9/1989 - 8/1990.

6. L. Ting, **V.N. Kabadi** (PI 9/1990 - 12/1991), "Species Transport Across Polymerized Vesicle Membranes", National Science Foundation, Grant No. CTS-8810283,$ 80,000, 9/1989 - 12/1991.

7. L. Ting, **V.N. Kabadi** (PI 9/1990 - 8/1993), "Reclamation of Electronic Materials from Xe- rographic Scraps", U.S. Department of Interior, Bureau of Mines, Grant No. G0299001, $112,158, 9/1989 - 8/1993.

8. **V. N. Kabadi** (PI), "A Study of the Effect of Enhanced Oil Recovery Agents on the Quality of Strategic Petroleum Reserve Crude Oil", U.S. Department of Energy, Grant No. DE-FG22-90PC90283, $ 12,800, 9/1990 - 9/1991.

9. **V.N. Kabadi** (PI), "Chromatographic Characterization of Coal and Petroleum Liquids", Exxon Corporate Research Center, $ 6,500, 1/1991 - 8/1992.

10. **V.N. Kabadi** (PI), S. Ilias, "Thermodynamic and Rheological Properties of Solid-Liquid Sys- tems in Coal Processing", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22-91PC91300, 9/1991 - 3/1995.

11. **V.N. Kabadi** (PI), "Improvement of Hydrogen solubility and Entrainment in Hydrocracker Feedstocks", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22-92MT92020, $ 198,114, 9/1992 - 3/1996.

12. S.Y. Chang, **V.N. Kabadi** (Co-PI), J. Kumar, "Solar Detoxification of Organic Pollutants", Sandia National Laboratory, $ 50,000, 6/1993 - 5/1995.

13. J. C. Chen, **V.N. Kabadi** (Co-PI), "Ignition Rate Measurement of Laser Ignited Coals", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22- 94MT94012, $ 199,400, 9/1994 - 8/1997.

14. **V.N. Kabadi** (PI), J.C. Chen, "High Temperature High Pressure Thermodynamic Measurements for Coal Model Compounds", U.S. Department of Energy, Pittsburgh Energy Technology Center, Grant No. DE-FG22-95PC95214, $ 199,991, 9/1995 - 8/1998.

15. **V. N. Kabadi** (PI), K. Schimmel, S.Y. Chang, "Air Force FAST Center for Environmental Remediation, Fate and Transport of Hazardous Chemicals", U.S. Air Force Office of Scien- tific Research, Grant No. F49620-95-1-0514, $ 3.35 million, 9/1995 - 8/2001.

16. M. Taggart, S.Y. Chang, **V.N. Kabadi** (Co-PI), "Identifying and Prioritizing Toxic Release Inventory", U.S. Army Industrial Operations Command, Contract No.DAAA09-96-P-0062, $48,653, 9/96 - 1/97.

17. **V. N. Kabadi** (Co-PI), R. Carbonell, and J. DeSimone (Co-Directors), " Center for Environmentally Resposnsible Solvents and Processes", NSF-STC Multi-Institutional (UNC-Chapel Hill, NC State, NC A&T, and UT Austin) Center, $ 18 million, 11/2000 to 11/2005.

18. **V.N. Kabadi** (PI), "Heat of Dissolution Measurements for CO_2 in Mixed Alkanolamine Solvents", U.S. Department of Energy, National Energy Technology Laboratory, Grant No. DE-FG26-03NT41912, $196,000, 9/2003 - 9/2006.

SPECIAL GRANTS BROUGHT TO THE UNIVERSITY:

1. F.G. King, **V.N. Kabadi** (Co-PI), "Enhanced Instruction in Chemical Process Dynamics and Control", National Science Foundation, $ 32,000, Grant No. CSI-8650813, 1986 - 1989

2. H. L. Martin, W. Crigler, T. Wilder, **V.N. Kabadi** (Co-PI), "Facility Enhancement for UNIX- Based Computer Aided Instruction", AT&T University Equipment Donation Program, $120,000 (equipment), 1989-1990

3. **V. N. Kabadi** (PI), D.A. Dillon, "Development of Networked Facilities for CAD Applications", AT&T University Equipment Donation Program, $250,000 (equipment), 1990-1991

4. F.G. King, T. Bardakci, **V.N. Kabadi**(Co-PI), "Curriculum and Laboratory Development in Chemical Engineering", Department of Education, Title III program, $180,194, 1988

5. **V.N. Kabadi** (PI), "Development of research computational facility and student reference library in Chemical Engineering Department", Exxon Research and Engineering Company, $13,000, 1988

6. **V.N. Kabadi** (PI), L. Carmichael (Co-PI), "Toxicity Evaluation of Organic Materials using Microtox System", Instrumentation Grant for Microtox System from AZUR Environmental, $10,000, 1997.

PROFESSIONAL ORGANIZATIONS:

1. American Institute of Chemical Engineers (AIChE) - Member

2. Americal Chemical Society (ACS) - Member

3. Society of Petroleum Engineers (SPE) - Member

JOURNAL PUBLICATIONS:

1. M. R. Doshi, W.N. Gill, **V.N. Kabadi**, "Optimal Design of Hollow Fiber Modules", AIChE J. 23, 765 - 768, 1977.

2. **V.N. Kabadi**, M.R. Doshi, W.N. Gill, "Radial Flow Hollow Fiber Reverse Osmosis: Experiments and Theory", Chem. Eng. Commun. 3, 339-365, 1979.

3. **V.N. Kabadi**, R.P. Danner, "Nomograph Solves for Solubilities of Hydrocarbons in Water", Hydrocarbon Processing, 58, 245-246, 1979.

4. **V.N. Kabadi**, R.P. Danner, "Modified Soave-Redlich-Kwong Equation of State for Phase Equilibria of Water-Hydrocarbon Systems", Ind. Eng. Chem. Process Des. Develop., 24, 537- 541, 1985.

5. **V.N. Kabadi**, W.A. Steele, "Simulation Study of the Melting for Diatomic Molecules with Quadrupolar Interactions", J. Phys. Chem., 89, 743-747, 1985.

6. **V.N. Kabadi**, W.A. Steele, "Simulation Study of Rotational and Translational Dynamics of Diatomic Molecules with Quadrupolar Interactions", J. Phys. Chem., 89, 1467-1473, 1985.

7. **V.N. Kabadi**, W.A, Steele, "Molecular Dynamics of Fluids: The Gaussian Overlap Model", Ber. Bunsenges. Phys. Chem., 89, 2-9, 1985.

8. **V.N. Kabadi**, W.A. Steele, "Statistical Mechanics of Non Spherical Molecules: Spherical Harmonic Expansions on Non-Spherical Surfaces", Ber. Bunsenges. Phys. Chem., 89, 9-16, 1985.

9. **V.N. Kabadi**, "Molecular Dynamics of Fluids: The Gaussian Overlap Model II", Ber. Bunsenges. Phys. Chem., 90, 327-332, 1986.

10. **V.N. Kabadi**, "Statistical Mechanics of Non-Spherical Molecules: Spherical Harmonic Ex- pansions on Non-Spherical Surfaces II Gay-Berne Gaussian Overlap Potential", Ber. Bunsenges. Phys. Chem., 90, 332-339, 1986.

11. **V.N. Kabadi**, W.A. Steele, "Isobaric and Isothermal Molecular Dynamics Simulations of Diatomic Systems", Moleculat Simulation, 4, 371-398, 1990.

12. S.S. Ramsinghani, **V.N. Kabadi**, "Thermodynamics of Coal-Derived Fluids 1. Phase Equilibria in Multi-Ring Aromatic Compounds", Fuel, 72, 1039-1045, 1993.

13. L. Srinivasan, **V.N. Kabadi**, "Thermodynamics of Coal-Derived Fluids 2. Vapour-Liquid Equilibria of Coal Liquid Fractions", Fuel, 73, 715-722, 1994.

14. N.P. Vaidyanathan, **V.N. Kabadi**, R. Vaidyanathan, R.L. Sadler, "Surface Treatment of Car- bon Fibers Using Low Temperature Plasma", J. Adhesion, 48, 1-24, 1995.

15. **V.N. Kabadi**, "Thermodynamics of Coal Derived Fluids 3. VLE and Heat Capacities of Coal Liquid Fractions", Fuel, 75, 363-372, 1996.

16. J.S. Wang, **V.N. Kabadi**, "Generalized Method for Prediction of Saturated Liquid Volumes Using Modified Rackett Equation and Van der Waals Volumes", AIChE J., 42, 595-598, 1996.

17. M Palakkal, **V.N. Kabadi**, "Viscosity of Coal Derived Liquids   1. A Group Contribution Method for Pure Model Compound Liquids", Energy & Fuels, 10, 333-340, 1996.

18. **V.N. Kabadi**, M. Palakkal, "Viscosity of Coal Derived Liquids 2. Application of the Model to Coal Liquid Fractions", Energy & Fuels, 10, 341-347, 1996.

19. J. S. Wang, **V.N. Kabadi**, "A Predictive Vapor Pressure Correlation for Organic Liquids", Fluid Phase Equilibria, in review.

20. S. Mahmood, Q. Zhao, **V.N. Kabadi**, "High Temperature VLE Data Measurement for Tetralin-Quinoline System",. J. Chem. Eng. Data, 46, 994-999, 2001.

21. R. Yadav, J.J. Luo, R. Sibert, **V.N. Kabadi**, "A High Temperature Thermodynamic Model for Solubility of Hydrogen in Hydrocarbons", Fluid Phase Equilibria, in review.

22. J.C. Chen, S. Musti, **V.N. Kabadi**, "Ignitability of Various Coals as Measured by Laser Ignition", ACS Div. Fuel Chem. Preprints, 41 (4), 1178, 1996.

23. J.C. Chen, S. Musti, **V.N. Kabadi**, "Ignition Behaviour of Pulverized Coals", ACS Div. Fuel Chemistry Preprints, 42(1), 359, 1997.

1.   A. Al-Ghamdi, **V.N. Kabadi**, "Vapor-Liquid Equilibrium Data Measurement for Benzene-Ethylbenzene System", J. Chem. Eng. Data, 46, 1330-1332, 2001.

25. Q. Zhao, **V.N. Kabadi**, "Vapor-Liquid Equilibrium Data Measurement for Ethylbenzene-Quinoline System", J. Chem. Eng. Data, in Press.

1.   Q. Zhao, **V.N. Kabadi**, "Incremental Enthalpy and Heat Capacity Measurements for Benzene-Ethylbenzene System", J. Chem. Thermodynamics, in Review.

2.   B. Westwood, **V.N. Kabadi,** "A Novel Pycnometer for Density Measurements at Elevated Temperatures", J. Chemical Thermodynamics, 35, 1965-1974, 2003.

3.   A. Javvadi, S. Owusu, **V.N. Kabadi,** "Infinite Dilution Partition Coefficients and Ternary LLE Data in Systems Containing an Organic Solvent and Water", Ind. Eng. Chem. Res., Submitted.

4. S. Begum, S. Owusu, **V.N. Kabadi,** "Supported TiO_2 Catalyst for Photocatalytic Detoxification", Environ. Sci. Technol., Submitted.

30. **V. N. Kabadi**, B. M. Rice, "Molecular Dynamics Simulations of Normal Mode Vibrational Energy Transfer in Liquid Nitromethane", J. Phys. Chem. A, 108, 532-540, 2004.

TECHNICAL PRESENTATIONS:

1. **V.N. Kabadi**, R.P. Danner, "Evaluation of Correlations for Hydrocarbon-Water Phase Equilibria", ACS Symposium, Airlie House, Washington D.C., 1979.

2. **V.N. Kabadi**, "Application of Computer Simulations to Study the Interfaces in Composite Materials", NASA Lewis Research Center, Cleveland, Ohio, February, 1988.

3. **V.N. Kabadi**, "Thermodynamics of Heavy Coal Liquids", University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, July, 1988.

4. **V.N. Kabadi**, S. Ramsinghani, "Phase Equilibria in Multi-Ring Aromatic Compounds", AIChE Annual Meeting, Washington D.C., November, 1988.

5. D. H. Buch, **V.N. Kabadi**, "Interfacial Studies of Flexible Chain Molecules Near Solid Surfaces", AIChE Annual Meeting, Washington D.C., November, 1988.

6. **V. N. Kabadi**, "Computer Simulation Study of Melting Transition in Polyatomic Systems", AIChE Annual Meeting, Washington D.C., November, 1988.

7. **V.N. Kabadi**, "Simulation Study of Stress-Strain Relationships in Simple Solids", AIChE Annual Meeting, San Francisco, California, November, 1989.

8. **V.N. Kabadi**, "MD Simulation Study of the Structure of Polyatomic Molecules Near a Graphite Surface", invited talk at the Mid-West Thermodynamics Symposium, Akron, Ohio, May, 1990.

9**. V.N. Kabadi**, "Thermodynamics of Heavy Coal Liquids", University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, July, 1990.

10. **V. N. Kabadi**, "Calorimetric and Phase Coexistence Properties of Coal Derived Fluids", University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, June, 1991.

11. **V. N. Kabadi**, "Pressure Tensor Computation During Molecular Dynamics Simulations", invited seminar presented at Penn State University Chemical Engineering Department, March, 1993.

12. M. Palakkal, J.S. Wang, **V.N. Kabadi**, "Thermodynamic and Rheological Properties of Solid- Liquid Systems in Coal Processing", University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, June, 1993.

13. A.P. Smith, J.J. Luo, **V.N. Kabadi**, "Experimental and Theoretical Determination of Hydrogen Solubility in Petroleum Fractions", The First Annual HBCU/Private Sector/FE Research and Development Technology Transfer Symposium, New Orleans, Lousiana, May, 1993.

14. S. Mahmood, J. Benson, **V.N. Kabadi**, "A Characterization Procedure for Coal Derived Liquids", The First Annual HBCU/Private Sector/FE Research and Development Technology Transfer Symposium, New Orleans, Lousiana, May, 1993.

15. J.S. Wang, M. Palakkal, **V.N. Kabadi**, "Thermodynamic and Rheological Properties of Solid- Liquid Systems in Coal Processing", University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, June, 1994.

16. J.J. Luo, **V.N. Kabadi**, "Thermodynamic Model for Hydrogen Solubility in Petroleum Fractions", Second Annual HBCU/Private Sector Energy Research and Development Technology Transfer Symposium, Birmingham, Alabama, April, 1994.

17. G. Sangal, J. Ragin, R. Sibert, **V. N. Kabadi**, "A Continuous Reactor for Photocatalytic Detoxification of Organic Pollutants", Emerging Technologies in Hazardous Waste Management VI, Atlanta, Georgia, September, 1994.

18. **V. N. Kabadi**, "Improvement of Hydrogen Solubility and Entrainment in Hydrocracker Feedstocks", Contractors' Review Meeting, U.S. Department of Energy Bartlesville Project Office, Fountainhead Resort, Oklahoma, June, 1995.

19. R. Sibert, **V.N. Kabadi**, "An Apparatus for Hydrogen Solubility Measurements", Fourth Annual HBCU/Private Sector Energy Research and Development Technology Transfer Symposium, Greensboro, North Carolina, April, 1996.

20. **V.N. Kabadi**, "A Group Contribution Model for Viscosity of Coal Derived Liquids", Fourth Annual HBCU/Private Sector Energy Research and Development Technology Transfer Sym- posium, Greensboro, North Carolina, April, 1996.

21. **V.N. Kabadi**, "High Temperature High Pressure Thermodynamic Measurements for Coal Model Compounds", presented at the University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, June 3, 1997.

22. **V.N. Kabadi**, "Air Force FAST Center for Environmental Remediation, Fate and Transport of Hazardous Chemicals – Second Year Review", presented at the FAST Center Review Meeting, Miami, Florida, September 30, 1997.

23. **V.N. Kabadi**, "Computation of Pressure Tensor in Molecular Dynamics Computer Simulations", presented at the AIChE Annual Meeting, Los Angeles, California, November 18, 1997.

24. **V.N. Kabadi**, "High Temperature High Pressure Thermodynamic Measurements for Coal Model Compounds", presented at the University Coal Research Contractors' Review Meeting, Pittsburgh, Pennsylvania, June 2, 1998.

25. **V.N. Kabadi**, "Molecular Dynamics Simulation of Flexible Chain Molecules on Graphite Surface", presented at 72nd Colloid and Surface Science Symposium, Penn State University, University Park, Pennsylvania, June 23, 1998.

0. S. Begum, D. Williams, **V.N. Kabadi**, "Supported TiO2 Catalyst for Photocatalytic Degradation of Organic Pollutants", presented at the National Conference on Environmental Remediation Science and Technology, Greensboro, North Carolina, September 8-10, 1998.

1. K. Hammond, **V.N. Kabadi**, "Partition Coefficients of Organic Pollutants between Aqueous and Non-Aqueous Phases", presented at the National Conference on Environmental Remediation Science and Technology", Greensboro, North Carolina, September 8-10, 1998.

2. **V.N. Kabadi**, Q. Zhao, "Complete Excess Gibbs Free Energy Function for Equilibrium and Liquid Phase Properties", presented at the Annual AIChE Meeting, Miami Beach, Florida, November, 1998.

3.   P. Adhangale, **V.N. Kabadi**, "Molecular Dynamics Computer Simulations of Partition Coefficients of Organic Molecules at the Air-Water Interface", presented at the Annual AIChE Meeting, Miami Beach, Florida, November, 1998.

4.   **V.N. Kabadi,** "MD Simulations of Phenomena at the Oil-Water Interface", presented at the Symposium in Honor of Dr. Eli Ruckenstein, AIChE Annual Meeting, Dallas, Texas, November, 1999.

5.   **V.N. Kabadi,** Q. Zhao, "High Temperature Thermodynamic Models Using VLE, H^E, and V^E Data", presented at the Annual AIChE Meeting, Dallas, Texas, November, 1999.

6.   **V. N. Kabadi,** "*Common Sense* in Thermodynamic Measurements", presented as graduate seminar, chemical engineering department, NC A&T State University, March 15, 2000.

33.   **V. N. Kabadi,** "Thrust area B progress report", presented at the annual NSF-STC Review, Chapel Hill, September, 2000

34.   **V.N. Kabadi,** B. M. Westwood, "A Novel Pycnometer for Measurement of Volumes of Mixing at High Temperatures", presented at the AIChE Annual Meeting, Los Angeles, California, November, 2000.

35.   **V.N. Kabadi,** A. Javvadi, "Partition Coefficients of Higher Alcohols in Water-Alkane Systems", presented at the Annual AIChE Meeting, Los Angeles, California, November, 2000.

36.   **V. N. Kabadi,** R. Kolagani, "Thermodynamic Measurements for CO2 Containing Systems", poster presented at the NSF-STC External Advisory Board Review meeting, Chapel Hill, North Carolina, April, 2001.

37.   **V.N. Kabadi,** "FAST Center for Environmental Remediation and Pollution Prevention", poster presented at The Connectivity Expo 2001, Winston-Salem, April, 2001.

FINAL TECHNICAL REPORTS:

1. **V.N. Kabadi**, "Thermodynamics of Heavy Coal Liquids", Grant No. DE-FG22-86PC90541,   U.S. Department of Energy, Pittsburgh Energy Technology Center, March, 1990.

2. **V.N. Kabadi**, "Species Transport Across Polymerized Vesicle Membranes",   Grant No. CTS-8810283, National Science Foundation, August, 1991.

3. **V.N. Kabadi**, "Thermodynamic Model for Calorimetric and Phase Coexistence Properties of Coal Derived Fluids", Grant No. DE-FG22-89PC89762, U.S. Department of Energy, Pittsburgh Energy Technology Center, October, 1992.

4. **V.N. Kabadi**, "A Study of the Effects of Enhanced Oil Recovery Agents on the Quality of Strategic Petroleum Reserves Crude Oil", Grant No. DE-FG22-90PC90283, U.S. Department of Energy, Pittsburgh Energy Technology Center, October, 1992.

5. **V.N. Kabadi**, "Reclamation of Electronic Materials from Xerographic Scrap Alloy", Grant No. GO299001, U.S. Department of Interior, Bureau of Mines, January, 1994.

6. **V.N. Kabadi**, "Thermodynamic and Rheological Properties of Solid-Liquid Systems in Coal Processing", Grant No. DE-FG22-91PC91300, U.S. Department of Energy, Pittsburgh Energy Technology Center, June, 1995.

7. **V.N. Kabadi**, "Improvement of Hydrogen Solubility and Entrainment in Hydrocracker Feedstocks", Final Technical Report, Grant No. DE-FG22-92MT92020, U.S. Department of Energy, Pittsburgh Energy Technology Center, February, 1997.

1. **V. N. Kabadi,** "High Temperature High Pressure Thermodynamic Measurements for Coal Model Compounds", Grant No. De-FG22-95PC95214, U.S. Department of Energy, Pittsburgh Energy Technology Center, March, 2000.

9. **V. N. Kabadi** (PI), K. Schimmel, S.Y. Chang, "Air Force FAST Center for Environmental Remediation, Fate and Transport of Hazardous Chemicals", U.S. Air Force Office of Scientific Research, Grant No. F49620-95-1-0514, $ 3.35 million, 9/1995 - 8/2002.

OTHER PUBLICATIONS:

1. **V.N. Kabadi**, "Reverse Osmosis in Hollow Fibers Radial Flow", M.S. Thesis, State University of New York at Buffalo, September, 1976.

2. **V.N. Kabadi**, "Statistical Thermodynamics of Fluids with Nonspherical Molecules", Ph.D. Dissertation, The Pennsylvania State University, University Park, Pennsylvania, 1982.

3. **V.N. Kabadi**, Co-author of "Chapter 5 - Vapor Pressure" and "Chapter 9 - Phase Equilibria   in Systems Containing Water", in API Technical Data Book, American Petroleum Institute, Washington, D.C., 1980.

GRADUATE STUDENTS:

Following is the list of graduate students that have completed their Masters thesis under my direction as the primary adviser.

Student	Area of Research	Graduation Date
1. Sunil Ramsinghani	Thermodynamics of coal liquids	1988
2. Dhaval Buch	Molecular dynamics of flexible chain molecules near solid surfaces	1988
3. Srinivasan Lakshminara-yanan	Thermodynamics of coal liquids	1990
4. Nirmala Vaidyanathan	Plasma treatment of carbon fibers	1990
5. Syed Haider	Stability of bilayer lipid membranes	1991
6. Xiaojin Xi	Molecular dynamics simulations of diffusivity of gases through porous media	1991
7. Tahir Hanif	Experimental measurements of diffusivity of gases through porous media	1991
8. Shaukat Mahmood	Thermodynamics of coal liquids	1993
9. Mohandas Palakkal	Viscosities of coal liquids	1994
10. Jinsong Wang	Thermodynamics of coal liquids	1995

11. Junjie Luo	Hydrogen solubility in hydrocarbons	1995
12. Cledra McCullers	Characterization of coal liquids	1995
13. Subhramanyam Musti	Laser ignition of coals	1996

Student Date	Area of Research	Graduation
14. Ahmad Al-Ghamdi	Thermodynamics of coal liquids	1997
15. Ronica Sibert	Measurement and models for solubility of hydrogen in hydrocarbons	1998
16. David Williams	TiO_2 photocatalytic degradation of organic pollutants	1998
17. Qingwen Zhao	High temperature thermodynamic properties of coal model compounds	1998
18. Shahnaj Begum	TiO_2 photocatalytic degradation of organic pollutants	2000
19. Anand Javvadi	Partitioning of higher alcohols in alkane- water mixtures	2000
20. Parag Adhangale	Molecular dynamics computer simulations of the air – water interface	2002
21. Brian Westwood	High temperature density measurements	2001
22. Rajiv Kolagani	VLE measurements of CO_2 containing systems	2001
23. Rameshwar Yadav	Enthalpy and density measurements of liquid mixtures containing CO_2	2003
24. Yugesh Mohanasu-ndaram	VLE measurements of CO_2 containing systems	2004
25. Uma Kallempudi	Density measurements at high pressures	2004
26. Zaki Rizvi	Partition coefficients of pollutants in alkane-water mixtures	2003
27. Sureshkumar Gutti	Heat of Mixing Measurements of Fluid Mixtures	2003(MS) Ph.D. (Current)

UNDERGRADUATE RESEARCH ASSISTANTS:

Following is the list of undergraduate students who have worked on research projects under my direction:

Student	Area of Research
1. James Lamont Adams (1989-90)	Thermodynamics of coal liquids
2. Collins Geter (1989-90)	Enhanced oil recovery
3. Lisa Ashby (1989-90)	Thermodynamics of coal liquids
4. Thomas Keefer (1989-90)	Diffusion through porous media
5. Felisha Daniels (1990-91)	Recovery of electronic materials from xerographic scrap alloy
6. Angelia Charles (1989-93)	Enhanced oil recovery
7. Jimetria Benson (1990-93)	Thermodynamics of coal liquids
8. Kimberley Rollins (1990-1994)	Thermodynamics of coal liquids
9. Gorav Sangal (1991-94)	Photocatalytic detoxification of organic pollutants

10. James Ledbetter (1991-1992)   Recovery of electronic materials from xerographic scrap alloy
11. Hung Nguyen (1992-93)   Thermal oxidation of minerals
12. Phillip Planes (1993)   Computer graphics and data analysis
13. Nia Banks (1993-95)   Thermal oxidation of minerals
14. James Ragin (1994-95)   Photocatalytic detoxification of organic pollutants

<u>Student</u>   <u>Area of Research</u>

15. Ronica Sibert (1993-95)   Hydrogen solubility in hydrocarbons
16. Carmen Blum (1999)   Calorimetric measurements
17. Rashawn Washington (current)   Calorimetric measurements

RESUME

Dr. Shen, Ji Yao, Associate Professor
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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.
9/88-12/91	Research Assistant, Dept. of Mechanical Engineering & Mechanics, ODU/NASA Langley Research Center.
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

- 1992-Present, Introduction to Engineering; Computer Programming for Engineers, Statics, Mechanics of Materials, Dynamics, Vibration, Finite Element Analysis, Aircraft Structures, Aircraft Performance, Quality Control, Total Quality Management, Polymer I, Polymer II, Industrial Materials and Processing, Metallurgy, Introduction to Manufacturing Processes, Statistics and Research Methods in Industrial Technology.
- 1988-1989, Teaching Assistant on Mechanism Design, Auto-Control and Digital Control Laboratory Experiment.

- 1975-1978 and 1980-1985, Associate Professor teaching at the Aeronautical Institute of Technology of China on Control Engineering, Vibration Theory, Dynamics, Modern Control Theory, Aircraft Structural Analysis, Aircraft Stability & Control, Material Science and Mechanics of Material.

RESEARCH AREAS

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

SPONSORED/PARTICIPATING RESEARCH
1. Coordinator, Aerospace Systems Research Group, NASA Center for Aerospace Research at A&T, NASA Grant: NAGW-2924, 2000-2002.
2. Principal Investigator (PI), **"Development of A Structural Damage Diagnostic and Monitoring System for Rocket Engines, Phase I: Structural Modeling for Typical Engine Components"**, NASA Grant: NAG3-2165, 1998-2000.
3. PI, **"Feasibility Investigation on the Development of A Structural Damage Diagnostic and Monitoring System for Rocket Engines"**, NASA Grant: NAG3-2055, 1997-1998.
4. Researcher, NASA Center for Aerospace Research at A&T, **"Hypersonic Aircraft Structural Analysis"** and **"Aircraft Propulsion System Analysis"**, NASA Grant: NAGW-2924, 1992-2000.
1. Co-Principal Investigator (Co-PI), **"Dynamics Analysis of a Two-Member Manipulator Arm"**, NASA Grant: NAG-1-1977, 1995-1997.
2. Co-PI, **"Computational Control of Flexible Aerospace Structural Systems"**, NASA Grant: NAG-1-1436, from NASA Langley Research Center, $225,768, 1992-1996.
3. Co-PI, **"Modeling Surface Stresses Using Finite Element Techniques"**, NASA Grant: 4-42025, from NASA Headquarter, $44,000, 1992-1994.
8. Research Associate, **"Distributed Parameter Formulation of LACE Satellite Model and Its Dynamic Test"**, NASA Grant: NAG-1-1436, 1992.
9. Research Assistant (RA), **"Integrated Control-Structure Analysis"**, NASA Grant: NAS1- 18584-134, 1991.
10. RA, **"Structural System Identification":** Analysis of the modal characteristics of NASA Spacecraft Control Laboratory Experiment (SCOLE), Solar Array Flight Experiment (SAFE), and NASA Mini-Mast. NASA Grant: NAS1-18584-75, NAS1-18584-63, NAS1-18584-1, NAS1-17993-63, 1988-1990.

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 Space'98 Conference: the 6th International Conference on Engineering, Construction, and Operation in Space, Albuquerque, New Mexico, April 25-29, 1998.
- 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*.

ROGER J. GAGNON

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School of Business and Economics
North Carolina A & T State University
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(336) 768-6203

EDUCATION

Ph.D.   Business Administration
               University of Cincinnati
               June 1982

               Major: Production/Operations Management
               Minor: Quantitative Analysis
                        (completed all course work for a second major in Quantitative Analysis)
               Minor: Corporate Finance

               Dissertation Title:
               "An Exploratory Analysis of the Relevant Cost Structure of Internal and External
               Engineering Consulting," Volume I-Text, Volume Il-Appendix.

M.B.A.   Management Science
               Clark University
               June 1971

B.S.   Engineering Management
               Boston University
               June 1968

EMPLOYMENT

July 1996 - Present   Associate Professor (tenured)
                             Department of Business Administration
                             School of Business and Economics
                             North Carolina A & T State University

August 2000 – Present   Adjunct Associate Professor
                             Babcock Graduate School of Management
                             Wake Forest University

August 1995-May 1996   Visiting Associate Professor
                             Department of Business Administration

University of Illinois at Champaign/Urbana

July 1988-August 1995   Associate Professor of Management
                               Babcock Graduate School of Management
                               Wake Forest University

September 1992-December 1992   Adjunct Associate Professor
                               Fuqua School of Business
                               Duke University

June 1983-June 1988   Assistant Professor of Management Sciences
                               Faculty of Management Sciences
                               The Ohio State University

January 1979-June 1983   Assistant Professor of Management
                               Department of Management
                               The University of Georgia

June 1968-September 1973   Plant Industrial Engineer
                               Johnson Steel and Wire Company
                               53 Wiser Avenue
                               Worcester, Massachusetts

ARTICLES AND CASES PUBLISHED OR ACCEPTED FOR PUBLICATION

(with Chwen Sheu) "Acquiring Advanced Engineering Technologies under Conditions of
        Performance Improvement," Computers & Industrial Engineering, Volume 45, Issue 3,
        October, 2003, pp. 393-416.

(with Shona Morgan) "Making the Argument for More Minority-Owned Business Cases",
        Accepted by the Journal of the Academy for Business Education, July 2003.

(with Janice Witt Smith) "Instructing the Technical and Behavioral Aspects of Total Quality
        Management: A Cross-Course Experiential Approach," The Journal of the Association of
        Business Education, Volume 2, Spring 2001, pp. 31-51.

(with R. Krovi) " Internet Use: Are Instructors Up to Speed?", OR/MS Today, Volume 27,
        Number 6, December 2000, pp. 32-35.

(with Ravi Krovi) "Internet Usage in Undergraduate Management Science and Operations
        Management Courses", Internet and Higher Education, Volume 2, Number 2-3, 2000,
        pp. 107-118.

(With Chwen Sheu), "The Impact of Learning, Forgetting and Capacity Profiles on the
        Acquisition of Advanced Technology", OMEGA: The International Journal of
        Management Sciences, Volume 28, Number 1, December 1999, pp. 51-76.

(with Janice Witt Smith) "People, Process, and Projects: The Keys to Instructing Total Quality Management," Decision Line, Volume 30, Number 1, 1999, pp.15-16.

(with Sanjoy Haldar), "Assessing Advanced Engineering Technologies," The International Journal of Technology Management, Volume 14, Nos. 2/3/4, 1997, pp. 439-469.

(with Michael DiNovi), "Designing a Purchase Order System for Multiple Variables," Industrial Management, Volume 39, Number 2, 1997, pp.6-9.

(With Chwen Sheu), "A Strategic MIGP Model for Acquiring Advanced Technologies," Computers & Industrial Engineering, Vol. 32, No. 1, 1997, pp. 145-168.

"Johannsen Steel Company Case," Production and Operations Management, 4th edition, Barry Render and Jay Heizer, Prentice-Hall, 1995, pp. 49-50.

(with Sanjoy Haldar), "Assessing Advanced Technologies: Survey Results," Engineering Management Journal, Vol. 7, No. 1, 1995, pp. 15-23.

(with Richard Baldwin), "The Transfer of Japanese Manufacturing Principles and Their Impact on Purchaser-Vendor Policies," Production and Inventory Management Journal, Third Quarter, 1993, pp. 26-30.

(with Chwen Sheu), "A Mixed Integer Programming Model For Acquiring Advanced Engineering Technologies," Computers & Industrial Engineering, Vol. 24, No. 1, 1993, pp. 33-50.

(with Soumen Ghosh), "A Comprehensive Decision Framework for Assembly Systems," Industrial Engineering, Vol. 24, No. 5, 1992, pp. 40-45.

(with Gregory Taylor), "How Student DS Projects Benefit All," OR/MS Today, August 1991, pp. 30-32.

(with Soumen Ghosh), "Assembly Line Research: Historical Roots, Research Life Cycles and Future Directions," Omega: The International Journal of Management Sciences, Vol. 19, No. 5, 1991, pp. 381-399.

"Assessing Strategies for Obtaining Advanced Engineering Technologies with Highly Uncertain Benefits," IEEE Transactions on Engineering Management, Vol. 38, No. 3, August 1991, pp. 210-223.

(with R. F. Deckro, E. P. Winkofsky, and J. E. Hebert), "A Decomposition Approach to Multi-Project Scheduling," European Journal of Operational Research, Vol. 51, No. 1, March 1991, pp. 110-118.

(with James Krasner), "The Optimal Mix of Internal/External Engineering Staff and Equipment with Different Levels of Capability and Performance," IEEE Transactions on Engineering Management, Vol. 37, No. 1, February 1990, pp. 37-47.

(with Soumen Ghosh), "A Comprehensive Literature Review and Analysis of the Design, Balancing and Scheduling of Assembly Systems," International Journal of Production Research, April 1989, pp. 637-670.

"Teaching Operations Design: An Experiential Approach," Decision Sciences, Vol. 19, No. 2, Spring 1988, pp. 453-471.

"Teaching Production/Operations Design: An Experiential Project Approach," Journal of Education for Business, Vol. 63, No. 5, 1988, pp. 223-228.

(with Samuel J. Mantel), "Strategies and Performance Improvement for Computer-Assisted Design," IEEE Transactions on Engineering Management, Vol. EM-34, No. 4, November 1987, pp. 223-235.

(with Timothy Cook), "Computerized Process Monitoring and Control Systems in the U.S. Textile Industry-A Survey," Textile Horizons, August 1985, pp. 39-42.

"A Strategic Framework for Promoting Management Consulting Research," Academic Consultants' Communiqué, Vol. 12, No. 3, November 1984, pp. 1-3.

"Empirical Research-- The Burdens and the Benefits," Interfaces, Vol. 12, No. 4, August 1982, pp. 98-102.

INVITED BOOK CHAPTERS

(with Soumen Ghosh), "Advances in Manufacturing Assembly Systems" for the text Manufacturing and Automation Systems: Techniques and Technologies which is one book in the five-volume series (#45, 46, 47, 48, 49), Control and Dynamic Systems, edited by Dr. C. T. Leonders (University of Washington) by Academic Press, January 1992, pp. 355-405.

OTHER REPORTS

"The Development, Solution and Analysis of Mixed Integer Linear and Goal Programming Models for Acquiring Advanced Engineering Solutions," submitted to the North Carolina Supercomputer Center at the conclusion of the research effort to test and compare supercomputer and personal computer performance in solving large-scale mixed integer goal programming models for strategically acquiring advanced engineering technologies, February 1993**. Supported by a grant from the North Carolina Supercomputer Center. CONFERENCE PROCEEDINGS ARTICLES/CASES PUBLISHED OR ACCEPTED FOR PUBLICATION**

"The Academic Supply Chain," Annual Meeting of the Academy of Business Education, September 2003.

"Forecasting Sales at Le Chateau Bolduc Winery," Proceedings of the 2002 Annual Meeting of the Decision Sciences Institute, November 2002.

(with Shona Morgan), "Where Are the Racial Minority Business Cases?", Proceedings of the 2002 Program of the Academy of Business Education, September 2002.

"The Pedersen Steel and Wire Company Case," Proceedings of the 2000 Annual Meeting of the Decision Sciences Institute, November 2000, pp., 103-104.

(With Janice Witt Smith), "Instructing Total Quality Management: A Cross-Course Experiential Approach," Proceedings of the 1999 Annual Meeting of the Decision Sciences Institute, November 1999, pp.317-319.

(With Chwen Sheu), "The Impact of Learning, Forgetting and Capacity Profiles on the Acquisition of Advanced Technology," Proceedings of the 1998 Annual Meeting of the Decision Sciences Institute, pp.1068-1070.

(With Ravi Krovi), "Internet Usage in Undergraduate Operations Management and Management Science Courses, " Proceedings of the 1998 Annual Meeting of the Decision Sciences Institute, pp. 738-740.

(With Janice Smith),   Behavioral and Technical Aspects of Quality Improvement: A Cross- Course, Experiential Approach," Proceedings of the 1998 Annual Meeting of Eastern Academy of Management, May 1998, pp.189-192.

(With Janice Smith), "Instructing the Technical and Behavioral Sides of Total Quality Management: A Cross Course Experiment," Proceedings of the 1998 Annual Meeting of the Southeast Decision Sciences Institute, February 1998, pp. 157-159, (This paper was selected as the Outstanding Paper in the Experiential Education Track at this conference.).

(With Chwen Sheu), "A Mixed Integer Nonlinear Programming Model for Acquiring Advanced Technologies under Conditions of Learning," Proceedings of the 1996 Annual Meeting of the Decision Sciences Institute, November 1996, pp. 951-953.

(With Chwen Sheu), "A Strategic Planning Model for Acquiring Advanced Technologies under Conditions of Learning and Forgetting," Proceedings of the 1994 Annual Meeting of the Decision Sciences Institute, November 1994, pp. 1257-1259.

(with Sanjoy Haldar), "How Engineering Managers Assess Advanced Technologies: Survey, Analysis and Implications," Proceedings of the American Society for Engineering Management, October 1993, pp. 40-46.

(with Chwen Sheu), "A Strategic MIGP Model for Acquiring Advanced Engineering Technologies with Linked Resources," Proceedings of the 1992 Annual Meeting of the Decision Sciences Institute, November 1992, pp. 1121-1123.

"Assessing the Value of Management Consultants," <u>Proceedings of the 1992 Annual Meeting of the Southeast Decision Sciences Institute Conference</u>, February 1992, pp. 42-46.

(with Chwen Sheu), "A Strategic MILP Model for Acquiring Advanced Engineering Technologies with Linked Resources," <u>Proceedings of the 1991 Annual Meeting of the Decision Sciences Institute</u>, November 1991, pp. 1009-1011.

(with Chwen Sheu), "Optimal Strategies for Acquiring Advanced Engineering Technologies with Linked Resources," published as a full paper in the <u>Proceedings of the Portland International Conference on Management of Engineering and Technology</u> (PICMET 91), October 1991, pp. 348-357.

(with Nancy Peters and David Gregory), "The Export Decision Process: An Exploratory Study," <u>Proceedings of the 1991 Southeast Decision Sciences Institute Conference</u>, February 1991, pp. 172-176.

(with Soumen Ghosh), "A Comprehensive Decision Framework for Socio-Technical Assembly Systems," <u>Proceedings of the 1991 Southeast Decision Sciences Institute Conference</u>, February 1991, pp. 309-314.

(with Joydeep Lahiri), "The Causes of Assembly System Research: Industry Push or Academic Pull," <u>Proceedings of the 1991 Southeast Decision Sciences Institute Conference</u>, February 1991, pp. 306-308.

(with Gregory Taylor and Brooke Saladin), "Teaching Quantitative Methods in an Integrated Business Curriculum," <u>Proceedings of the 1990 Annual Meeting of the Decision Sciences Institute</u>, November 1990, pp. 612-614.

(with Soumen Ghosh), "Assembly Line Research: Historical Growth Patterns and Current Research Directions," <u>Proceedings of the 1990 Annual Meeting of the Southeast Decision Sciences Institute</u>, February 1990, pp. 210-215.

"A Dynamic, Integrated Strategy for Promoting Management Consulting Research," <u>Proceedings of the 1990 Annual Meeting of the Southeast Decision Sciences Institute</u>, February 1990, pp. 153-157.

(with Greg Taylor), "Introducing Statistics and Management Science to MBA Students: An Experiential Project Approach," <u>Proceedings of the 1989 Annual Meeting of the Decision Sciences Institute</u>, November 1989, pp. 453-455.

(with Richard Baldwin), "Japanese Manufacturing Technology Transfer: A Regional Analysis," <u>Proceedings of the 1989 Annual Meeting of the Decision Sciences Institute</u>, November 1989, pp. 1101-1103.

"Assessing Strategies for Implementing CAD Technology with Uncertain Benefits," published in the proceedings of the 1989 Operations Management Association Convention, <u>Managing Technology for Competitive Effectiveness</u>, April 1989, pp. 47-62.

(with Richard Baldwin), "The Transfer of Japanese Manufacturing Principles and Their Implications for Purchaser-Vendor Policies," <u>Proceedings of the 1989 Annual Meeting of the Southeast Decision Sciences Institute</u>, February 1989, pp. 371-375.

(with Soumen Ghosh), "Assembly Line Research: Historical Patterns and Current Directions," <u>Proceedings of the 1988 Annual Meeting of the Decision Sciences Institute</u>, November 1988, pp. 1007-1013.

(with Chwen Sheu and James Krasner), "Optimal Strategies for Obtaining Advanced Engineering Technologies with Pooled Resources," <u>Proceedings of the Annual Meeting of the Midwest Decision Sciences Institute Conference</u>, May 1988, pp. 59-61.

(with James Krasner), "An Optimal Mixed-Integer Programming Formulation of an Integrated Internal/External Engineering Staff and Equipment Requirements Under Conditions of Learning," <u>Proceedings of the 1987 Annual Meeting of the Decision Sciences Institute</u>, November 1987, pp. 1030-1038.

"Teaching Operations Design: An Experiential Project Approach," <u>Proceedings of the 17th Annual Meeting of the American Institute for Decision Sciences</u>, November 1985, pp. 188-191.

"An Integrated Strategy for Increasing Management Consulting Research," <u>Academy of Management Proceedings</u>, August 1984, pp. 148-152.

The Internal Staff/External Consultant Decision: A Framework for Analysis," <u>Proceedings of the Southern Management Association</u>, 1983, pp. 159-161.

SPONSORED RESEARCH

Awarded summer research grants by the Babcock Graduate School of Management, Wake Forest University, 1988, 1989, 1990, 1991, 1992, 1993,1994.

Awarded three Ohio State University College of Business Seed Money Research Grants: (1) "A Decomposition Approach to Multi-Project Scheduling" (1987); (2) (with David Collier) "Quantifying the Impact of Technology on Service Industries" (1987); and (3) "Techniques for Economically Justifying the Acquisition of Advanced Manufacturing Technologies" (1985).

"An Exploratory Analysis of the Relevant Cost Structure of Different Levels of Involvement of Internal and External Engineering Consulting Involved with Computer-Assisted

Engineering Design and Testing," sponsored by the University of Cincinnati, June 1977-June 1978.

OTHER RESEARCH

Proprietary Research Monographs:

"An Exploratory Analysis of the Relevant Cost Structures of Different Levels of Involvement of Internal and External Engineering Consulting Involved with Computer Assisted Design and Testing-Background and Research Methodology: A Preliminary Report," June 1978, 190 pages.

"An Exploratory Analysis of the Relevant Cost Structure of Different Levels of Involvement of Internal and External Engineering Consulting Involved with Computer-Assisted Engineering Design and Testing," **sponsored by a grant from the Structural Dynamics Research Corporation** through the University of Cincinnati, June 1977-June 1978.

PRESENTATIONS

"The Academic Supply Chain", presented at the 2003 Annual Meeting of the Academy of Business Education, September 2003.

"Making the Argument for More Minority-Oriented Business Cases", presented at the 2002 Annual Meeting of the Decision Sciences Institute, November 2002.

"Forecasting Sales at Le Chateau Bolduc Winery", presented at the 2002 Annual Meeting of the Decision Sciences Institute, November 2002.

"Where Are the Racial Minority Business Cases?", presented at the 2002 Program of the Academy of Business Education, September 2002.

"The Piedmont Theatre Company Case," presented at the 2001 Annual Meeting of the Decision Sciences Institute, November 2001.

"The Pedersen Steel and Wire Company Case," presented at the 2000 Annual Meeting of the Decision Sciences Institute, November 2000.

(With Janice Witt Smith, "Instructing Total Quality Management: A Cross-Course Experiential Approach," presented at the 1999 Annual Meeting of the Decision Sciences Institute, November 1999.

(With Chwen Sheu), "The Impact of Learning, Forgetting and Capacity Profiles on the Acquisition of Advanced Technology," presented at the 1998 Annual Meeting of the Decision Sciences Institute, November 1998.

(With Ravi Krovi), "Internet Usage in Undergraduate Operations Management and Management Science Courses," presented at the 1998 Annual Meeting of the Decision Sciences Institute, November 1998.

(With Janice Smith), "Behavioral and Technical Aspects of Quality Improvement: A Cross- Course, Experiential Approach," presented at the 1998 Annual Meeting of Eastern Academy of Management, May 1998.

(With Janice Smith),   Instructing the Technical and Behavioral Sides of Total Quality Management: A Cross Course Experiment," presented at the 1998 Annual Meeting of the Southeast Decision Sciences Institute, February 1998.

(With Ravi Krovi) "Uses of the Internet/World Wide Web in Instructing Operations and Management Science Courses," presented at the 1997 Annual Meeting of the Decision Sciences Institute, November 1997.

"Acquiring Advanced Technologies under Conditions of Learning and Forgetting," Presented to the faculty at the College Business and Economics, North Carolina A & T State University, December 5, 1996.

"A Mixed Integer Nonlinear Programming Model for Acquiring Advanced Technologies under Conditions of Learning," presented at the 1996 Annual Meeting of the Decision Sciences Institute, November 1996.

"Selecting Purchase Order Quantities under Conditions of Quantity Discounts, Market and Technical Obsolescence and Limited Data," presented at the 1995 Annual Meeting of the Decision Sciences Institute, November 1995.

"A Mixed Integer Nonlinear Programming Model for Acquiring Advanced Technologies under Conditions of Learning and Forgetting," presented at the 1994 Annual Meeting of the Decision Sciences Institute, November 1994.

"A Mixed Integer Nonlinear Programming Model for Acquiring Advanced Technologies under Conditions of Learning," presented at the 1994 Annual Meeting of the Production and Operations Management Society, October 1994.

(with Sanjoy Halder), "A Survey of the Process Used to Assess Advanced Engineering Technology," presented at the Fourth International Conference on Management of Technology, February/March 1994.

(with Chwen Sheu), "A Mixed Integer Nonlinear Programming Model for Acquiring Advanced Technologies," presented at the 1993 Annual Meeting of the Decision Sciences, November 1993.

(with Sanjoy Haldar), "A Survey and Analysis of the Criteria, Weight, Methodologies and Environment Surrounding the Process of Assessing Advanced Engineering

Technologies," presented at the 1993 Annual Meeting of the Production and Operations Management Society, October 1993.

(with Sanjoy Haldar), "How Engineering Managers Assess Advanced Technologies: Survey, Analysis & Implications," presented at the American Society for Engineering Management Conference, October 1993.

(with Chwen Sheu), "A Strategic MIGP Model for Acquiring Advanced Engineering Technologies with Linked Resources," presented at the 1992 Annual Meeting of the Decision Sciences Institute, November 1992.

"A Comprehensive Review and Classification of Methodologies for Economic Justification of Advanced Technologies," presented at the 1992 Production and Operations Management Society Annual Meeting, October 1992.

"Assessing the Value of Management Consultants," presented at the 1992 Annual Meeting of the Southeast Decision Sciences Institute, Savannah, Georgia, February 1992.

"The Integration of Engineering and Management Education and Career Opportunities," Presented to the Winston-Salem Chapter of the Institute of Industrial Engineers, November 20, 1991.

(with Chwen Sheu), "A Strategic MILP Model for Acquiring Advanced Engineering Technologies with Linked Resources," presented at the 1991 Annual Meeting of the Decision Sciences Institute, November 1991.

(with Chwen Sheu), "Optimal Strategies for Acquiring Advanced Engineering Technologies with Linked Resources," presented at the Portland International Conference on Management of Engineering and Technology, October 1991.

(with Nancy Peters and David Gregory), "The Export Decision Process: An Exploratory Study," presented at the 1991 Southeast Decision Sciences Institute Conference, February 1991, pp. 172-176.

(with Soumen Ghosh), "A Comprehensive Decision Framework for Socio-Technical Assembly Systems," Southeast Decision Sciences Institute Conference, February 1991, pp. 309-314.

(with Joydeep Lahiri), "The Causes of Assembly System Research: Industry Push or Academic Pull," Southeast Decision Sciences Institute Conference, February 1991, pp. 306-308.

(with Gregory Taylor and Brooke Saladin), "Teaching Quantitative Methods in an Integrated Business Curriculum," presented at the Annual Meeting of the Decisions Sciences Institute, San Diego, California, November 1990.

(with David Gregory and Nancy Peters), "The Export Decision Evaluation Process: A State Export Agency, Company, and Research Perspective," presented at the Annual Meeting of the Decision Sciences Institute, San Diego, California, November 1990.

(with Soumen Ghosh), "Assembly Line Research: Historical Growth Patterns and Current Research Directions," Annual Meeting of the Southeast Decision Sciences Institute, Columbia, South Carolina, February 1990.

"A Dynamic, Integrated Strategy for Promoting Management Consulting Research," presented at the Annual Meeting of the Southeast Decision Sciences Institute, Columbia, South Carolina, February 1990.

(with Richard Baldwin), "Japanese Manufacturing Technology Transfer: A Regional Analysis," presented at the Annual Meeting of the Decision Sciences Institute, New Orleans, Louisiana, November 1989.

(with Greg Taylor), "Introducing Statistics and Management Science to MBA Students: An Experiential Project Approach," presented at the Annual Meeting of the Decision Sciences Institute, New Orleans, Louisiana, November 1989.

(with Richard Baldwin), "The Transfer of Japanese Manufacturing Principles and Their Implications for Purchase-Vendor Policies," presented at the Annual Meeting of the Southeast Decision Sciences Institute, Charleston, South Carolina, February 1989.

(with Soumen Ghosh), "Assembly Line Research: Historical Patterns and Current Directions," presented at the Annual Meeting of the Decision Sciences Institute, Las Vegas, Nevada, November 1988.

(with Chwen Sheu and James Krasner), "Optimal Strategies for Obtaining Advanced Engineering Technologies with Pooled Resources," presented at the Midwest Decision Sciences Institute Annual Meeting, Louisville, Kentucky, May 1988.

(with James Krasner), "An Optimal Mixed-Integer Programming Formulation of an Integrated Internal/External Engineering Staff and Equipment Requirements Under Condition of Learning," presented at the Decision Science Institute's Annual Meeting, Boston, Massachusetts, November 23-25, 1987.

"The Optimal Mix of Multi-Level Internal and External Engineering Resources for Obtaining Advanced Engineering Technology," presented at the National ORSA/TIMS Conference, St. Louis, Missouri, October 25-28, 1987.

(with Soumen Ghosh), "A Comprehensive Literature Review and Analysis of the Design, Balancing and Scheduling of Assembly Systems," presented at the National Conference of the Decision Sciences Institute, Honolulu, Hawaii, November 14-16, 1986.

"Teaching Operations Design: An Experiential Project Approach," presented at the American Institute for Decision Sciences National Meeting, Las Vegas, Nevada, November 11-13, 1985.

(with Soumen Ghosh and Bellur N. Srikar), "A Comprehensive Literature Review and Hierarchical Taxonomy for the Design and Balancing of Assembly Lines," presented at the National ORSA/TIMS Conference, Atlanta, Georgia, November 4-6, 1985.

"The Optimal Mix of Internal and External Engineering Staff and Equipment to Complete Advanced Engineering Projects," presented at the National TIMS/ORSA Conference, Boston, Massachusetts, April 29-May 1, 1985.

"An Integrated Strategy for Increasing Management Consulting Research," presented at the Forty-Fourth Annual Meeting of the Academy of Management, Boston, Massachusetts, August 12-15, 1985.

"An Internal Staff/External Consultant Decision: A Framework for Analysis," presented at the Southern Management Association Conference, Atlanta, Georgia, November 1983.

"An Assessment of Engineering Progress Functions for Computer-Assisted Design Projects," presented at the National ORSA/TIMS Conference, San Diego, California, October 25-27, 1982.

INVITED PRESENTATIONS

"A Strategic Goal Programming Model for Engineering Technology Planning," presented at the National TIMS/ORSA Meeting, Chicago, May 1993.

"A Methodology for Measuring and Comparing Alternative Strategies for Obtaining Computer-Assisted Engineering Technologies with Highly Immeasurable Benefits," presented at the National ORSA/TIMS Conference, Orlando, Florida, November 1983.

PROFESSIONAL AFFILIATIONS, OFFICES HELD AND EDITORIAL REVIEW BOARDS

Professional Offices Held: Member, Board of Directors, Columbus, Ohio Chapter The American Production and Inventory Control Society; 1985/1986.

Member, Board of Directors, Northeast Georgia Chapter, The Institute of Industrial Engineers, 1980-1981, 1981-1982, 1982-1983.

President, Northeast Georgia Chapter, The Institute of Industrial Engineers, 1982-1983.

Professional Affiliations: INFORMS
The Institute of Industrial Engineers
Decision Sciences Institute
The American Production and Inventory Control Society
IEEE Engineering Management Society
Production and Operations Management Society
Academy of Business Education

Editorial Review Boards: Member, Editorial Review Board,
Journal of Operations Management
(since October 1995 and reappointed in November 1999)

Professional Committees   Case Studies Committee, Decision Sciences Institute, 2002
and 2003

DOCTORAL AND MASTERS COMMITTEES

Member of Ph.D. dissertation committee for Richard Baldwin, "Effects of Japanese Management Technology Transfer on Ohio Industry," The Ohio State University, completed December 1987.

Member of M.S. thesis committee for Rajesh Shah, "A Preliminary Evaluation of Visi-Schedule as an Instructional Tool," Department of Civil Engineering, The Ohio State University, completed March 1985.

Curriculum Vita
Derrek Butler Dunn, Ph.D.
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RESEARCH:

Research interest include the area(s) of Wireless Communication Systems, Global Positioning Systems and Real-Time Information Processing using Acousto-Optics.

CURRENT PROFESSIONAL APPOINTMENTS and REGISTRATIONS:

-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)

-Engineer-in-Training (E.I.T.), State of Virginia, 1995

WORK EXPERIENCE:

Industrial:
HBCU and MEI Summer Research Faculty
Oak Ridge National Laboratory/Oak Ridge Associated Universities
Oak Ridge, TN 37831
-May 2003 to August 2003: Software Radio Development using MATLAB.

Summer Research Faculty

Navigation Research and Development Center
Applied Research Laboratory at Penn State University
995 Newton Road
Warminster, PA 18974
-May 2002 to August 2002: Involved in global positioning system research, with Mr. Marvin May-ARL/PSU, using a CAST GPS signal simulator and two ASTECH GPS receivers.

Summer Research Faculty
Navigation Research and Development Center
Applied Research Laboratory at Penn State University
995 Newton Road
Warminster, PA 18974
-May 2001 to August 2001: Involved in global positioning system research, with Mr. Marvin May-ARL/PSU, using a CAST GPS signal simulator and two ASTECH GPS receivers.

Summer Research Faculty
Applied Research Laboratory at Penn State University
P.O. Box 30
North Atherton Street
State College, PA 16801
-May 1999 to August 1999: Involved in environmental research, with Dr. Russell Philbrick-PSU/ARL, using a LIDAR to measure ozone, water vapor and particulate matter in the lower atmosphere.

University Faculty Hire
Hewlett-Packard Labs
3500 Deer Creek Road
Palo Alto, CA 94086
-May 1998 to August 1998: Designed and tested an analog oscillator for a RFID tag radio transmitter

EDUCATION:
July 1994 - August 1997
Doctor of Philosophy in Electrical Engineering
The Bradley Department of Electrical Engineering
Virginia Polytechnic Institute and State University
Graduation Date: June 27, 1998

June 1994 - May 1995
Master of Science in Mathematics
The Department of Mathematics
Virginia Polytechnic Institute and State University
Graduation Date: May 13, 1995

August 1991 - June 1993
Master of Science in Electrical Engineering

The Bradley Department of Electrical Engineering
Virginia Polytechnic Institute and State University
Graduation Date: June 26, 1993

August 1986 - December 1990
Bachelor of Science in Electrical Engineering
North Carolina A&T State University
Graduation Date: December 19, 1990

August 1986 - December 1989
Bachelor of Science in Mathematics
North Carolina A&T State University
Graduation Date: December 18, 1989

PROFESSIONAL SOCIETIES:
-American Society for Engineering Education- (1999 to Present)
-National Association of Industrial Technology (NAIT)- (1998 to Present)
-National Association of Radio and Telecommunication Engineers (NARTE) - (2000 to Present)
-Pi Mu Epsilon, The National Mathematics Honor Society- (1988 to Present)
-Institute of Electrical and Electronics Engineers (IEEE)- (1987 to Present)
-Alpha Chi Sophomore Honor Society- (1987 to Present)
-Alpha Lambda Alpha Freshman Honor Society- (1986 to Present)

SPONSORED RESEARCH, EQUIPMENT and IN-KIND EQUIPMENT GRANTS:
Title: Wireless Radio Location (WRL) Systems Development Project
$4,000.00 (North Carolina Space Grant Consortium) 2003/2004 Academic Year(s), PI

Title: Optical Communication Networking Laboratory at North Carolina A&T State University
$15,000.00 (Lucent Technologies) 2002/2003 Academic Year, PI

Title: 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

Title: Undergraduate Scholarships for Global Positioning System Research
$120,000.00 (Office of Naval Research) 2002/2003 to 2006/2007 Academic Year(s), PI

Title: Wireless Indoor Position Location System
$298,000.00 (NASA) 2001/2002 to 2004/2005 Academic Year(s), PI

Title: 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

Title: EPA Minority Institution Academic Undergraduate Student Fellowship (Jackie Green)
$23,373.00 (EPA) 2002/2003 to 2003/2004 Academic Year(s), PI

Title: Distance Learning Development Laboratory at North Carolina A&T State University
$12,399.00 (Hewlett-Packard National Contributions Program) 2001/2002 Academic Year, PI

Title: Refurbishment of a Sound Detection and Ranging (SODAR) Instrument
$13,501.00 (Environmental Protection Agency/Penn State University) 1999/2000 Academic Year, PI

Title: RF and Microwave (RFAM) Circuit Design Laboratory at North Carolina A&T State University(Second Installment)
$237,870.00 (Agilent Technologies University Grants Program) 1999/2000 Academic Year, PI

Title: Wireless Communication Laboratory at North Carolina A&T State University
$125,000.00 (Lucent Technologies) 1999/2000 Academic Year, CO-I

Title: RF and Microwave (RFAM) Circuit Design Laboratory at North Carolina A&T State University(First Installment)
$299,355.00 (Hewlett-Packard University Grants Program) 1998/1999 Academic Year, PI

Title: Wireless Communication (WICOM) Laboratory at Tuskegee University
$305,460.00 (Hewlett-Packard University Grants Program) 1997/1998 Academic Year, PI

PUBLICATIONS:
Textbook(s):
Mathematics for Technologist in Electronics, Second Edition by Dewayne Brown and **Derrek Butler Dunn**, Published by Pearson Custom Publishing, 2002, ISBN 0-536-68102-3

Journal Article(s):
Cynthia Carlton Gillispie-Johnson, **Derrek B. Dunn**, DeWayne Brown, and Vincent W. Childress, "*Establishing a Computer-Mediated Communication Laboratory in a Graphic Communications Department*", Visual Communications Journal 2002, p. 34-37.

Jiangang Xia, **Derrek Butler Dunn**, and Ting-Chung Poon, "*Image Edge Enhancement by Bragg Diffraction*", Optics Communications vol.128 p.1-7, July, 1996.

Conference Paper(s):
Derrek Butler Dunn, DeWayne Brown, and Thomas Avery *"Advancing Technology in Wireless Communications, Part II"*, IEEE Southeastcon '02, April, 2002

Derrek Butler Dunn, *"An RFID/IPS Indoor Positioning System"*, The Thirty-First Southeastern Symposium on System Theory (SSST99), March 21-23, 1999

Yolanda McLeod and **Derrek Butler Dunn**, *"Advancing Technology in Wireless Communications"*, IEEE Southeastcon '98, April 24-26, 1998

Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon, *"Design and Use of a Cascaded Acousto-Optic Image Processing System as a Bandpass and Bandstop Image Processing Filter"*, IEEE Southeastcon '97, April 12-14, 1997

Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon, *"Three Dimensional Analytical and Numerical Solutions for Acousto-Optic Interaction"*, The Twenty-Ninth Southeastern Symposium on System Theory (SSST97), March 9-11, 1997

Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon," *The Function of the Sound Wave in an Acousto-Optic Image Processing System*" Proceedings of the IEEE Southeastcon '96, April 11-14, 1996

Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon, *"High Frequency Noise Reduction Using an Acousto-Optic Image Processing System"*, Proceedings of The Twenty-eighth Southeastern Symposium on System Theory (SSST96), March 31-April 2, 1996

Derrek Butler Dunn, "*Verification of the Solutions of the Paraxial Wave Equation for Optical Diffraction through a Rectangular Aperture in the Fresnel Region*", Proceedings of The Engineering and Architecture Symposium at Prairie View A&M University(E&A '96 Symposium), February 5-6, 1996

Oral Presentation(s):
Michael Wright, Angela Marks and **Derrek B. Dunn,** *"Design of an Optical Transceiver",* Sixth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina State University, April 26, 2002
Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon, " *Design and Implementation of a Cascaded Acousto-Optic Image Processing System*" The Optical Society of America (OSA) Annual Meeting, Rochester, NY; October 20-25, 1996

Derrek Butler Dunn, Jiangang Xia and Ting-Chung Poon, " *Design of an Acousto-Optic Image Processing System to Perform Image Edge Enhancement Using Bragg Diffraction*" IEEE Virginia Mountain Section Technical Mini-Symposium'96, May 23, 1996

Poster Presentation(s):
Dion Stallings and Stacy Raynor, and **Derrek Butler Dunn**, "*Implementation of a Bandpass Filter using Microstrip Technology for a Wireless LAN*", NAFEO High Tech Student Expo 2002, Washington, DC, March 21, 2002

Michael Wright, Angela Marks, and **Derrek Butler Dunn**, "*Security Aspects of an Optical Transceiver for Telecommunication Applications*", NAFEO High Tech Student Expo 2002, Washington, DC, March 21, 2002

Angela Marks, Michael Wright and **Derrek Butler Dunn**, "*Implementation of an Optical Transceiver for Telecommunication Applications*", Ron McNair Symposium, North Carolina A&T State University, January 28, 2002

Angela Marks, Michael Wright and **Derrek Butler Dunn**, "*Wireless RS-232 Laser Transceiver for Secure Computer Network Communications*", EMERGE Workshop 2001, Georgia Tech, November 29, 2001

Trina Posey, Terrance Blackmon, Justin Taylor and **Derrek Butler Dunn**, "*TDMA vs. CDMA, Which will be the Access Technology of the Future*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Wayne Morrison, Kennedy Cheruiyot and **Derrek Butler Dunn**, "*What is NAMPS (Narrowband Advanced Mobile Phone Service)?*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Bryan Mason, Chico Foxx, Hayes Bowling III and **Derrek Butler Dunn**, "*Optical Routers and their improved performance in relations to LANs and WANs*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

David Jones, Louis Tyson and **Derrek Butler Dunn**, "*Wireless Communication Comparisons Between Bluetooth, Jini, and Salutation Protocols*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Wilson Skipwith, Terrell Goudy and **Derrek Butler Dunn**, "*Digital versus Analog*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Issac M. Black, Bert A. Davis, Candice Coltrane, Courtney Amos, Shedrick Bessent, Jason Sherrill, Roderick Bradford, John Dingle and **Derrek Butler Dunn**, "*Time Division Multiple Access (TDMA) versus Code Division Multiple Access (CDMA) for use as an Access Technology*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Ronetta Mosby and **Derrek Butler Dunn**, "*Digital Communication Using Frequency-Shift Keying*", Fifth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina A&T State University, April 20, 2001

Naidra Hemingway and **Derrek Butler Dunn**, "*Application of Passive Networks for Voltage Signal Waveform Shaping*", Fourth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), Winston-Salem State University, April 14, 2000

Raschad E. Hines and **Derrek Butler Dunn**, "*Application of Rheostats and Potentiometers*",

Fourth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), Winston-Salem State University, April 14, 2000

Rosette V. Ladson and **Derrek Butler Dunn**, "*Applications of Passive Networks for Measuring Resistive Circuit Elements*", Fourth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), Winston-Salem State University, April 14, 2000

Ronetta Mosby and **Derrek Butler Dunn**, "*Design and Applications of Passive Filter Networks*", Fourth Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), Winston-Salem State University, April 14, 2000

Melanie Ellis, Adrain L. Martin, and **Derrek Butler Dunn**, "*Communication Circuits Simulation Programs used in the RF & Microwave Circuit Design Lab at North Carolina A&T State University*", Third Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina Central University, April 16, 1999

Nicole Wilson, Jamila Moore, and **Derrek Butler Dunn**, "*Implementation of the RF & Microwave Circuit Design Lab at North Carolina A&T State University*",Third Annual Undergraduate Research Conference North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP), North Carolina Central University, April 16, 1999

SUPERVISED GRADUATE STUDENT(S):
[North Carolina A&T State University]
Mr. Muhammad Al-Humaigani, Ph.D. Student, Proposed Graduate Date: May 2004
Indiana State University Consortium Ph.D. Degree program in Technology Management

Ms. Vernita Bryant, MSIT-ECT Candidate, Proposed Graduate Date: May 2004
Project Topic: Analysis of Receiver Induced Position Error using a GPS simulator

[Tuskegee University]
Mr. Shyam Prosad Chanda, M.S.E.E., Graduation Date: May 1998
Project Topic: Two Dimensional Acousto-Optic Image Processing using Superposition

Ms. Julia Gaines, M.S.E.E., Graduation Date: May 1998
Project Topic: Real-Time 1-D Image Processing using Higher Order Bragg Diffraction

CURRICULUM VITAE

Solomon Bililign Ph.D.

Professor and Chairperson

Educational Background

1991 Ph.D. University of Iowa, *Atomic Molecular and Laser Physics.*

1987 CERTIFICATE: International Center for Theoretical Physics; Trieste, Italy.

1985 M.S. Addis Ababa University *Surface Science.*

1977 B.S. Addis Ababa University *Physics Education/with a minor in Math.*

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.

1985-1987 Lecturer: Addis Ababa University, Addis Ababa, Ethiopia.

1983-1985 Research Assistant, Addis Ababa University, Addis Ababa, Ethiopia

Details of Professional experience: Research:

Previous Research

Spectroscopy of Transition State Dynamics (1988-1991)

State-to- State Photochemistry (1988-1991)

Laser Spectroscopy and Photodynamics (1991-1993)

Electronic Structure Calculations (1991-1993)

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)

CURRENT COLLABORATIONS:

Laboratoire Aime Cotton and ASCI, Campus d'Orsay, France: 2000-present

Duke University, UNC Chapel Hill and Stanford University:
2000-present: (ITR)
JILA Research: Joint Laboratory Astrophysics (NIST)/University of Colorado, Boulder.
2000-2001
Dr. Solomon Bililign Curriculum Vitae 2004
(4of 4)
Publications (Most recent)
27. Brian C. Hattaway, **Solomon Bililign**, Lionel Uhl, V. Ledentu and Gwang-Hi Jeung, Energy transfer in Li(4p) + (Ar, H2 and
CH4) Collisions, Submitted to **J. Chem. Phys, 120, (**2004)
26. **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**.**
25. N. Vaval **and S. Bililign, and** Robert J. Gdanitz **"**Density functional study on the structure and stability of positive iron raregas
complexes, Fe+Xn (X = Ar, Xe; n=1-6**" Chemical Physics** 290/2-3 ,171 – 176 (2003).
24. S. Bililign, B. C. Hattaway, and Gwang-Hi Jeung" Nonradiative Energy Transfer in Li (3p) + CH4 Collisions" *J. Phys.*
Chem. A106, 222, (2002).
23. **S. Bililign**, B. C. Hattaway, T. L. Robinson, and Gwang-Hi Jeung "Far-Wing Scattering Studies on the Reaction Li* (2p, 3p)
+ H2 ¨ LiH (*v* = 1, 2, *J*) + H", *J. Chem. Phys. 114,* 7052 (2001).
22. S. Bililign, B. C. Hattaway, Neri Geum and Gwang-Hi Jeung, "Energy Transfer in Li (3p) - H2 Collisions*" J. Phys. Chem.*
A104, 9454-9458 (2000).
21. S. Feigerle, **S. Bililign** and John C. Miller, "Nanochemistry: Chemical Reactions of Iron and Benzene within Molecular
Clusters," *Journal of Nanoparticle Research. Volume 2(2)* 147-155 (June 2000).
20. B. E. McCarter**, S. Bililign**, C. S. Feigerle, J. C. Miller "Nanochemistry: Iron Cluster Reactions with Methyl Iodide," **J. Phys.**
Chem. 103, 6740 (1999).
19. **S. Bililign**, C. S. Feigerle, and John. C. Miller. "Inverse Laser Ablation Formation and Chemistry of Nanoparticles from
Gaseous Precursors." *Applied Surface Science.127*, 344 (1998).
18. **Bililign**, C. S. Feigerle, John C. Miller and M. Velegrakis."Non-Statistical Bond Breaking in the Multiphoton
Ionization/Dissociation of [Fe (CO)5]mArn Clusters." *J. Chem. Phys. 108*,6312 (1998).
PRESENTATIONS (Most Significant)
1. Research and Education in Chemical Physics at A&T, talk given at the annual meeting of the national Society of Black
Physicists, Atlanta, GA, February, 14, 2003, at the National Science Foundation, Division of Chemistry, December 11,
2002, at the NC AAPT meeting March 22, 2003, and at the Annual Life and Physical Sciences Symposium, NC A&T
Biology Dept., April 5, 2003.

2. DFT Studies of the Structure of Fe+ Rn (R = Ar, Xe, n = 1 – 6) Clusters. Presented at the American Physical Society
Division of Atomic, Molecular and Optical Physics Meeting, May 29-June 1, 2002, Williamsburg, VA.
3. Red-Wing scattering Studies of Li(4p) + Ar, H2 and CH4 Collisions. Presented at the American Physical Society
Division of Atomic, Molecular and Optical Physics Meeting, May 29-June 1, 2002, Williamsburg, VA.
4. Energy Transfer in Li(3p) + Ar, H2 and CH4 Collisions: **A comparative study**. Presented at the American Physical
Society Division of Atomic, Molecular and Optical Physics Meeting, May 29-June 1, 2002, Williamsburg, VA.
5. Energy Transfer and Reactions in Li*(3p) + H2 Collisions. A seminar presented at the Department of Physics, East
Tennessee State University, Johnson City, TN, Oct. 30,2000
6. Formation and Chemistry of Nanoparticles from Gaseous Precursors by Multiphoton Ionization/Dissociation.
Presented at the Gordon Research Conference On Clusters, Nanocrystals, & Nanostructures Connecticut College July 24
- July 29, 1999.
7. Laser-induced transition metal chemistry within clusters Presented at the 9th International Symposium on
Resonance Ionization Spectroscopy: New Directions and Applications June 21 - June 25, 1998, The University of
Manchester Institute of Science and Technology.
8. Metal ion Chemistry Initiated by Ionization/Dissociation of Organo-Metallic Precursors
Presented 1. Fourth Winter Gordon Research Conference on Structures, Energetics and Dynamics of Gaseous Ions.
Feb. 22-28, 1997,Ventura CA.
2. The Fifth Workshop Consortium for Nanostructured Materials, Nashville, Tennessee, Oct. 17-19, 1996.
3. Joint APS/AAPT Meeting, April 17-21, 1997 Washington D.C

List honors and awards

AWU/DOE Faculty research Fellowship award 1995.
NRC/HBCU Faculty research Fellowship Award, 1996, 1997.
Outstanding Faculty Mentor Award, NCAMP (NSF) April 1998.
Faculty Award, National Honors, College of Arts and Sciences April 1998.
The National Science Foundation CAREER Award, which helped in the establishment of a new laser lab.
JILA visiting fellowship, 2001-2002
Named Outstanding Senior Researcher for A&T, 2001-2002
Sigma-Pi-Sigma : Physics Honor Society
Phi-Kappa-Phi
Dr. Solomon Bililign Curriculum Vitae 2004
(4of 4)
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**

SERVICE
Physics Graduate Coordinator: 1998-2001
MS proposal Committee
Colloquium organizer 1995-96, 1996-97
Library Liaison: 1993-94, 1994-95, and 1995-96
Acting Chairperson of the Physics Department. Spring 1997
Publication Committee College of Arts and Sciences (2001)
Member of the University Senate (representing the department) fall 1996- present.
Member of the research and development advisory committee of North Carolina Genomics and Bioinformatics Consortium.
Member of the Interdisciplinary PhD planning committee: Program: Energy and Environmental Studies.
Member of the FUTURES VENTURE SEED GRANT, task force (2002)

Community Service
  Served as a science fair judge at General Greene Science and Technology School (2002)
  Participated in a CAREER FAIR at Northeast High School on Oct 30, 2001.
  Public lecture on Lasers for public scientific literacy (CIVITAN CLUB of GREENSBORO) 1999.
Dr. Solomon Bililign Curriculum Vitae 2004
(4of 4)
Teaching
1. **Undergraduate courses taught include**
Laser Electronics,
Special Topics
College Physics I
General Physics I and II
Quantum Mechanics I and II
Mathematical Physics
Physics orientation
2. **Graduate courses taught include**
-Classical Mechanics: PHYS. 600
-Statistical Mechanics: PHYS. 630
-Atomic and Molecular Physics: PHYS 735.
-Quantum Mechanics II and I. PHYS 620/720
-**Spectroscopic techniques PHYS 736**
-Graduate Research and Thesis: PHYS 770, PHYS 791/792
. *MS Students and their research:*
Past.
Ben McCarter; Currently at Corning
Thesis title: Iron Cluster reactions with Methyl Iodide
J. Phys. Chem. A103, 6740, (1999)
Tito Robinson, Currently at Kodak
Thesis title: Electronic Orbital Alignment Effects in the Reaction Li (2p) + H2
J. Chem. Phys. 114, 7052, 2001
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
J. Phys. Chem.A106, 222 (2002)
J. Chem. Phys A104,9454(2000)
Tucker Swindell:
Thesis Title: Quenching of Excited States of Lithium by Alkane and Alkene Hydrocarbons

CORNELIUS MARLOW HINTON, PHD, PMP
(336) 299-7459 (Work), (336) 299-7459 (Home)
Email: mhinton@ncat.edu

EDUCATION

B.S., Electrical Engineering, N.C. A&T State University, Greensboro, NC
M.S. Computer Science, University of Illinois, Champaign-Urbana, IL
M.S.C. Project Management, Stevens Institute of Technology, Newark, NJ
PhD, Jacksonville State, Jacksonville, FL

SKILLS ACQUIRED

- Project Management   - Grid Computer Technology   - Database Expertise
- Research Computing   - Operating Systems   - High Performance Computing

WORK EXPERIENCE

DIRECTOR, RESEARCH COMPUTING (2002- Present), Information Technology &
Telecommunications, North Carolina A&T State University, Greensboro, NC.
Responsibilities: To oversee the technological needs of the research community at the university
in conjunction with the Division of Research including optimized utilization and operational
enhancements of the Research infrastructure.

SR. PROJECT MANAGER, SOFTWARE SYSTEM DEVELOPMENT (1989-2002)
AT&T – Integrated Workforce Solutions (IWS), Greensboro, NC
Responsible for planning, organizing, developing, and executing software projects including corporate
mergers and acquisitions, web-enabling, and international projects. Also responsible for providing
supervision of technical teams to provide system development and support.

SR STAFF MEMBER, UNIX OPERATING SYSTEM DEVELOPMENT (1984-1989)
AT&T – Bell Laboratories, Short Hills, New Jersey, NJ
Responsible for software development, training, and support of the UNIX Operating System,
including licensing and contractual customer relationships.

SYSTEMS DEVELOPER, EMSP DIGITAL SIGNAL PROCESSING (1981-1984)
AT&T – Federal Systems, Greensboro, NC

PROJECT LEADER, Logicon, Torrance, CA (1977–1979)
PROJECT LEADER, Rockwell International, Anaheim, CA (1977–1979)
PRINCIPLE DEVELOPER, National Bureau of Standards, Gaithersburg, MD (1977-74)

TEACHING EXPERIENCE (1992 – Present)

SOFTWARE PROJECT MANAGEMENT, Dept. of Comp. Science, N.C. A&T State Univ. Currently teaching a graduate course open to all disciplines but focuses on software project management procedures, methodologies, processes and life cycle. The course includes individual project assignments as well as team projects.

DATABASE SYSTEMS, Dept. of Comp. Science, N.C. A&T State Univ, Greensboro, NC Senior Computer Science majors are taught all the elements of database design and database systems including project assignments using the Oracle relational database management system.

UNIX OPERATING SYSTEM, Dept. of Computer Science, GTCC, Greensboro, NC

PROFESSIONAL PUBLICATIONS:
"N.C. A&T High Performance Computing–Small Beginnings, Big Vision" January, 2004
"Research Grid Computing at North Carolina A&T State University" November, 2003
 "Cool Under Fire - A Profile of Top Computer Professionals" ComputerWorld
"An Object Oriented Approach to Software Development" (1992)
Computational Algorithm for Computer Costing Model" Univ. of Illinois (1987)
A Signature Verification Pen using Parallel Interfaces", NBS Publication (1977)
Additionally, he has published several articles on the Project Management discipline.

PRINCIPLE INVESTIGATOR FOR PROJECTS OF SIMILAR CALIBRE:
Network Structure Implementation for Research Access and Grid Computing (2003)
Interdisciplinary Studies in Genomic Diversity (CO-PI with Dr. Millibut Worku) (2003)
IBM Shared University, Research Grant, IBM Corporation (2002)
Educational Skills Enhancement Grant [Distance Learning], Pew Foundation (2002)
AT&T Hardware /Software Laboratory Equipment Grant, AT&T (1994-1992)

PROFESSIONAL MEMBERSHIP AFFILIATION (CURRENT AND PRIOR):
Project Management Institute Member (PMI)
Association of Computing Machinery (ACM)
Institute of Electrical and Electronics Engineers (IEEE)
Phi Kappa Phi Honor Society Member

SYNERGISTIC ACTIVITIES:
Dr. Hinton is currently serving as the Director of Research Computing and is implementing high performance computing at the university.   He is currently creating a research grid environment for support of all of the campus research efforts including engineering, genomics, bioinformatics, and life sciences and high performance computing.   He also oversees the entire academic and research computational laboratories on campus.   He has a strong background in database systems, high performance computing, and project management.   He has over 29 years in industry and academia and is also a PMP (Project Management Professional).   He also served as the Director of the Center for Distance Learning for the University.

DR. MULUMEBET WORKU
CURRICULUM VITAE

Office Address
229b Webb Hall
North Carolina A&T State University
1601 E. Market Street
Greensboro, NC 27411
(336) 334 – 7615
Fax: (336) 334-7288
worku@ncat.edu

EDUCATION

University of Maryland – College Park, MD (May 1993)
Doctor of Philosophy, Animal Sciences

University of Maryland – College Park, MD (December 1989)
Master of Science, Animal Sciences

University of Alemaya – Alemaya, Ethiopia (September 1980)
Bachelor of Science, Animal Sciences

PROFESSIONAL EXPERIENCE

Assistant Professor/Biotechnologist **North Carolina A&T State University**
August 1999 – Present Greensboro, NC

Visiting Professor/microbiology instructor **North Carolina A&T State University**
March 1999 – August 1999 Greensboro, NC
Taught general and basic microbiology

Research Associate   Immunology and Disease Resistance Laboratory-USDA -ARS
1996-1998 Beltsville, MD
Working under Dr. Albert Guidry in collaboration with Dr. Joseph Patti of Texas A&M to assess the utility of microbial surface adhesions for mastitis prevention

Staff Fellow   Laboratory of Cellular Hematology, Center for Biologics Evaluation and Research – FDA
1993 – 1996 Bethesda, MD
Working Dr Leana Harvath to determine the association between Fc receptors and CD45 on human neutrophils using fluorescence resonance energy transfer and flow cytometric evaluation of binding

Research Assistant   Milk Secretion and Mastitis Laboratory – USDA –ARS
1986 – 1993   Beltsville, MD
Working with Dr Max Paape as part of graduate training through a cooperative agreement between the USDA and the University of Maryland

Research Fellow   University of Glasgow
1984 – 1985   Scotland, UK
Working with Dr Peter Holmes to gain training in the use of nuclear techniques in animal science and to learn parasite detection methods. Afforded an opportunity to attend courses in animal physioogy and parasitology. Provided an opportunity to visit the University of Dublin Ireland with the Vet Club.

Assistant Lecturer/Research Assistant   Addis Ababa University
1982 – 1984   Addis Ababa, Ethiopia
Working in the institute of Pathobiology under Dr Getachew Tilahun to conduct epidemiology studies on the incidence of parasitic infections in sheep and goats and their relationship to immune status. Evaluation of a radiation attenuated vaccine against Dictyoucaulus filarial lung worm in small ruminants in collaboration with the International livestock center for Africa. Working with Dr Ephrem Mamo to evaluate water metabolism in Boran cattle under ranch conditions as a demonstration for nomadic tribesmen. Evaluation of the reproductive toxicity of the water extract of Phytolacca Dodencandra a naturabre l molusscicide in mice. Conducted laboratory demonstration of parasites to students in the Veterinary School in Debre Zeit. Responsible for overseeing the animal facility of the institute. Provided a fellowship through the international atomic energy agency to obtain training in Glasgow, Scotland.

Assistant Lecturer/Zoo Manager   Alemaya College of Agriculture
1981-1982   Alemaya, Harrar, Ethiopia
Teaching introduction to animal husbandry in the tropics. Laboratory assistant in animal anatomy and physiology. Appointed by the Dean as manager of the College Zoo housing lions, crocodiles, hyenas and primates. Responsible for renovation of the zoo and increasing holdings following the war.

Graduate Assistant   Alemaya College of Agriculture
1979-1981   Alemaya, Harrar, Ethiopia
Teaching sections of Animal Husbandry in the Tropics, sheep and goat husbandry and laboratory assistant for graduate course in Environmental Physiology under Dean Ephrem Mamo. Research on immune response to tape worms directed at development of vaccines. Advised undergraduate students.

Professional Development

2003   Certificate of Course Completion: Molecular Phylogenetics – Summer
            Institute in Statistical Genetics, NC State University
2003   Certificate of Course Completion: Bioinformatics – Summer Institute in
            Statistical Genetics, NC State University
2003   Certificate of Course Completion: Microarray Analysis – Summer Institute

	in Statistical Genetics, NC State University
2003	Certificate of Participation – 2nd Annual Science Frontiers in Research Symposium, NC A&T State University
2003	Certificate of Appreciation – Volunteer Services, Guilford Country Board of Education
2003	Certificate – Animal Genomics Symposium, NC State University
2002	Plaque – NC Small Farms Week
2002	Certificate of Appreciation – Graduate Student Appreciation Week, NC A&T State University
2001	National Advisor for the Organization of Tropical Studies visited Costa Rica
2001	CAST biotechnology communicator
2001	Certificate of Attendance – IACUC 101, NC State University College of Veterinary Medicine
1993	Featured Article – ARS Report: Graduate Work on F_c Receptors on Bovine Neutrophils
1985	Certificate of Course Completion – Nuclear Techniques in Animal Science

Honors

1992	USDA Merit Award – Works Related to the Production of Bi-Specific Antibodies for the Control of Mastitis
1992	Visiting Fellow – University of Turku, Finland
1992	University of Uppsala, Sweden
1988	Graduate Fellowship – University of Maryland Graduate School
1988	Gamma Sigma Delta Honor Society of Agriculture
1985	International Atomic Energy Agency Fellowship – University of Glasgow, Scotland
1985	Certificate of Course Completion – Nuclear Techniques in Animal Science
1988	Gamma Sigma Delta Honor Society of Agriculture

PROFESSIONAL MEMBERSHIPS

National

American Association of Veterinary Immunologists
American Society of Animal Science
Gamma Sigma Delta Honor Society of Agriculture
IFIC Foundation Media Guide communicator on Food Safety and Nutrition
NASA Epscor and FARR grant reviewer
National Advisor for Duke University Organization of Tropical Studies
On-line FAO Symposium in biotechnology member
Southern Ag-Biotech Consortium for underserved communities Community Outreach
USDA National Research Initiative (NRI) Panel on Animal Genomics and Genetic Mechanisms
USDA Sustainable Agriculture Reviewer

STATE

Agromedicine Institute member

NC State Center for the biology of Nematode Parasitism member

NC State Fair Bio-frontiers Exhibitor Committee 2001

NC State Summer Institute in Statistical Genetics Laison

North Carolina Genomics and Bioinformatics Consortium member

Animal Health Project Collaborator NC State, #NCV-VMAA-1013

UNIVERSITY

Graduate Council
Graduate School Advisory Board
Graduate School Representative on Senate New programs and Curriculums Committee
Ronald McNair Symposium organizing Committee
Teaching Assistant Manual Preparation Advisory Committee
University Biosafety Committee
University Animal Care and Use Committee
University Biotechnology Committee
Women in STEM Disciplines Summit Organizing Committee
DOR Computational Science and Engineering Committee
Annual Life and Physical Sciences Symposium Organizing Committee
Honors Program Student Mentor
National Conference on Environmental Science and Technology Committee

SCHOOL OF AGRICULTURE

Laison NC State Bioinformatics Center
Environmental Sciences Planning Committee
Graduate Advisory Board Representative
CES Planning Committee Representative
Biotechnology /Biodiversity team co-coordinator
Agromedicen Nutrition and Food safety, Minority and Environmental Health Niche
Evans Allen Manual Review Chair and Committee Member
Graduation Marshal (Fall and Spring 2001)
Search Committee for Department Chair of the Department of Animal Sciences
Small Farms Week - Organizing Committee
Summer Biotechnology Workshop Organizer
Bridging the Biotechnology Divide Symposium Organizer

DEPARTMENT OF ANIMAL SCIENCE

Biotechnology Advisor
Bridge Student Advisor Graduate Student Committees
Chair Graduate Committee
GANNN Student Advisor
Graduate Coordinator

Oversee Micorarray Facility Research and Teaching Laboratory and Research Assistant
Oversee Bioinformatics Learning Facility
PI Goat Demonstration Unit

SERVICE MEMBERSHIPS

* Ethiopian Tree Fund Founding Member
* Ethiopian Tree Fund Board Member
* Gamma Sigma Delta Honor Society of Agriculture-Secretary
* Campus Coordinator for the Southern Ag-biotech consortium for underserved Communities
* Chair Organizing Committee of the Annual Bridging the Biotech-Divide Symposium

SPECIAL SKILLS

2003	FDA Reviewer training: Core modules VIII, 1993-1994 and I, II, IV, VII - "Field Guide to GenBank and NCBI Molecular Biology Resources" Workshop
2003	Microarray workshop
2003	Vector NTI /Labshare
2002	Microarray and SNP Analysis
2002	Bioinformatics
2002	Biotechnology media communication
2002	Blackboard
1999	Webassign
1999	Information technology tools for research and education
1998	SQL, PLSQL, Oracle forms and reports, ITAT Corp.
1996	Molecular Biology E-mail Servers
1994	PCR and Molecular Hybridization techniques, FAES NIH
1990	SAS statistical analysis software

CAREER HIGHLIGHTS

* 2003 Submission of Three intellectual property disclosures to the University
* 2003 Hosting the Field Guide to NCBI resources the first at NC A&T, in an HBCU and the second in Land-grant University
* 2002 Participation of Agricultural Genetics and Biotechnology class in evaluation of the CD-ROM for the NIH Human Genome Project
* 2002 Establishment of a virtual center and website for The Center of Excellence for studies in Genomic Diversity as a small "c" center in the department of Animal Sciences and submission of a strategic plan for Genomic sciences at NC A&T
* 2002 Establishment of a meat goat demonstration herd at NC A&T
* 2001 The annual Bridging the Biotech divide symposium, educational outreach for genomic sciences at NC to teachers and on farm demonstrations of biotechnology
* 2001 Organizing the first workshop in Bioinformatics at NC A&T
* 2001 Establishment of the first Bioinformatics learning facility and microarray facility

- 2001 Campus coordinator of the Southern Ag-biotech consortium for underserved communities
- 1993 Definition of the structural heterogeneity of Fc receptors on bovine neutrophils

GRANTS
Funded Proposals

2003-2006   USDA Evans Allen, Deciphering Gene Expression Associated with the
                Inflammatory Response to E. Coli Endotoxin in Cattle

The long-term goal of this research is to develop a greater understanding the underlying cause of bacteria borne inflammation and to develop a process for targeting genes for disease intervention by appropriate drug development and gene therapies. This study will target bovine mastitis initiated by E. coli and the progression of inflammation at the genetic level. The specific objectives of the proposed project that will contribute to the achievement of this long-term goal are: To assess gene expression at the level of transcription, to identify the effect of host factors on bacterial virulence genes, to assess gene expression at the level of translation and to characterize genes and proteins identified as important components of the inflammatory response.

Worku, PI

2003 – 2006   A Model Interdisciplinary Biotechnology and Biodiversity Program

Total Amount Awarded: $200,000
 Worku, Co-PI - USDA Capacity Building grants Program

2003   Institutionalizing the Ronald McNair Symposium

Total Award Amount: $15000
Worku, Collaborator - FUTURES

2002 - 2004   The Southern Agbiotech Consortium for Underserved Communities (SACUC)

A joint effort of eleven 1890 institutions, industrial partners governmental agencies, and farm organizations to promote agbiotech outreach to farmers and consumers and strengthen K-Life science education. The consortium will lower disparities in dispersal of science-based information and aid in rural sustainability. Over 40 counties and schools in ten states have been identified as the primary outreach areas, based on income levels and rural isolation. The objectives of SACUC are: (1) Educational Outreach through workshops; (2) Commodity Outreach through on farm demonstrations and field days (3) Community Outreach through an annual symposium (4) Socioeconomic Studies through surveys USDA/ IFAFS

Worku, PI - Campus Coordinator
$223,997 - current

2002 – 2003   North Carolina A&T Interdisciplinary Graduate Teaching in Biotechnology, Genomics and Bioinformatics

Source of support: US Department of Education
Project Location: NC A&T State University, NC
Total Award amount: $640,000
Starting date: 09/15/00
Ending date : 09/15/04

Proposal status: current
Collaboration between the School of Agriculture and Environmental Sciences and The College of Arts and Sciences provides training to MS level students. Students have been recruited into the program and training provided. As a result of this effort our students are participants in PhD programs in Genomics and are trained through workshops and collaborative arrangements in addition to conducting thesis research in one of these areas.

Worku, Co-PI
$640,000

2002 – 2003   A Proposal to Establish a Center of Excellence for studies in Genomic Diversity

Source of support: Futures Venture Seeds GRANTS (NC A&T)
Project Location: NC A&T State University, Greensboro, NC
Total Award amount: $15,000
Starting date:04/11/2002
Ending date : 05/15/2003
Proposal status: completed

2002 – 2003   A Model Interdisciplinary Biotechnology and Biodiversity Program

Source of support: Futures Venture Seeds GRANTS (NC A&T)
Project Location: NC A&T State University, Greensboro, NC
Total Award amount: $15,000
Starting date:04/11/2002
Ending date : 05/15/2003
Proposal status: completed

2002   Bridging the Biotech Divide Symposium Support

Source of support: NC Biotechnology Center,
Project Location: NC A&T State University, Greensboro, NC
Total Award amount: $1,500
Starting date: 03/26/02, 03/26/03
Ending date : 03/26/02 03/26/03
Proposal status: complete

2001 – 2003   Regulation and Expression of Fc receptors in Cows with E. coli Mastitis -USDA
Evans Allen
Studies on Fc receptor gene expression in response to E. coli endotoxin that has
resulted in the development of assays and identification and isolation of proteins
and genes as markers for apoptosis and for modulation of the immune response.
Three disclosures of intellectual property have been submitted to the University.

Worku, PI: Completed
$300,000

2001 – 2004   Title: Agricultural Education To Address Emerging Needs of The Genomics era

Collaboration between four departments in the School of Agriculture and
Environmental Sciences and leading laboratories in the USDA. As part of this
effort a new graduate level course in bioinformatics has been developed and a
bioinformatics learning facility established. Further faculty training workshops in
bioinformatics, Microarray analysis and new gene discovery have been conducted.

Source of support: USDA 1890 Capacity Building grants program
Project Location: NC A&T State University, Greensboro, NC
Total Award amount: $199,760,
Starting date: 08/15/01
Ending date : 08/15/04
Proposal status: current

2001 – 2004   Goats as an Alternative Enterprise.
Source of support: Golden Leaf foundation and Evans Allen
Project Location: NC A&T State University
Total Award amount: $15,500/year
Starting date:2001
Ending date :2004
Proposal status: current

2001 – 2002   Strengthening a Collaborative Proposal for Small and Medium Size Farms Using a
Bridge Grant

Source of support: USDA IFAFS/Bridge grant,
Project Location: NC
Total Award amount: $15,500
Starting date: 2001
Ending date : 2002
Proposal status: current

1999 – 2003   NC A&T Biotechnology Education,
Source of support: NC Biotechnology Center
Project Location: NC A&T
Total Award amount: $34,562/year

Starting date: 07/012002
Ending date : 07/01/2003
Proposal status: current

PROPOSALS PENDING

2003   REU in environmental sciences NSF-collaborator

2003   ARCH toxicogenomics in agriculture and environmental health Worku PI

NONFUNDED PROPOSALS

2002 – 2005   Research Experience for Undergraduates in Interdisciplinary Natural Energy Science and Engineering
Pending submitted to NSF Millie Worku Co-PI $ 299,331

2002   Detection of Campylobacter. USDA capacity Building grants Program Worku CO PI

2002   Integrated Undergraduate Training in Animal Biotechnology Worku CO-PI USDA Challenge Grants

2001   Center for the Biology of Nematode Parasitism, NC State University investigator NSF submitted $40,000,000

2001   Ethiopia USAID Bid with NC State University and Texas A&M Worku coordinator

2001   University of Virginia international biosafety initiative. Worku coordinator

2001   Women in Science Program NSF Worku PI

2000   Development of an Animal Biotechnology Course. To The NC Biotech Center $90,000

2000   Mary Mafuyi, Franklin County cooperative outreach support , Worku CO, PI

2000   Interdisciplinary studies in genomic diversity Worku PI, USDA Capacity building grants program

TEACHING
COURSES TAUGHT
1ST and 2nd SUMMER SESSION 2003

ANSC 799   Graduate Thesis

ANSC 999   Continuation of Graduate Thesis

FALL 1999 - Present
Undergraduate Courses
ANSC 214   Agricultural Genetics

Fall 1999
BIOL 220   Basic Microbiology
BIOL 221   General Microbiology

Graduate Courses
ANSC 665   Techniques in Biotechnology

FALL 2001
Undergraduate Courses
ANSC 214   Agricultural Genetics

Graduate Courses
ANSC 665   Techniques in Biotechnology

ANSC 701   Topics in Animal Health/section

PAST COURSES TAUGHT
1981   Sheep production, University of Alemaya

1980   Animal Husbandry in the Tropics, University of Alemaya

1982   Animal Parasitology Lab, University of Alemaya

1982   Animal Physiology Lab, University of Alemaya

1993   Animal Physiology Lab, University of Maryland – College Park, MD

COURSES DEVELOPED AND APPROVED
Bioinformatics and Genome Analysis - ANSC 776

PUBLICATIONS
Abstracts
2003   Perceptions about biotechnology in five counties in North Carolina. M. Worku, B Gray and A Thompson. Journal of Applied Biotechnology, Food Science and Policy. Accepted for publication ABFSP0047
2003   Perceptions about biotechnology in five counties in North Carolina. M. Worku, B Gray and A Thompson. Applied Biotechnology, Food Science and Policy. (poster Abs) 13 th Biennial ARD Symposium Atlanta Georgia
2003   M. Worku. The Fc receptor binding IgM a Marker for apoptosis? 13 th Biennial ARD Symposium Atlanta Georgia

2003	Molecular and Genomic Technologies and Environmental Mastitis. Mulumebet Worku. 2003. Proceedings of the 2002 National Conference on Environmental Science and Technology p263-281.
2003	Godfrey Ejimakor; Worku M, Mafuyi M, , Potential Alternative Enterprises for Small Farmers in North Carolina. Jul 2,2003 AAEA Annual Meeting
2002	Carr, J. P. S. A. Ibrahim, A. Bynum, C. W. Seo, G. Shahbazi, and M. Worku. 2002. Viability of Bifidobacteria in Commercial Yogurt Products in North Carolina. IFT Annual Meeting Program and Abstracts. (Abs. 73-6).
2002	M. Worku, K. Campbell and M J. Paape. Regulation of Immunoglobulin binding and Fc receptor expression on bovine Neutrophils ADSA 2002
2002	M. Worku , K. Campbell, and M.J. Paape. Flow Cytometric Evaluation of Sodium Butyrate on Apoptosis of Bovine Neutrophils. ADSA 2002.
2002	Amy-Ward Johnston, M. Worku and Kevin Anderson. Immunoglobulin Binding in Cows with Staphylococcus Aureus ADSA 2002.
2002	J. P. Carr, S. A. Ibrahim, G. Shahbazi, M. Worku, C. W. Seo Viability of Bifidobacteria in Yogurt Products Found in North Carolina . North Carolina Agricultural and Technical State University, Greensboro, NC.2002 American Society of Microbiology.
2002	Carr J.P, S.A. Ibrahim, G. Shahbazi, M. Worku, and C.W. Seo. 2002. Viability of Bifidobacteria in Yogurt Products Found in North Carolina. J. Dairy Sci. 85:Supp 1. J. Dairy Sci. 76, (Suppl. 1): (1049).
2002	Carr J P, S A. Ibrahim, G Shahbazi, C W. Seo, M Worku. 2002. Shelf- Life of Yogurt Products Containing Bifidobacteria. 54th Southeast Regional Meeting of the American Chemical Society, Charleston, SC. (Abs # 61).
2002	Sutton*1, M.Worku2, and B. Alston-Mills1 The Institute of Nutrition 13th Annual Research Symposium 2002 Beta-Lactoglobulin as a Facilitator of Transcellular Transport of IgG in Caco-2 Cells. L. F.
2002	Sutton*1, M.Worku2, and B. Alston-Mills1, 1North Carolina State University, 2North Carolina ADSA Production Division, ADSA Southern Branch, and Northeast ASAS/ADSA Section 223, 2002.
2001	J Waterman and M. Worku Bovine PMN Express Cycloxygenase-2 When Stimulated with Lipopolysacharide ADSA 2001
2001	K. Campbell, M.J. Paape and M. Worku Differential Tyrosine Phosphorylation on Bovine PMN Proceedings of the NC academy of Sciences 2001
2001	J. Ward and M. Worku IgM Binding Proteins on Bovine PMN ADSA 2001
2001	Matterson P, M. Worku and Candace Brown. Modified Tunel Assay for Determination of Apoptosis of Bovine PMN.ADSA 2001.
2001	Proteins Modulating Inflammation M Worku. Piedmont Triad Connectivity Expo Proceedings. Wake Forest University 2001.
Modulation of Apoptosis in Bovine Blood PMN by Actinomycin-D,

2001   Lipopolysaccharide, and Sodium Butyrate. P Matterson*, S. Knight and M. Worku; , #1381, J. Anim. Sci. Vol 79 Suppl 1 ADSA 2001

2001   Campbell, Kynita and Mulumebet Worku. North Carolina Agricultural and Technical State University. The Effect of Modulators of Bovine Polymorphonuclear Neutrophils on Protein Tyrosine Phosphorylation. 1379, J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

2001   WATERMAN, JENORA AND MULUMEBET WORKU. North Carolina Agricultural and Technical State University. Bovine Neutrophils Release the COX-2 Protein When Stimulated with Bacterial Lipopolysaccharide, 1380, J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

2001   Johnston-Ward Amy, Sommer Knight, and Mulumebet Worku. Isolation of Membrane Proteins Associated with IgM Binding to Bovine Neutrophils. 1383 J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

2001   Knight, Sommer, Patricia Matterson, Stephanie Dance and Mulumbet Worku. cDNA Integrity Kit is Able to Detect Conserved Sequences in Bovine Neutrophils., 1382 J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

1998   Talbot, N.E., Paape, M.J., and Worku M.1998. Selective Expansion and Continuous Culture of Macrophages from Adult Pig Blood. Vet. Immunol. Immunopathol. 64(2): 173-90.

1998   M.Worku, A.J. Guidry, J.Patti. 1998. Factors Affecting Adherence of Staphylococcus Aureus to Bovine Mammary Secretory Epithelial Cells. Dairy Science

1998   Wang Y., M.J. Paape and M. Worku. 1998. Expression of CD14 receptors on bovine neutrophils. 1998. Dairy Science.

1997   E. Monfardini, M. Paape, B. Burvenich, M. Worku and Y. Wang. Expression of L. Selection in Relation to Parturition in Dairy Cows. 1997. Dairy Science

1996   Talbot, N.C., Worku, M., Paape, M.J. Grear, P, Rexroad, C.E.,Jr and Pursel G. V., 1996. Continuous Cultures of Macrophages Derived from the 8-Day Epiblast of the Pig. In Vitro cell Dev. Biol. 32:541.

1995   M.Worku, M.J. Paape, A.L. Di Carlo, M.E. Kherli, and W.W. Marquardt. Complement Component C3b and Immunoglobulin Fc Receptors on Neutrophils from Calves with Leukocyte Adhesion Deficiency. 1995. Am. J. Vet. Res. 56:435.

1994   M. Worku, M.J. Paape, R. Filep, and R.H. Miller. 1994. Effect of In Vitro and In Vivo Migration of Bovine Neutrophils on Binding and Expression of Fc Receptors for IgG2 and IgM. AM.J.Vet. Res 55:221.

1994   M.Worku, M.J. Paape, and W.W. Marquardt. 1994. Modulation of Fc Receptors for IgG on Bovine Polymorphonuclear Neutrophils by

Interferon-g R Through De Novo RNA Transcription and Protein Synthesis. Am. J. Vet. Res 55:234.

1994   M.Worku, N.E. Brownson, D.A. Terle and L. Harvath. 1994. Physical and Functional Interactions Between CD32 and CD 45 on Human Neutrophils. 1994. Mol. Biol. Cell. (Suppl. 5):123A

1994   M.Worku D.A. Terle, N.E. Brownson and L. Harvath. Interactions Between the Low Affinity Fc Receptor (CD32) and Leukocyte Common Antigen (CD45) on Human Neutrophils. 1994. NIH Research Festival. September 19-23, 1994.

1994   M.Worku D.A. Terle, N.E. Brownson , J. Vostal and L. Harvath. Interactions between the Low Affinity Fc Receptor (CD32) and Leukocyte Common Antigen(CD45) on Human Neutrophils. 1994. Gordon research conferences Holderness School, New Hampshire

1992   Guidry, A.J., M.J. Paape, K.E. Squiggins, M.Worku, C.N. Hambelton, and R.H. Miller. 1992. Monoclonal Antibodies to Subpopulations of Bovine Neutrophils. Comp. Haemat. Int. 2:18.

1992   Worku, M. M.J. Paape and W.W. Marquardt. 1992. Interferon Gamma Up-regulates Fc Receptors for Monomeric IgG on Bovine Neutrophils (PMN) by De Novo RNA Transcription and Protein Synthesis. FASEB J. 6:A1050.

1992   Worku, M. and M.J. Paape. 1992. Fc Receptor Expression on Bovine Peripheral Blood Mononuclear Cells. J. Dairy Sci., 70 (Suppl 1)

1991   Worku, M. M.J. Paape and W.W. Marquardt. 1991. Modulation of Bovine PMN Fc Gamma Receptors Using Bovine Recombinant Interferon Gamma. FASEB J. 5: A732

1991   Worku, M. M.J. Paape and W.W. Marquardt 1991. Trypsin Sensitivity, Density and Type Specificity of Fc Receptors (FcR) on Bovine Neutrophils (PMN). J. Dairy Sci (Suppl. 1)

1991   Worku, M.M.J. Paape and R. Filep. 1991. Regulation in Binding of IgG2 and IgM to Bovine Neutrophils (PMN). Annual Meeting Soc. Leukocyte Biology, Aspen CO. 50 (Suppl).

1990   Jain, N.C., M.J. Paape, L.M. Berning, S.K. Salgar and M.Worku. 1990. Functional Competence and Monoclonal Antibody Reactivity of Neutrophils from Cows Inoculated with Escherichia Coli Endotoxin. Comp. Haemat. Int. 1:10.
        Worku M, M.J. Paape and W.W. Marquardt. 1990. Preliminary Characterization of Fc Receptors on Bovine Blood and Mammary

1990   Neutrophils. In proceedings of an international conference on Mastitis: Physiology/Pathology University of Ghent Belgium, Sept 18-22.

1989   Worku, M., M.J. Paape, A.J. Guidry, K.E. Squiggins and R.R. Peters. 1989. Production and Characterization of Monoclonal Antibodies to Bovine Peripheral Blood Mononuclear Cells. FASEB j. 3:A2251.

THESIS ADVISED

2003   Pei Wang Preliminary Evaluation of Microarray analysis for studies in bovine Mastitis

2003   Angelique Marie Fuller Expression of the Intracellular Region of C-Kit in the Peripheral Blood Mononuclear Cells of Canines With and Without Mast Cell Disease

2002   Amy Johnston Ward Presented the environmental importance of her research topic to Greensboro the Beautiful as part of an application for the Moore fellowship Proteins Modulating Inflammation.

2001   J. Waterman Expression of the Cyclooxygenase 2-Gene by Bovine Neutrophils.

2001   K Campbell The Effects of Lipopolysaharide, Sodium Butyrate and Dexamethasone on Ligand Binding and Fc Receptor Expression and Protein Tyrosine Phosphorylation and Apoptosis of Bovine Neutrophils.

THESIS ADVISED Recently defended

Roberto Franco- May 2004 Alternative anti-helminthics for the control of goat parasites

Gregory Bernard – May 2004 Meat Goat enterprise genetics and control of intestinal parasites

Nicholas Cunningham – May 2004 Evaluation of anti-inflammatory agents to control neutrophil activation

Takia Harris May 2004– Gene Expression in activated bovine neutrophils

Zaki Abdulrahman - Optimization of E. coli RNA isolation methods for studies in global gene expression in response to host factors May 2004

On going Thesis
Kristy Terell: Sequence conservation in Fc receptor ITAM motifs

Yohannes Asfaw - A comparison of two methods for the evaluation of bacterial diversity for applications in biodiversity December 2004

Odett Alexander – Evaluation of ethnic (Jamaican), African (FAMACHA) and local (NC) parasite control methods in goats and microsatelilte analysis May 2005

Jill Bowman- Ethical implications and host factors of bacterial products in milk

PAPER PRESENTATIONS

Accepted for presentation

Immunomodulaion of bovine receptors for IgG2 and IgM by Shitake musroom extracts.
K Gyenai, M. Worku, O Ishekhumen, and P. Matterson. North Carolina A&T State University.
ASAS 2004

The Effects of Anti-Inflammatory Agents on Gene Expression of Bovine Neutrophils
Nicholaus Cunningham, Patricia Matterson, Mulumebet Worku
North Carolina Agricultural and Technical State University, Greensboro North Carolina ASAS
2004

IDENTIFICATION OF GENES ASSOCIATED WITH INFLAMMATION IN BOVINE PMN.
Takia Harris and Worku, Mulumebet , Par=trica Matterson and David Fargo . Department of
Animal Sciences, North Carolina A&T State University, Greensboro, NC and UNC Chapel Hill
27411. ASAS 2004

Evaluation of Three Novel Anthelmintics to Control Internal Parasites Populations in Adult
Female Boer Goats. R.A. Franco, M. Worku, J.E. Miller, D. Libby, and T. Hanner. North
Carolina Agricultural and Technical State University, Greensboro; Louisiana State University,
Baton Rouge, LA. ASAS 2004

Evaluation of Diatomaceous Earth as a component of goat production practices. Gregory C.
Bernard, M. Worku, D. Libby, T. Hanner, and M. Ahmedna and Patricia Matterson. Department
of Animal Sciences, North Carolina A&T State University. ASAS 2004

Past presenatations:
03   orku M, Benjamin Gray, A. Thompson. Perceptions about biotechnology in
               five counties in NC. Annual Bridging the biotech Divide Symposium NC
               A&T
02   orku M, Yang G and Thompson A. Indigenous Knowledge and
               Bioinformatics: Partnering for Rural Agriculture Journal of Social and
               Behavioral Sciences, Special Issue with the Theme of "21st Century
               Agriculture: Economic and Social Impacts on Small Farms and Rural
               Communities."
02   ıng G, M Worku, M Kamp-Glass & A Thompson. 2002. Economic

Potentials of Micropropagation for Small-Scale Farmers. Journal of Social and Behavioral Sciences, Special Issue with the Theme of "21st Century Agriculture: Economic and Social Impacts on Small Farms and Rural Communities." 2002

92   ape, M.J. M.Worku and A.L. Di Carlo. 1992. Immunoglobulin and Complement Receptor Expression on Neutrophils(PMN) from Calves with Leukocyte Adhesion Deficiency(LAD). Proc. 5th Intl. Cong. On Cell Biol. Madrid. Spain

89   ape, M.J, L.M. Bernning, S.K. Salgar, M.Worku and R.R. Peters. 1989 Use of Flow Cytometry in Diagnosis of Mastitis. Proc. 28th Annual Meeting, National Mastitis Council, p227.

89   ape, M.J., L.M. Berinning , S.K. Salgar, M.Worku and R.R. Peters 1989. Fluorescent-Activated Cell Analysis: Applications on Mastitis Research. Proc,. Int. Conf on Mastitis, St. Georgen Austria. P62.

91   ape, M.J., A.J. Guidry, M.Worku and R. Filep. 1991. Flow Cytometric Characterization of Anti-Bovine PMN Monoclonal Antibodies. XV Congress International Society of Analytical Cytology, Bergen, Norway.

97   .J. Paape, M. Worku, L. Johnson. Practical Applications of Flow Cytometry in Mastitis and Animal Production. 1997 University of Ghent Symposium on the Applications of Flow Cytometry to Dairy Science.

INTELLECTUAL PROPERTY

Title of Invention: A Method to Detect Cyclooxygenase 2 on Bovine Neutrophils
Inventors' Names: Mulumebet Worku and Jenora Waterman

Title of Invention: A Bovine IgM Binding Protein
Inventors' Names: Mulumebet Worku and Amy Ward Johnston

Title of Invention: The Gene Encoding Bovine COX-2
Inventors' Names: Mulumebet Worku, Sommer Knight, and Patricia Matterson

REFEREED JOURNAL PUBLICATIONS

2003   Perceptions about biotechnology in five counties in North Carolina. M. Worku, B Gray and A Thompson. Journal of Applied Biotechnology, Food Science and Policy. Accepted for publication ABFSP0047

2003   Molecular and Genomic Technologies and Environmental Mastitis. Mulumebet Worku. 2003. Proceedings of the 2002 National Conference on Environmental Science and Technology p263-281.

1998   Talbot, N.E., Paape, M.J., and Worku M.1998. Selective Expansion and Continuous Culture of Macrophages From Adult Pig Blood. Vet. Immunol. Immunopathol. 64(2):173-90.

1996   Talbot, N.C., Worku, M., Paape, M.J. Grear, P, Rexroad, C.E.,Jr and Pursel G. V., 1996. Continuous Cultures of Macrophages Derived From the 8-Day Epiblast of the Pig. In Vitro Cell Dev. Biol. 32:541.

1995   M.Worku, M.J. Paape, A.L. Di Carlo, M.E. Kherli, and W.W. Marquardt. Complement Component C3b and Immunoglobulin: Fc Receptors on Neutrophils from Calves with Leukocyte Adhesion Deficiency. 1995. Am. J. Vet. Res. 56:435.

1994   M. Worku, M.J. Paape, R. Filep, and R.H. Miller. 1994. Effect of In Vitro and In Vivo Migration of Bovine Neutrophils on Binding and Expression of Fc Receptors for IgG2 and IgM. AM.J.Vet. Res 55:221.

1994   M.Worku, M.J. Paape, and W.W. Marquardt. 1994. Modulation of Fc Receptors for IgG on Bovine Polymorphonuclear Neutrophils by Interferon-G Through De Novo RNA Transcription and Protein Synthesis. Am. J. Vet. Res 55:234.

1992   Guidry, A.J., M.J. Paape, K.E. Squiggins, M.Worku, C.N. Hambelton, and R.H. Miller. 1992. Monoclonal antibodies to subpopulations of bovine neutrophils. Comp. Haemat. Int. 2:18.

1990   Jain, N.C., M.J. Paape, L.M. Berning, S.K. Salgar and M.Worku. 1990. Functional Competence and Monoclonal Antibody Reactivity of Neutrophils from Cows Inoculated with Escherichia coli Endotoxin. Comp. Haemat. Int. 1:10.

1987   Mamo E and Worku M. Oral Administration of a Water Extract of Phytolacca Dodecandra l'herit in Mice—Effects on Reproduction. Contraception. 1987. 35(2):155-61.

Non-Refreed Publications

02   oteins for the Modulation of Inflammation.   Department of Animal Sciences report 1.

ABSTRACTS

Accepted:

Immunomodulaion of bovine receptors for IgG2 and IgM by Shitake musroom extracts.

K Gyenai, M. Worku, O Ishekhumen, and P. Matterson. North Carolina A&T State University. ASAS 2004

The Effects of Anti-Inflammatory Agents on Gene Expression of Bovine Neutrophils
Nicholaus Cunningham, Patricia Matterson, Mulumebet Worku
North Carolina Agricultural and Technical State University, Greensboro North Carolina ASAS 2004

IDENTIFICATION OF GENES ASSOCIATED WITH INFLAMMATION IN BOVINE PMN.
Takia Harris and Worku, Mulumebet , Par=trica Matterson and David Fargo . Department of Animal Sciences, North Carolina A&T State University, Greensboro, NC and UNC Chapel Hill 27411. ASAS 2004

Evaluation of Three Novel Anthelmintics to Control Internal Parasites Populations in Adult Female Boer Goats. R.A. Franco, M. Worku, J.E. Miller, D. Libby, and T. Hanner. North Carolina Agricultural and Technical State University, Greensboro; Louisiana State University, Baton Rouge, LA. ASAS 2004

Evaluation of Diatomaceous Earth as a component of goat production practices. Gregory C. Bernard, M. Worku, D. Libby, T. Hanner, and M. Ahmedna and Patricia Matterson. Department of Animal Sciences, North Carolina A&T State University. ASAS 2004

03	odfrey Ejimakor; Worku M, Mafuyi M. Potential Alternative Enterprises for Small Farmers in North Carolina. Jul 2, 2003 AAEA Annual Meeting
2002	Sutton*1, M.Worku2, and B. Alston-Mills1 The Institute of Nutrition 13th Annual Research Symposium 2002 Beta-Lactoglobulin as a Facilitator of Transcellular Transport of IgG in Caco-2 Cells. L. F.
2002	Sutton*1, M.Worku2, and B. Alston-Mills1, 1North Carolina State University, 2North Carolina ADSA Production Division, ADSA Southern Branch, and Northeast ASAS/ADSA Section 223, 2002.
02	P. Carr, S. A. Ibrahim, G. Shahbazi, M. Worku, C. W. Seo Viability of Bifidobacteria in Yogurt Products found in North Carolina . North Carolina Agricultural and Technical State University, Greensboro, NC. 2002 American Society of Microbiology.
02	ırr J.P, S.A. Ibrahim, G. Shahbazi, M. Worku, and C.W. Seo. 2002. Viability of Bifidobacteria in Yogurt Products found in North Carolina. J. Dairy Sci. 85:Supp 1. J. Dairy Sci. 76, (Suppl. 1): (1049).

02   rr J.P, S.A. Ibrahim, G. Shahbazi, M. Worku, and C.W. Seo. 2002. Viability of Bifidobacteria in Yogurt Product. 102nd General Meeting of the American Society for Microbiology, Salt Lake City, Utah. (ABS # O –7).

02   rr J P, S A. Ibrahim, G Shahbazi, C W. Seo, M Worku. 2002. Shelf- Life of Yogurt Products Containing Bifidobacteria. 54th Southeast Regional Meeting of the American Chemical Society, Charleston, SC. (Abs # 61).

02   rr, J. P. S. A. Ibrahim, A. Bynum, C. W. Seo, G. Shahbazi, and M. Worku. 2002. Viability of Bifidobacteria in Commercial Yogurt Products in North Carolina. IFT Annual Meeting Program and Abstracts. (Abs. 73-6).

01   . Worku , K. Campbell, and M.J. Paape.Flow Cytometric Evaluation of Sodium Butyrate on Apoptosis of Bovine Neutrophils. ADSA 2002.

01   Knight and M. Worku cDNA Integrity from Bovine PMN, ADSA 2001

01   J Waterman and M. Worku Bovine PMN Express Cyclooxygenas-2 When Stimulated with Lipopolysacharide ADSA 2001

01   Campbell, M.J. Paape and M. Worku Differential Tyrosine Phosphorylation on Bovine PMN Proceedings of the NC Academy of Sciences 2001

01   aterman, Jenora and Mulumebet Worku . North Carolina Agricultural and Technical State University. Bovine Neutrophils Release the COX-2 Protein When Stimulated with Bacterial Lipopolysaccharide, 1380, J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

01   Ward and M. Worku IgM Binding Proteins on Bovine PMN ADSA 2001

01   atterson P, M. Worku and Candace Brown. Modified Tunel Assay for Determination of Apoptosis of Bovine PMN.ADSA 2001.

01   oteins Modulating Inflammation M Worku. Piedmont Triad Connectivity Expo Proceedings. Wake Forest University 2001.

01   odulation of Apoptosis in Bovine Blood PMN by Actinomycin-D, Lipopolysaccharide, and Sodium Butyrate. P Matterson*, S. Knight and M. Worku; , #1381, J. Anim. Sci. Vol 79 Suppl 1 ADSA 2001

01   ampbell, Kynita and Mulumebet Worku, North Carolina Agricultural and Technical State University. The Effect of Modulators of Bovine Polymorphonuclear Neutrophils on Protein Tyrosine Phosphorylation. 1379, J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

01   hnston-Ward Amy, Sommer Knight, and Mulumebet Worku. Isolation of Membrane Proteins Associated with IgM Binding to Bovine Neutrophils. 1383 J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

01   night, Sommer, Patricia Matterson, Stephanie Dance and Mulumebet Worku. cDNA Integrity Kit is Able to Detect Conserved Sequences in Bovine Neutrophils. , 1382 J. Anim Sci. Vol 79 Suppl 1 ADSA 2001

98   .Worku, A.J. Guidry, J.Patti. 1998. Factors Affecting Adherence of Staphylococcus aureus to Bovine Mammary Secretory Epithelial Cells. Dairy Science

98   ang Y., M.J. Paape and M. Worku. 1998. Expression of CD14 Receptors on Bovine Neutrophils. 1998. Dairy Science.

97   Monfardini, M. Paape, B. Burvenich, M. Worku and Y. Wang. Expression of L. Selection in Relation to Parturition in Dairy Cows. 1997. Dairy Science

94   .Worku, N.E. Brownson, D.A. Terle and L. Harvath. 1994. Physical and Functional Interactions Between CD32 and CD 45 on Human Neutrophils. 1994. Mol. Biol. Cell. (Suppl. 5):123A

94   .Worku D.A. Terle, N.E. Brownson and L. Harvath. Interactions Between the Low Affinity Fc Receptor (CD32) and Leukocyte Common Antigen (CD45) on Human Neutrophils. 1994. NIH Research Festival. September 19-23, 1994.

94   .Worku D.A. Terle, N.E. Brownson , J. Vostal and L. Harvath. Interactions Between the Low affinity Fc receptor (CD32) and Leukocyte Common Antigen (CD45) on Human Neutrophils. 1994. Gordon Research Conferences Holderness School , New Hampshire

92   Torku, M. M.J. Paape and W.W. Marquardt. 1992. Interferon Gamma Upregulates Fc Receptors for Monomeric IgG on Bovine Neutrophils (PMN) by De Novo RNA Transcription and Protein Synthesis. FASEB J. 6:A1050.

92   orku, M. and M.J. Paape. 1992. Fc Receptor Expression on Bovine Peripheral Blood Mononuclear Cells. J. Dairy Sci., 70 (Suppl 1)

91   orku, M. M.J. Paape and W.W. Marquardt. 1991. Modulation of Bovine PMN Fc Gamma Receptors Using Bovine Recombinant Iinterferon Gamma. FASEB J. 5: A732.

91   orku, M. M.J. Paape and W.W. Marquardt 1991. Trypsin Sensitivity, Density and Isotype Specificity of Fc Receptors (FcR) on Bovine

Neutrophils (PMN). J. Dairy Sci (Suppl. 1)

91   orku, M.M.J. Paape and R. Filep. 1991. Regulation in Binding of IgG2 and IgM to Bovine Neutrophils (PMN). Annual Meeting Soc. Leukocyte Biology, Aspen CO. 50 (Suppl).

90   orku M, M.J. Paape and W.W. Marquardt. 1990. Preliminary Characterization of Fc Receptors on Bovine Blood and Mammary Neutrophils. In proceedings of an International conference on Mastitis: Physiology or Pathology? University of Ghent Belgium, Sept 18-22.

WEB-BASED PUBLICATIONS

Center of Excellence for Studies in Genomic Diversity and CD-Rom

Bridging the Biotech Divide Symposium I and II

Bioinformatics Learning Facility

Bioinformatics and the Human Genome Project: CD-Rom and Brochure publication – Lindsey R. Denning (in collaboration with Colleen Butts and Tiffany Harris), January 2001

Presentations

2002   Beta-Lactoglobulin as a Facilitator of Transcellular Transport of IgG in Caco-2 cells. L. F. J. Anim. Sci. Vol. 80, Suppl. 1/J. Dairy Sci. Vol. 85, Suppl. 1. Graduate Paper Competition

2002   How to communicate with your advisor : M. Worku NSF STARR Students

2002   Sutton*1, M.Worku2, and B. Alston-Mills1, 1North Carolina State University, 2North Carolina ADSA Production Division, ADSA Southern Branch, and Northeast ASAS/ADSA Section 223, 2002.

1997   M.J. Paape, M. Worku, L. Johnson. Practical Applications of Flow Cytometry in Mastitis and Animal Production. 1997 University of Ghent Symposium on the Applications of Flow Cytometry to Dairy Science.

1992   Paape, M.J. M.Worku and A.L. Di Carlo. 1992. Immunoglobulin and Complement Receptor Expression on Neutrophils (PMN) from Calves with Leukocyte Adhesion Deficiency (LAD). Proc. 5th Intl. Cong. On Cell biol. Madrid. Spain

1991   Paape, M.J., A.J. Guidry, M.Worku and R. Filep. 1991. Flow Cytometric

Characterization of Anti-Bovine PMN Monoclonal Antibodies. XV
Congress International Society of Analytical Cytology, Bergen, Norway.

1989   Paape, M.J, L.M. Bernning, S.K. Salgar, M.Worku and R.R. Peters. 1989
        Use of Flow Cytometry in Diagnosis of Mastitis. Proc. 28th Annual
        Meeting, National Mastitis Council, p227.

1989   Paape, M.J., L.M. Berinning , S.K. Salgar, M.Worku and R.R. Peters
        1989. Fluorescent-Activated Cell Analysis: Applications on Mastitis
        Research. Proc,. Int. Conf on Mastitis, St. Georgen Austria. P62.

2002   Beta-Lactoglobulin as a Facilitator of Transcellular Transport of IgG in
        Caco-2 cells. L. F. J. Anim. Sci. Vol. 80, Suppl. 1/J. Dairy Sci. Vol. 85,
        Suppl. 1. Graduate Paper Competition

NON-REFEREED PUBLICATIONS

2002   Proteins for the Modulation of Inflammation Department of Animal
        Sciences report 1
2003   Meat Goats as an alternative enterprise NC A&T Extension Bulletin
2003   Ethnic Goat marketing Calendar in preparation

RESEARCH APPRENTICESHIP AND UNDERGRADUATE ADVISED PRESENTATIONS

2003   Isolation of Bovine Peripheral Blood Neutrophils by Using Percoll
        By: Virginia Blue
        Midway High School, Junior, Sampson County

02   olle Ogechi Uzochukwu – DNA, PCR, and Bioinformatics 2002
        ilford Couty
01   icia J. Conner – Bovine PMN Fight Inflammation 2001
        .E. Smith High School, Fayetteville NC
00   ndsey Denning – Neutrophils, Protein, RNA, and DNA for Biotechnology –
        Research Apprenticeship Program 20001E.E. Smith High School,
        Fayetteville NC

UNDERGRADUATE ADVISED RESEARCH

03   vaku B. Gyeni – The effect on immunoglobulin binding and Fc receptor
        expression on bovine neutrophils 2003

02   lucational CD –Rom for the control of Goat parasites Honors Program

01   oinformatics and the Human Genome Project. Colleen Butts[1]. Lindsey Denning[1], Tiffany Harris[1], and M. Worku[2] [1]E.E. Smith High School, Fayetteville NC and [2]North Carolina A&T State University, Greensboro, NC

Press Releases

- Interview on A&T Radio Joya Wesley – Careers in Genomics 2002
- A&T Today- 2003 Academic Giants Genomics Central
- Biotechnology Outreach for Small Farms Day March 21 2002 The Business Journal N.C. A&T to host biotech symposium The School of Agriculture and Environmental Sciences at North Carolina A&T State University will host "Bridging The Biotech Divide," a symposium that will explore emerging issues in agricultural biotechnology.
- Bioinformatics
- Growing Good-Guy Blood Cells in Culture, ARS June 29, 2000
- ARS 1993 Fc receptor on bovine leukocytes.

PROFESSIONAL MEETINGS

2003   Animal Genomics Symposium, NC Biotechnology Center

2003   13th Biennial Research Symposium – Atlanta, GA

2003   Exon – Intron "New Discovery" Workshop, NC A&T State University – Greensboro, NC

2003   Worku, Sommer, Kynita Paape and Matterson. American Dairy Science Association (ADSA), American Society of Animal Science (ASAS), and Mexican Association of Animal Production (AMPA) Joint Meeting

2003   Zia Symposium, New Mexico State University - Las Cruces, New Mexico

2002   NC Genomics and Bioinformatics Consortium Meeting – Raleigh, NC

2002   SACUC Annual Meeting, Fort Valley State University

2002   Greensboro, NC – Women in Agriculture Symposium

2002   Berkeley, CA – Bioinformatics Tools for Comparative Genomics Workshop

2002   Collaboration models - SAES Summit 2002

2002   Yang G, M Worku, M Kamp-Glass & A Thompson. 2002. Economic potentials of micropropagation for small-scale farmers. Presented at the 67th Annual Conference (21st Century Agriculture: Economic and Social Impacts on Small Farms and Rural Communities), The Association of Social and Behavioral Scientists, Inc. March 20-23, 2002, Greensboro, NC

2002   Worku M, Yang G and Thompson A. Indigenous Knowledge and Bioinformatics Partnering for Rural Agriculture. Presented at the 67th Annual Conference (21st Century Agriculture: Economic and Social Impacts on Small Farms and Rural Communities), The Association of Social and Behavioral Scientists, Inc. March 20-23, 2002, Greensboro, NC.

2002   Plant and Animal Genomics Meeting – January

2001	NBIF Bioinformatics workshop participant, NC A&T

2002	Microarray and SNP technology MWG workshop
2001	Emerging Issues Forum – NC State
2001-2002	Animal Genomics Symposium, NC Biotech Center
2003	Microarray and SNP Workshop NC A&T
2002	Comparative Genomics Workshop, Berkeley California
2001	St. Louis - CAST Biotechnology Communicators Summit, ST Louis
2000	ARD Symposium, Washington DC

2003   National Conference on Environmental Science and Technology, NC A&T

2003   Bioinformatics and Genomics Workshop NC A&T

2001   NC Academy of Sciences

2001   Annual Life and Physical Science Symposium NC A&T Biology Department

2002   SACUC Annual Meeting Fort Valley
2002   NC Supercomputer center consortium bioinformatics tools training
2001   SACUC Annual Meeting, Tuskegee University
2001   NIH-NHGRI Genomics short course participant

SCHOLARLY AND COMMUNITY SERVICE
2003   Gamma Sigma Delta Secretary

2003   USDA National Research Initiative (NRI) panel on Animal Genomes and Genetic Mechanisms

2001   NASA EPSCOR Grant Reviewer

2000   Patricia Matterson organized for and hosted the NC Histopathology Technologists Meeting

2000   High School Apprenticeship Program – Lindsey Denning has worked in the laboratory during the summer of 2000. Mentored Lindsey Denning and Two students from Fayetteville High school in a high school project to identify careers in the 21st century which resulted in the production of a comprehensive booklet on Bioinformatics as a career option.

2000   Ashley Parker from the GAMSEC program worked in the lab in collaboration with Steve Hurley in the summer of 2000.

2002-2003	1994. Supervise five MS level students in the planning and conduction of thesis research
	1995. Organize Annual Biotech Symposium
	1996. Conduct Summer biotechnology Workshop
	1997. RAP student Genomic exhibit travel
	1998. Participate in Field day – Golden Leaf
	1999. Organize a Bioinformatics workshop for faculty staffs and graduates Students University wide.
	2000. Establish a Microarray facility
	2001. Conduct RAP Student bioinformatics/biotechnology workshop
	2002. Ethiopia and culture presentation at Matte Reed Center
	2003. Recruit interns for internship opportunities
	2004. Participate in State fair exhibit
	2005. Invited to Participate on Advisory Board for Ethiopia Tree Fund Foundation
2000- present	Outreach for underserved communities
1998	Editorial assistance of papers presented at an International congress on the developments in Mastitis Research at the University of Ghent in Belgium
2001	Campus Coordinator- SACUC-Southern Ag-biotech Consortium
2002-2003	Department Graduate Coordinator
1994-1995	Review and committee member of investigation of new drugs(IND) submissions for Biologics
1993	USDA Sustainable Agriculture Grant reviewer
1997	Assist in the Organization of a conference of US Mastitis Research Workers
2001	Agriculture Program of the Texas A&M University System as represented by the Texas Agricultural Experiment Station (TAES), to include my name as a short-term specialist on its bid for Ethiopia's Amhara National Regional State (ANRS) Implementation of Agricultural Research, Extension, and Pilot Watershed Management Activities and Micro-Enterprise Development Activities.
2003	Research Careers in Bioinformatics An Emerging Challenge for Undergraduate Education
2001	Organized a Bioinformatics workshop for faculty staffs and graduates

Students University wide.

2001	Organized a media training workshop in Ag biotechnology IFIC and Susan Peterson Productions.
2002	ANSC 665 visited MWG-Biotech in High point a leading Genomics and Bioinformatics company.
2002	ANSC 665 incorporated bioinformatics and Grant Writing exercises.
2002	NC Supercomputing center familiarization account opened
2002	Collaborative opportunities with leading scientists at the USDA, NC State, Iowa State University, Tuskegee University UNC Charlotte and NC Super computing center established.
2002	Teaching material in Agricultural Genetics obtained from Dr Max Rothschild USDA coordinator of the Pig Genome Project, Iowa State University.
2001	Summer training opportunity provided to Kynita Campbell through our USDA collaborator Dr Max Paape.
2001	Course building material in Bioinformatics obtained through our collaborators at NBIF New Mexico State University Dr John Spalding.
2001	Provided training for one student in the Honors Program Candace Brown in ANSC 214.
2001	Provided employment and Training for two undergraduate students
2001	Collaborated with Dr Bette McKnigth to provide training and research opportunities for one MS level student in the biology department Stephanie Vance.
2001	Ag-biotech outreach information provided during small farms week
2002	Ethiopia Day cultural Exhibits provided to Matte Reed Center
2001	Visited Costa Rica Organization of Tropical Studies site Due University, representing NC A&T
2001-2003	Conducted Workshop in biotechnology to RAP and ICAN students
2001	Participated in International Education Week by providing ANSC

214 AND 665 students lecture material relevant to international themes, ANSC 214 students were exposed to a web-quest in Biodiversity students carried out exercises relating her activities to information about NC based on the training experiences of Vanessa Lamb currently on biodiversity training in Tanzania

2001   Provided research and training information to International student seeking entry to the Masters program

2001   Collaboration with Dr Brenda Alston Mills NC State University characterization of FcRn receptor and role of factors in milk ongoing

2001   Beta tester for cDNA integrity kit produced by Kierkegaard and Perry laboratories Gaithersburg MD Completed Web site development and establishment of ag-biotechnology interest group for dissemination of agbiotec information

2001   Collaboration with- Center for Nematode biology invited faculty participant NC State University

2001   NASA EPSCOR grant reviewer

2001   Beta tester for Kierkegaard and Perry cDNA integrity Kit

THESIS
M.Worku. 1989. Monoclonal antibodies recognizing determinants on bovine peripheral blood leukocytes (Msc Thesis), Univ. of Maryland.

DISSERTATION
M.Worku. 1993. Structure function and cell Biology of Fc receptors on bovine neutrophils (PhD Dissertation), Univ. of Maryland.

THESES COMMITTEES (CHAIRED & SERVICE AS MEMBER)
2003   Feasibility study to evaluate the use of microarrays in studying global gene expression in response to endotoxin. Pei Pei Wang, **Major Advisor**

2003   Expression of the Intracellular Region of C-Kit in the Peripheral Blood Mononuclear Cells of Canines With and Without Mast Cell Disease Angelique Marie Fuller, **Major Advisor**

2002   Amy Ward Johnston. Isolation and Characterization of the protein binding IgM on bovine Neutrophils
2002   S. N. Knight. Molecular and Genomic Characterization of activated bovine blood Neutrophils – **Worku, M. Major Advisor**
2001   J. Waterman Expression of the Cyclooxygenase 2- gene by bovine

Neutrophils. Defended April 2001 - **Worku, M Major Advisor**

2001 The Effects of Lipopolysacharide, Sodium butyrate and Dexamethasone on ligand binding and Fc receptor expression and protein tyrosine phosphorylation and apoptosis of bovine neutrophils. Defended April 2001 By: Kynita Campbell, **Worku, M Major Advisor**

Current and Former Graduate Students:

Jenora Wateramn   2002   pursuing PhD in Functional Genomics
Kynita Winn Campbell 2002 Currently at National Eye Institute NIH
Amy Ward Johnston 2002 Currently at Guilford College
Sommer N Knight 2002 Currently Medical Student in East Carolina Medical School
Angelique Fuller 2003 Currently at NC State Veterinary Medical School
Pei Wang 2003 Currently seeking employment

Current and just completed MS students
Zaki Abdulrahman
Takia Harris
Gregory Bernard
Nicholaus Cunningham
Yohannes Asfaw
Gregory C Bernard
Kristy Terell
Odette Alexander
Jill Bowman

Graduate Student Employees

Prasannaa Ganesan – Electrical Engineering
Archana Prabahakaran – Chemical Engineering

Undergraduate Students – Takia Harris
Dawn Hampton
Jamie Harris
Doug Wiggers
Lindsey Denning
Erika Brown
Kwau Gyeani

Honors student and community service – Lindsey Denning, Candace Brown

Mentor to Honors Program students

MS Advisory Committee membership
Jewel Carr – Food Science

Richard Mason - ANSC
Mani Matlaputi – NARS- research advice
Lareese Donaldson-ANSC
Lakesha Woodson Biology

Supervise one Research Assistant: Ms Patricia Matterson

Manuscripts prepared for submission

The effects of lipopolyssacharide, dexamethasone, and sodium butyrate on protein tyrosine phosphorylation. Kynita C Winn[a], Mulumebet Worku[b], and Max Paape[c][a] National Institute of Health, Bethesda, MD [b] North Carolina Agricultural and Technical State University, Faculty of Animal Science, Greensboro, NC [c] United States Department of Agriculture, Beltsville, MD

Apoptotic responses of PMN following experimental challenges with sodium butyrate, dexamethasone, and lipopolysaccharide. Kynita C Winn[a], Mulumebet Worku[b], and Max Paape[c,] [a] National Institute of Health, Bethesda, MD[b] North Carolina Agricultural and Technical State University, Faculty of Animal Science, Greensboro, NC [c] United States Department of Agriculture, Beltsville, MD

Ligand Binding and Fc receptor expression responses of PMN following experimental challenges with sodium butyrate, dexamethasone, and lipopolysaccharide. Kynita C Winn[a], Mulumebet Worku[b], and Max Paape[c] [a] National Institute of Health, Bethesda, MD[b] North Carolina Agricultural and Technical State University, Faculty of Animal Science, Greensboro, NC[c] United States Department of Agriculture, Beltsville, MD

BINDING EXOGENOUS AND ENDOGENOUS IMMUNOGLOBULINS TO POLYMORPHONUCLEAR NEUTROPHILS FROM HEALTHY COWS AND COWS WITH STAPHLYOCOCCUS AUREUS MASTITIS. Amy Johnston-Ward[1], Mulumebet Worku[1], Kevin Anderson[2] . [1]Department of Animal Sciences, North Carolina Agricultural and Technical State University. [2]College of Veterinary Medicine, North Carolina State University

Journal of Veterinary Immunology and Immunopathology. Title: Expression of COX-2 by LPS-Stimulated Bovine Neutrophils. Waterman[1], JD and Worku[2], M. [1]Current Address: North Carolina State University, Center for the Biology of Nematode Parasitism, 840 Main Campus Dr., Partners II Suite 1400, Raleigh, NC 27606. [2]Corresponding Author: North Carolina Agricultural and Technical State University, 1601 East Market St., Greensboro, NC 27411; Tel (336) 334-7615 Fax (336) 334-7288; Email: worku@ncat.edu.

REFERENCES

Dr David Libby
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Greensboro NC 27411
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libbyd@ncat.edu

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Greensboro NC 27411
(336)-334-7979

Dr. Max J. Paape
Research Dairy Scientist
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Beltsville, MD 20705-2350
301/504-8302
mpaape@anri.barc.usda.gov

N. Radhakrishnan, PhD, PE
Vice Chancellor for Research and Economic Development
North Carolina A&T State University

Education:

PhD	1969	University of Texas at Austin (Civil Engineering)
MTech	1962	Indian Institute of Technology (Civil Engineering)
BEngr	1960	University of Madras (Civil Engineering)

Summary of Experience:

1999 to date   Senior Executive Service (SES**) Director** of Computational and Information Sciences   Directorate (2003 program $180M) and **Chief Information Officer** for the Army's Corporate R&D Laboratory – U.S. Army Research Laboratory (ARL).

1986 to 1999   **Director** of Information Technology Laboratory (1999 program $110M) and Chief Information Officer of nation's largest civil/environmental engineering R&D organization—U.S. Army Engineer Waterways Experiment Station (WES)

1983 to date   Manager of large, joint computing facilities (over 8 TFlops), providing both management/business and scientific/engineering processing

1969 to 1999   Research/project manager— $30K in 1972 to $12M/year in 1986

1970 to 1999   Member of MS and PhD graduate committees at various universities on behalf of local candidates

1970 to 1990   Adjunct professor, Mississippi State University, teaching graduate courses at WES Graduate Institute in finite element method and soil-structure interaction; also developer/instructor of short courses in several computer-aided engineering areas for practicing engineers/scientists

1976 to date   Member of advisory boards at several universities

1959 to 1962   Lecturer for undergraduate and graduate courses in geotechnical engineering.

Strong Attributes:

o **Demonstrated experience in building, leading and managing an inter-disciplinary R&D program.**

  - Proven ability to recruit, retain, lead, and manage several hundred well qualified scientists
     and engineers
  - Experience in managing large programs ($100-180M/year)
  - Demonstrated ability to motivate and mentor professionals

- Well balanced skills exhibiting both research as well as business acumen.

o   **Well connected with academia and industry.**

- Has performed research in a number of areas including finite element method, soil-structure
  interaction, computational science and engineering, etc.
- Has taught both undergraduate and graduate level courses for over 25 years
- Guided students at Masters and Doctorate levels
- Member of several university advisory boards
- Particularly strong ties with Historically Black Colleges/Universities and Minority Universities
- Experience in working with industry and academia together (Computational Science and
  Engineering, Collaborative Technology Alliance, Army Knowledge Management Center,   CADD/GIS Technology Center, etc.)

o   Proven ability to conceive, develop, and build new programs and establish Centers involving inter-disciplinary areas.
    Examples:

- Establishment of an inter-disciplinary Computational Science &Engineering Group in CISD, recruiting several PhDs, and obtaining funding (1999)
- Establishment of A DoD/Army Information Assurance Center (for DoD High Performance Computing, AMC, and ARL) (1999)
- Army Knowledge Management Fusion Center (2003)
  Center of Expertise for Automated Language Translation (proposed in 2003)
- Establishment of a Tri-Services Computer-Aided Design and Geographic Information Center (1989)
- Key player in establishing the first DoD High Performance Computing Center in Vicksburg (1989)
- Establishment of the Corps of Engineers Central Processing Center (1989) in ITL.
- Establishment of the first Corps of Engineers Software Technology Center (1989)
- Establishment of first Corps of Engineers Civil Works Guidance Update Center (1994)
- Designed and built two state-of-the-art, modern, high technology buildings (75,000sq.ft) for the Information Technology Laboratory at Vicksburg, MS.

o   **Demonstrated ability to conceive and obtain new funding for programs.**
    Examples:

- Obtained funding for the Information Assurance Center ($5M/yr) – 1999.
- Obtained funding for a new project called Edge Warrior (intelligence information to the soldier) as part of a DoD initiative called Horizontal Fusion (10M in 2003, likely   to grow to $2
- Obtained funding for a new Language Translation Project from DoD ($2/ in 2003 , likely to grow to $6M/yr) – 2003.

- Obtained funding for an Army Knowledge Management Fusion Center at ARL $4Min 2003, likely to grow to $8M/yr) - 2003
- Obtaining funding for a variety of Computational Science projects in inter-disciplinary areas ($8M/yr) – 1999-2003
   - Obtained funding for an inter-disciplinary, inter-directorate research program in Computational Signature Modeling ($2M/yr) – 2002-2003
   - Obtained funding to build two state-of-the-art Collaboratoriums to display interactive, immersive scientific visualization applications ($4M) – 2001-2003.
   - Highly successful project and Center for Computer-Aided Structural Engineering (CASE) and Geotechnical Aspects of CASE (GCASE) (1975 - 1999)
   - Initiated and obtained funding for several other engineering research programs —Soil-Structure Interaction Analysis, Risk and Reliability Analysis for Hydraulic Structures, Innovative Design and Construction, etc.
- Grew the Information Technology Laboratory (ITL) at the Waterways Experiment Station (WES) from $20M/year to $110M/year in 12 years through new programs – 1987-   1999.

o **Other Specialized Experience:**

- Unique position in the organization (both at WES in Vicksburg and the current one in ARL) where I am responsible for both the scientific and research side of computing as well as the management and enterprise side of the business as the Chief Information Officer (CIO). Probably, the only such position in the federal government.
- Manages an IT/CIO infrastructure budget of $36M/year at ARL.
- Demonstrated experience in successfully running a cost-reimbursable (fee-for-service) program for most of all Information Management support for the organization.
- Developed a Vision for a World-Class Information Technology Infrastructure at ARL And have implemented most of the plan in a record 3 ½ years.
- Designed and built a state-of-the-art communications infrastructure for ARL extending to all buildings and users at the three major ARL sites (Adelphi, Aberdeen, White Sands).
- Replaced over 2500 personal computers at ARL in one year bringing them to world-class standards through an innovative leasing arrangement with one of the major vendors.
- Totally upgraded the Video Teleconferencing (VTC) infrastructure at ARL in 2 years.
- Very effective communicator who excels in marketing, briefing, presentations, and writing.

Positions:

05/99 to date   *Director, Computational and Information Sciences Directorate (Senior Executive Service) U.S. Army Research Laboratory (ARL), Aberdeen, MD*
   Manages a budget of $180M (overall ARL budget is $900M/yr) and over 750 government and contract people. The Directorate does basic and applied research in Battlefield Communications, Data Fusion and Knowledge Management, Computational Science and Engineering, and Battlespace Environment and Atmospheric Science. Responsible for running a DOD High Performance Computing Center specializing in state-of-the-art scalable and vector computing hardware, scientific visualization, etc., and collaboration with researchers and academia in a number of application areas such as Computational Fluid

Dynamics (CFD), Computational Structural Mechanics (CSM), and Computational Chemistry and Materials (CCM). Responsible for the Army High Performance Computing Research Center (AHPCRC) currently located at the University of Minnesota. Established and currently run a DoD HPC Information Assurance Intrusion Detection Center. Responsible for a Government Industry-University consortium doing research in advanced communications and networks. Other major projects include Horizontal Fusion for the Soldier, Army Knowledge Management Center, Chem-Bio propagation models, Language Translation research, effects of atmospheric conditions on Army's mission, Decision Aids for the Commander and the Soldier, etc. In addition, serves as the Chief Information Officer (CIO) for ARL and in this capacity is responsible for providing a world-class Information Technology infrastructure for ARL (annual budget $36M). This includes a state-of-the-art communications network, video teleconferencing services, enterprise applications and management, libraries, and document management. Much sought after speaker for professional, government, and industry audiences on the future of engineering and information technology.

07/86 to 05/99   *Director, Information Technology Laboratory (Supervisory Civil Engineer)*
U.S. Army Engineer Waterways Experiment Station (WES), Vicksburg, MS
Established and Managed the Information Technology Laboratory (ITL), the premier engineering IT laboratory in the Department of Defense and one of five laboratories at WES, the largest civil and environmental engineering R&D complex in the U.S. Built the lab from $15M/year (FY87) to a budget of $110M/year (FY99) and over 250 government and 150 contract employees. Main research thrusts were in interdisciplinary engineering computer applications, computer science, information technology, and instrumentation design. R&D projects addressed structural engineering, soil-structure interaction, risk and reliability assessment, innovative design methods, development of large MISs, scientific visualization, virtual reality, and high-bandwidth communications. Major facilities included the first of four DoD High Performance Computing Major Shared Resource Centers (containing a heterogeneous mix of scalable and vector supercomputers), the Tri-Service CADD/GIS Technology Center, the largest of two Corps of Engineers Regional Processing Centers, the Corps' Software Technology Center, the leading Scientific Visualization Center in the federal government, an advanced technology mini-laboratory for investigating emerging data interpretation methods and tools, a state-of-the-art electronic meeting facility for groupware sessions, an instrumentation design and development laboratory, and a large technical library that has one of the finest civil engineering collections in the world. In addition, served as the Chief Information Officer (CIO) for WES with responsibility for planning, resourcing, designing, building/procuring, operating, maintaining, and disposal of over $200M in IT resources. Over a 10 year period, designed and built from scratch WES's technological infrastructure which included a 21-mile-long fiber optic backbone running both FDDI and ATM and providing online library services, electronic publishing, e-mail, electronic information exchange, etc. Widely recognized and regularly consulted as aggressive, innovative leader in R&D thrust areas. Served on advisory board of several universities and graduate committees of several MS and PhD students.

09/69 to 12/89   *Adjunct Professor, Mississippi State University*

Taught graduate courses in finite elements and soil-structure interaction analysis . Participated in graduate student committees for research . **Have been in several Masters degree committees as well as three PhD committees.**

10/83 to 06/86   *Chief, Automation Technology Center (Supervisory Civil Engineer), WES*

Managed a large interdisciplinary organization with total budget of over $11M/year (FY86) and over 60 government and 20 contract employees performing R&D in engineering and scientific, business, and management computer applications.

09/69 to 10/83   *Civil Engineer/Research Civil Engineer, Automatic Data Processing Center,*

WES

Served as Researcher and Project Manager for several engineering computer-oriented projects and as senior advisor to Chief, ADP Center, on technical matters. Developed Computer-Aided

Structural Engineering (CASE) Project. Developed and conducted a number of short courses for practicing engineers on computer-related engineering topics.

09/66 to 05/69   *Research Engineering Assistant, University of Texas at Austin*

Taught graduate courses in geotechnical engineering and performed research on development of finite element analysis for soil-structure interaction problems. Participated in several engineering consulting projects with Dr. Lymon Reese.

09/62 to 08/66   *Lecturer in Civil Engineering, Indian Institute of Technology, Bombay, India*

Taught graduate and undergraduate courses in geotechnical engineering, earth dam design, foundation analysis, and laboratory techniques. Conceived, developed, and implemented a state-of-the-art undergraduate laboratory in soil mechanics. Provided research guidance to several graduate and senior level undergraduate students in their thesis/special projects topics. Served on research committees and advisory committees to student bodies.

02/62 to 08/62   *Lecturer, College of Engineering, Guindy, Madras, India*
05/59 to 06/60

Taught undergraduate courses in general engineering and surveying

Academic Partnering Activities:

Have sponsored several R&D projects at various universities in engineering, computer science, and interdisciplinary areas over a period of 33 years. Since 1996, have played a leadership role in DoD in partnering with universities in computer and computational science research areas. Work with internationally recognized academic leaders in several universities in defining the research program, evaluating project proposals, and reviewing results. Some

partnering universities I have worked with include this effort have been Mississippi State University, University of Texas at Austin, Ohio State University, NSF National Center for Supercomputing Applications at the University of Illinois, NSF Center for Research in Parallel Computing at Rice University, Syracuse University, University of Tennessee, University of Southern California, University of Florida, Jackson State University, Clark-Atlanta University and Morgan State University. Responsible for managing the Army High Performance Computing Research Center (AHPCRC) involving the Universities of Minnesota, North Dakota, Jackson State, Florida A&M, Howard, and Clark-Atlanta. Responsible for a Collaborative Technology Alliance (CTA) in Advanced Communications Research with Industry as the lead and universities in partnership. **Have a strong reputation in nurturing and partnering with HBCUs/MIs**.

Advisory Boards:

Serve (or have served) on several Advisory Boards — Rice University, NSF Center for Research in Parallel Computing (CRPC); University of Minnesota, Research Management Team, Army High Performance Computing Research Center (AHPCRC); Mississippi State University Computer Science Department; Mississippi State University, NSF Engineering Research Center Affiliate Group; University of Southern Mississippi, School of Mathematical Sciences; University of Southern Mississippi, Computer Science Department; Jackson State University, Computer Science Department; Jackson State University, Engineering Department; NSF Center for Computational Chemistry, Jackson State University; Army Research Office, Advisory Board for Computer Science; Army HBCU Center of Excellence in Information Sciences, Clark-Atlanta University; Engineering Advisory Board, University of Puerto Rico at Mayaguez;, etc.

Major Recognitions:

2003   Army Superior Service Award
2000-03 Exceptional Performance Ratings in the SES Service
2003   Nominated by supervisor for Presidential Meritorious Performance Award
1970-99 Consistent Exceptional Performance Ratings
1999   Decoration for Exceptional Civilian Service, Department of the Army
1997   Computing in Civil Engineering Award, American Society of Civil Engineers

1997   John J. Franke Professional Service Award, Federation of Government Information
               Processing Councils (also in 1993)
1997   Director's Award for Excellence in Equal Employment Opportunity, WES (also in 1995,
                1988)
1996   Member of "Federal 100," *Federal Computer Week* magazine (also in 1993)
1994   Agency Award for Excellence, *Government Computer News* magazine
0   Award for Executive Excellence, General Services Administration's Interagency
               Committee
               on Information Resources Management
1   Decoration for Exceptional Civilian Service, Department of the Army
1992   Army Meritorious Civilian Service Award

Dr. Huiming Anna Yu
Department of Computer Science
North Carolina A&T State University

Professor of Computer Science Department
Director of Graduate Studies of Computer Science Department
Faculty Advisor of the Society of Women Engineers

Education:
Ph.D. in Computer Science, Stevens Institute of Technology, 1992
M.S. in Computer Science, Hefei Polytechnic University, 1982
B.S. in Electrical Engineering, Xiamen University, 1976

Professional Experience:
Professor, North Carolina A&T State University (June 2002 - Present)
Associate Professor, North Carolina A&T State University (June 1997 – June 2002)
Assistant Professor, North Carolina A&T State University (Aug. 1992-May 1997)
Research Assistant, Stevens Institute of Technology, Hoboken, NJ (1991-1992)
Associate Software Engineer, Syncsort Inc., Woodcliff Lake, NJ (1990-1991)

Honors:
2004:   Nominated for Presidential Awards for Excellence in Science, Math and Engineering Mentoring (Pending)
2003:   IBM Outstanding Faculty Award
2001:   College of Engineering "Associate Professor Level Teaching Excellence Award"
2001:   Department of Computer Science "Teacher of the Year" Award
2001:   Selected and Published in Who's Who in the World
2000:   College of Engineering "Research Excellence Award"
2000:   Department of Computer Science "Researcher of the Year" Award
1999:   Selected and Published in Who's Who in Science and Engineering
1999:   Department of Computer Science "Researcher of the Year" Award
1999:   Nominated for Distinguished Service as a SIGAda volunteer or leader award
1996:   Department of Computer Science "Researcher of the Year" Award
1993:   Inducted into UPE Honor Society

Grants Awards:

1. 2003: PI of "Migrate Web-Based Application Systems from Tomcat to WebSphere", IBM, $40,000.
2. 2002-2006: Co-PI of "Carolina Cyber-Defender Scholarship", NSF (with UNCC), NC A&T SU received $1,833,000.
3. 2002-2003: PI of "A Web-Based Visualization and Collaboration Tool for 3D/4D Imagery and Geospatial Information", National Imagery and Mapping Agency, $98,840.
5. 2001-2003: Co-PI of "The DoD Carolina Cyber-Defender Scholarship Program", National Security Agency (with UNCC), NC A&T SU received $200,000.
6. 2000-2002: Co-PI of "Design and Implementation of a Web-Based GIS Road Closure Information System", Department of Transportation, $240,000.
7. 2000: PI of "Enhancing Women Engineers Education", Goldman Sachs, $9,205.

8. 1998-2000: PI of "Enhancing Minority Research and Education in Robotics", U.S. DOE, $40,457.
9. 1997-2000: PI of "Hybrid Motion Planning with Multiple Destinations", NASA, $278,937.
10. 1995-1996: PI of "Ada 95 Resources to Support Software Engineering and Software Reuse Courses", Defense Information Systems Agency (DISA), $45,577.
11. 1995: Co-PI of "Software Engineering and Software Reuse Courses Using Ada 95", DISA, $59,874.
12. 1994: A Free Copy of InQusix software package from Software Productivity Solutions, Inc., $13,000.
13. 1993: PI of "Multiple Mobile Robot Path Planning", COE Initial Research Grant, $3,750.
14. 1993: Co-PI of "Research Instrumentation of Proposal", Department of Defense, $370,704.

Recently Refereed Journal Publications
1. Yu, H. and Su, T., "Destination Driven Motion Planning Via Obstacle Motion Prediction and Multi-State Path Repair", Journal of Intelligent & Robotic Systems Theory and Applications, February 2003.
2. Yu, H., Dozier, D., Chi, C. and Bi, Q., "Hybrid Evolutionary Motion Planning for Mobile Robot", International Journal of Knowledge-Based Intelligent Engineering Systems, Vol. 5 No.4, October 2001.
3. Yu, H., Hu, Y. and Gao, M., "Color Space Conversion Circuit Based on Parameterized High-Radix Multiplication Algorithm", Microelectronics and Computer, No. 5, 2001.
4. Yu, H., Chi, C., Su, T. and Bi, Q., "Hybrid Evolutionary Motion Planning Using Follow Boundary Repair for Mobile Robot", The Journal of Systems Architecture, Volume 47, Issue 7, July 2001.
5. Monroe, J. and Yu, H., "A Software Engineering Using Ada 95 Course", Ada Letters, Vol. XVIII No.1, January 1998.
6. Yu, H., "A Course in Software Reuse with Ada 95", Ada Letters, Vol. XVIII No.1, January 1998.
7. Yu, H., "Using Object-Oriented Techniques to Develop an Ada 95 Reuse Library", Ada User Journal, Vol. 19 No.1, April 1998.
8. Yu, H. and Malik, R. "Aimy-an Autonomous Mobile Robot Navigation in an Unknown Environment with Infrared Detector System", Journal of Intelligent & Robotic Systems Theory & Applications, Vol. 14 No. 2, October 1995.

Recently Refereed Conference Proceedings Publications
1. Yu, H., Wang, L., Zhang, J. and Barksdale, J., "Developing Visualization Modules Using Design Pattern Technology", will appear in the Proc. of IASTED Int. Conf. On Data Modeling and Simulation, June 2004.
2. Yu, H., Zhang, J., Wang, L. and Barksdale, J., "A Secure Web Application: 3D Visualization and Collaboration", Proc. of The 2nd IASTED Int. Conf. on Communication, Internet, and Information Technology, November 2003.
3. Yu, H., Wang, L., Zhang, J., Barksdale, J. and Rutschman, D., "A Platform Independent 3D Visualization System", Proc. of The 3rd IASTED Int. Conf. On Visualization, Imaging, and Image Processing, September 2003.
4. Rutschman, D., Yu, H., Emmanuel, N. and Wang, L., "WebGISRCI: A Web-Based GIS Road Closure Information System", Proc. of th Int. Conf. on Information and Knowledge Sharing, November, 2002.

5. Yu, H. and Su, T., "A Destination Driven Navigator with Dynamic Obstacle Motion Prediction", Proc. of the IEEE Int. Conf. on Robotics and Automation, 2001.

6. Chen, Z., Xu, B. and Yu, H., "Detecting Concurrently Executed Pairs of Statements Using Adapted MHP Algorithm", Proc. of ACM SIGAda Int. Conf., 2001.

7. Yu, H, "Using Advanced Technology to Enhance Undergraduate Robotics Education", Proc. of the IASTED Int. Conf. Computers and Advanced Technology in Education, 2000.

8. Yu, H., Su, T., Chi, C. and Thompson, R., "Pursuing A Dynamic Target Through Motion Prediction and Follow Boundary Repair", Proc. of the IASTED Int. Conf. Robotics and Applications, 2000.

9. Yu, H., Chi, C. H. and Bi, Q., "Optimal Motion Planning for Mobile Robots Using Hybrid Evolutionary Algorithms", Proc. of the Pacific-Asia Int. Conf. on Microcomputer Applications, 2000.

10. Yu, H., Chi, C., Su, T. and Headen, T., "Collision Free Navigation in Unstructured Environments", Proc. of the IASTED Int. Conf. Robotics and Applications, 2000.

11. Yu, H., Chi, C. J. and Mosley, G., "Integrating Cross-Line Representation and Evolutionary Algorithms into Robot Motion Planning", Proc. of the Second IASTED Int. Conf. Control and Applications, 1999.

12. Yu, H., Chi, C., Dozier, G. and Qiang B., "Intelligent Motion Planning by a Hybrid Evolutionary Planner", Proc. of the IASTED Int. Conf. Robotics and Applications, 1999.

13. Yu, H., "Enhancing Minority Robotics Education", Proceedings of the ADMI Conference, 1999.

14. Yu, H. and Chen, W., "Integrating Research and Practice into a Undergraduate Robotics Course", Proc. of the 1999 Spring Regional Conf. of the Middle Atlantic Section of the ASEE, 1999.

15. Li, B., Xu, B. and Yu, H., "Transforming Ada Serving Tasks into Protected Objects", The proceedings of ACM SIGAda Annual International Conference, 1998.

16. Yu, H., "Using Object-Oriented Techniques to Develop Reusable Components", Proceedings of Tri-Ada, 1997.

17. Yu, H., "A Course in Software Reuse with Ada 95", Proceedings of 11th Annual ASEET Symposium, 1997.

18. Monroe, J. and Yu, H., "A Software Engineering Using Ada 95 Course", Proceedings of 11th Annual ASEET Symposium, 1997.

19. Yu, H, Esterline, A. and Monroe, J., "Object Oriented Formal Specification to Support Ada 95 Reuse", Proceedings of Tri-Ada, 1996.

20. Yu, H., Russell, K., Downey, A. F., Lee, L. and Clay, R. N., "An Object Oriented Ada 95 Library", Proceedings of 10th Annual ASEET Symposium, 1996.

21. Yu, H. and Monroe, J. "An Approach to Formal Specification for Ada 9X Software Reuse", Proceeding of the Thirteenth Annual National Conference on Ada Technology, 1995.

22. Yu, H. and Mathis, W., "A Real-Time Reexecutive Multiprocess Scheduling for a Sensor Based Mobile Robot System", Proceedings of the Third IASTED International Conference on Robotics and Manufacturing, 1995.

23. Yu, H. and Malik, R., "An Object-Oriented Concurrent Language for Programming Mobile Robot", Proceeding of Third International Conference on Automation, Robotics and Computer Vision, 1994.

24. Monroe, J. and Yu, H., "A Systematic Object Identification Technique in the Object-Oriented Paradigm", Proceeding of the Twelfth Annual National Conference on Ada Technology, 1994.
25. Yu, H. and Monroe, J., "Integrating Ada into Reusable Software Engineering", Proceeding of the Twelfth Annual National Conference on Ada Technology, 1994.
26. Malik, R. and Yu, H., "The Infrared Detector Ring: Obstacle Detection for an Autonomous Mobile Robot", IEEE 35th Midwest Symposium on Circuit and Systems, 1992.
27. Malik, R. and Yu, H., "Obstacle Avoidance with Infrared Detector Ring", 23th Annual Pittsburgh Conference on Modeling and Simulation, 1992.

Books:

I cooperated with Bin Lin and Wei Xia to write a textbook, "Object-Oriented Programming with Ada 95", which was published in 1997.

Graduate Students Advised and Supported

I have advised and provided financial support for fifty-nine graduate students. Thirty-seven of them have received MS degrees. I have served as a member of thirty graduate student thesis/project committees. I have also advised more than thirty graduate students who elected the course option. .

Reviewer, Conference Chair and Program Committee

Serve as a reviewer, conference chair and program committee for eight conferences and two journals