

Leading, Connecting, Transforming

Meeting the Needs of North Carolina:
100 NC State Programs that Impact the State

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As the world continues to change at a rapid pace, NC State is helping to shape the future with an uncommon focus. Our university has lived the land-grant mission of engagement for 120 years, listening proactively and constantly, remaining steadfast in a commitment to partners and the citizens of North Carolina, and following through with determined action.

NC State stands ready to lead, connect and transform through our teaching, research and outreach. Through strategic planning and a commitment to address the state's and nation's most pressing issues, NC State is organizing to focus on the following areas:

- Preparing Leaders for our State, Nation, and the World
- Creating Innovation in K-20 Education
- Growing and Sustaining the Nation's Energy and Environment
- Advancing the Health and Well-Being of Our Citizens
- Economic Development, Community Outreach and Social Equity

At NC State, however, this commitment is more than inspiring talk—it is what we do now and have always done. To demonstrate our real, ongoing and institution-wide commitment to serving the needs of North Carolina, we have prepared this summary of 100 programs that are impacting our state and nation. Our history is one of listening to the needs of North Carolina and responding with real-world applications that solve real-world problems. Our future is to use knowledge, collaboration and creativity to impact the most pressing needs of society—today and, even more importantly, tomorrow.

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Leading, Connecting, Transforming

Preparing Leaders for our
State, Nation, and the World

The University of North Carolina Tomorrow

Section 1

Pre-College Programs

The Need

According to the Commission on the Future of Higher Education, “access to American higher education is unduly limited by ... inadequate preparation, lack of information about college opportunities, and persistent financial barriers.” Pre-college programs are designed specifically to address these access issues, and many have demonstrated a measurable impact. To broaden that impact and to leverage the strengths of individual programs, a coordinated effort is critical.

Serving the Need

NC State’s Office of Pre-College Programs provides a single point of contact for students and families who want to participate in pre-college opportunities. More than 50 pre-college programs are offered by NC State and its partners in a variety of academic disciplines, each giving students a taste of life at NC State while helping them prepare for college. Pre-college programs offer students at the elementary, middle, and high school levels a rich variety of opportunities to explore interests, acquire knowledge, investigate careers, conduct research, build portfolios, experience campus life, sharpen academic skills, interact with university faculty, and envision their own future—all in preparation for college enrollment. The Office supports pre-college program faculty and staff and works to strengthen programs by providing information to families and prospective participants, expanding offerings, increasing student participation, monitoring and evaluating program effectiveness, increasing program resources, cultivating partnerships, and inviting broad community support. Impacts of the Office of Pre-College Programs include:

- Coordination of marketing efforts for pre-college programs
- Development of a “pipeline” student database
- Attention to college access issues for prospective low-income and first generation college students
- Expansion of pre-college populations to include community college transfer students
- Outreach to students from underrepresented populations
- Enhanced communication and collaboration among pre-college programs
- Focus on engaging students in science, technology, engineering, and mathematics
- Representation of pre-college populations in the university’s grant-seeking efforts
- Increased awareness of pre-college programs as a pathway to higher education
- Improved relationships and partnerships with school districts and community agencies

Impact beyond North Carolina

In late 2007, the NC State Office of Pre-College Programs will host a first-time summit to analyze pre-college programs with regard to their impact on access to higher education. The summit will bring together program leaders from across North Carolina and the nation to share best practices and to plan for the future.

For more information, contact

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Minority Engineering Programs

The Need

High technology industries in North Carolina and the US require a diverse pool of engineering graduates prepared to meet the challenges of the 21st century. Engineering colleges and universities face similar hiring challenges as current engineering faculty enter retirement. As a land grant institution, NC State has an obligation to provide education to all citizens, including minority high school graduates seeking engineering degrees. The College of Engineering is committed to providing opportunities for minorities to achieve engineering degrees.

Serving the Need

For nearly 12 years, our Minority Engineering Programs Office (MEP) has maintained a National Minority Engineering Programs Advisory Board. More than two dozen active board members are from companies who work tirelessly to diversify their company's engineering workforce. In addition to attending biannual board meetings, these company representatives participate in minority student programs and activities that offer a greater knowledge of and more frequent access to our underrepresented minority engineering students. MEP activities and outcomes include:

- Matching top minority high school students with scholarships to attract the best and brightest to NC State
- Summer Transition Program (STP), providing minority students the opportunity to take classes and acclimate to college life during the summer before their first fall semester
- Student Advancement and Retention Teams (START), a mentoring program that pairs upper class minority engineering students with freshmen students
- Freshmen Orientation Courses designed to promote professional and career development of freshmen underrepresented minorities in the College of Engineering
- Opportunities for minority engineering students to participate in national and international NSBE conferences with support from corporate sponsors
- Increased minority enrollment and the graduation rates of minority engineering students
- Using MEP National Advisory Board members to help prepare students for the workforce

Impact beyond North Carolina

A larger percentage of African American and other minority students are enrolled in engineering and active in graduate and undergraduate research. Annually NC State ranks in the top five nationally in number of B.S. engineering degrees awarded to African Americans. NC State's minority engineering undergraduates routinely receive several competitive new job offers, with approximately 15 percent gaining acceptance to the top graduate engineering colleges in the nation.

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Outreach to Diverse and Underserved Prospective Students

The Need

Outreach programs for underserved populations continues NC State's mission of providing access to educational opportunities to the students of North Carolina, a mission that has never been more important to the future of the state.

Serving the Need

Programs that reach out to all corners of North Carolina insure that students from across the state have the opportunity to benefit from an NC State education. Enrolling students from diverse backgrounds benefits the education of all students. Activities to support this goal include the following:

- A national award-winning "planning for college" brochure created for the parents of first generation college-going students. Available in both English and Spanish, this brochure has been distributed widely across North Carolina and adopted by some high schools for use in their college planning sessions.
- Admissions staff participate in college fairs across North Carolina, reaching every county in the state from Murphy to Manteo.
- Pack Preview recruitment events are held across North Carolina during the Fall and Spring semesters. Pack Previews are targeted towards minority high school students and bring the university to the students and their families to discuss admission requirements, academic resources, and other resources available at the NC State.
- Day-long campus visit programs are held for African American, Hispanic/Latino, and Native American students. These programs give students and their families the opportunity to allay any special concerns they may have about attending NC State. Feedback regarding the programs has been extremely positive, as students regularly comment on how warm and inviting an environment NC State proved to be.
- Admission information in Spanish is provided on NC State's website. In addition, Admissions produces a number of other publications in Spanish and has conducted ten workshops on college preparation for Hispanic students and their parents; presented at three conferences on Hispanic student outreach strategies; participated in ten Hispanic college fairs; hosted campus visits for two Hispanic community organizations; and provided translation services for the Math-Science Education Network pre-college program and FAFSA Day.

Impact beyond North Carolina

The educational benefits of recruiting diverse students will serve our graduates as they move into careers that will take them to leadership positions around the country and the world.

For more information, contact

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Pack Promise

The Need

According to local and national demographic trends, the future growth in high school graduates eligible to attend college will be largest among low-income families. With the rising costs of four-year public institutions, there is concern that low-income students will not attend college for financial reasons.

Serving the Need

To address that concern, the university created Pack Promise. The NC State Board of Trustees approved Pack Promise in April 2006. The first class of 315 Pack Promise Scholars enrolled for the 2006-07 academic year. A new class will be added annually until four years of scholars are enrolled. Pack Promise guarantees that NC State's neediest students will have 100 percent of their financial need met through a combination of scholarships, grants, Federal Work-Study employment, and need-based loans of no more than \$2,500 per academic year. More than just a financial aid program, Pack Promise is a set of principles designed to accomplish the following:

- Encourage first generation and low-income college student attendance
- Minimize the loan burden for needy students
- Promote access and academic success for undergraduate students from low income families through more intensive and focused academic advising support
- Increase fall-to-fall retention rates and six-year graduation rates
- Provide faculty and student mentoring to assist Pack Promise Scholars in the transition to college life
- Improve satisfaction levels of students with academic and student support services compared to previous cohorts
- Develop workshops on debt management and basic money management as well as informational sessions on "how to navigate NC State"
- Connect faculty with students to enhance the student's academic experience through undergraduate research opportunities
- Address the shortage of graduates in the STEM disciplines (science, technology, engineering and math) by encouraging Pack Promise Scholars to pursue undergraduate and graduate degrees in those disciplines

Impact beyond North Carolina

Pack Promise has been cited as one of the earliest programs of its kind at a public university. The program is open to both resident and non-resident undergraduates and provides full financial aid funding for those students. NC State traditionally has not met the full financial needs of non-residents, so it is anticipated that the financial aid packages offered through Pack Promise will be a significant factor in increasing the diversity of our non-resident undergraduate enrollment.

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Park Scholarships

The Need

An investment in the development of the talents and capabilities of highly motivated young men and women is a needed public service of untold value, through the provision of successive generations of first-rate scientists, scholars, and leaders to serve the State and nation. It is important to encourage our brightest students to develop their leadership skills and civic responsibilities.

Serving the Need

The Park Scholarships were established in 1996 with the support of the Park Foundation of Ithaca, New York. The Park Scholarships program provides educational opportunity for exceptionally talented and well-prepared young men and women to develop leadership skills and civic awareness, including the full cost of education and related expenses, enrichment activities, and a stipend for a personal computer. The scholarship is awarded to high school seniors from all over the country for undergraduate study in any discipline at NC State based on scholarship, leadership, service and character.

Enrichment activities, under the guidance of faculty, form the core of the Park Scholarships experience. These activities create a civic sense and prepare leaders that will handle tomorrow's local, state, and national challenges. Opportunities for leadership development and volunteerism include:

- Leadership Academy: a three-day institute featuring speakers and activities to enhance leadership abilities and self-awareness
- Freshman Seminar: weekly meeting with distinguished speakers, e.g. Governor Jim Hunt and investigative journalist Roberta Baskin, who wrote about the controversial Nike sweatshops
- Speaker Series: a succession of renowned speakers, including New York Times Columnist Nicholas Kristof who recently visited to talk about Darfur.
- Service Raleigh: a city wide day of service started by Park Scholars in 1998; students organize 2000 volunteers to work with over 40 agencies across Raleigh
- Enrichment trips: scholars enjoy community-building retreats to locations like Yosemite National Park in California and take horizon-expanding trips, including one to Washington, D.C. to meet with civic and political leaders, including visits with Supreme Court Justice Scalia
- Mentors and Faculty Guidance: scholars connect often and in meaningful ways with faculty mentors who encourage risk taking and critical thinking

Impact beyond North Carolina

Alumni show early indicators of leadership in state, national, and international settings. A recent survey by NC State found that 34 percent of Park Scholar alumni hold leadership positions with volunteer/service organizations. Many are working with such organizations as Teach for America, the Peace Corps, and in offices of US senators and representatives. Alumni are attending prestigious graduate schools at places like Oxford, Cambridge, Stanford, and Yale Universities and Mayo Medical School, in addition to working at Fortune 500 companies and start-ups like Google.

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The Caldwell Fellows

The Need

The success of a democratic society rests in citizens and leaders with principled, thoughtful engagement in the common good. The mission of the Caldwell Fellows aligns with the NC State mission to serve the citizens of North Carolina through undergraduate education that develops principled and skillful public servants. The Caldwell Fellows provides an environment for learning that stresses creativity, problem solving, social responsibility, and respect for human diversity, focused on the explicit outcome of developing leaders committed positive social change.

Serving the Need

The approach of the Caldwell Fellows is unique among leadership development programs at NC State. Through a rigorous selection process, this merit-based scholarship program identifies some of the most promising students at NC State. Caldwell Fellows undertake the kind of experiential learning proven most effective to further moral development and strong, principled leadership. Through group and individual initiatives, current students within the program contribute countless hours of service. On-going and individual Caldwell service initiatives include the following:

- The SATELLITE program for 10 years has provided an annual 5-day camp for high school students from North Carolina counties with the lowest level of educational resources. Designed to introduce promising but at-risk students to the possibilities of education and careers in the fields of sciences and technology, the camp is completely planned, resourced, and run by NC State undergraduates, under the leadership of students who are Caldwell Fellows.
- ‘Chuck-It’ is the NC State football game recycling program. Started by a Caldwell Fellow in 2003, it is now a university fixture. The Fellows coordinate the campus volunteers who work the ‘Chuck-It’ wagons each game day.
- PULL addresses needs of rural elderly in Liberty N.C. through the construction and installation of home handicap accessibility technologies, e.g. ramps, pull bars, etc.
- Summer Dance is a summer camp program for children in Southeast Raleigh with a community performance offered by the campers at the program’s end.

Impact beyond North Carolina

Service ventures by Caldwell Fellows have taken place in multiple states and countries and have ranged from one week to a full semester of volunteer service. Students have taught English, led health education classes, served as translators, built houses, constructed wells and community centers, provided AIDS/HIV education, conducted research, studied social issues and injustice, and served as good-will ambassadors.

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Freshman Transition Program

The Need

Freshman year is usually the most challenging in any student's college career. Research consistently indicates that the transition from high school to college is difficult at best for most students, particularly for those students who are not as well prepared as they could be for the rigors of college coursework. For this group of students (including some first generation college students, students from small, rural high schools, etc.), the adjustment to college will most likely be overwhelming. However, research indicates that such students can benefit both personally and academically from an intensive, highly structured program of support and challenge.

Serving the Need

In Summer 1985, NC State enrolled the first participants in what was then known as the University Transition Program. For 22 years the Transition Program has provided services to a select cohort of students identified as likely to benefit by its intensive interpersonal focus. For 2006-07, 81 new freshmen were enrolled; at the end of the academic year, 62% were in good academic standing and 17 students had GPAs of 3.0 or better. The Transition Program, administrated through the Division of Undergraduate Academic Programs, works co-operatively with the Department of Counselor Education in support of its personal development concentration. The Transition Programs impacts include:

- Helping to strengthen the University's commitment to its land grant philosophy through its admissions practices
- Encouraging the development of relationships between NC State and high school counselor practitioners
- Providing opportunities for professionals in surrounding communities to develop meaningful relationships with NC State students.
- Helping participating students develop relationships with professionals in various fields of work throughout North Carolina and beyond
- Serving as a model for an intensive, personalized advising process across the university and beyond
- Providing workshops on First Year Programs through conference presentations
- Co-hosting a regional conference on The First Year Experience to share findings with other secondary and post secondary institutions

Impact beyond North Carolina

The Transition Program's combination of support, challenge, and intensity as it relates to academic advising and personal development is a unique experience found in few programs nationwide. This provides an equally unique advantage to NC State students who choose to enroll in the Transition Program.

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First Year College

The Need

Research shows a growing trend of “undecidedness” in the constantly changing student population. More and more traditional age students are not ready to decide on a major when they enter college and need time to explore potential academic and career options prior to deciding. NC State has responded to this need by creating the First Year College, whose mission is to guide students through a structured process for transition to the University and selection of a major. The program is particularly well-suited for students who prefer a year of study and guidance before moving into an academic major and those who seek a first year experience with immersion into the academic, social, and cultural life of the university.

Serving the Need

The FYC was created as a comprehensive research-based intervention program for first year students to improve retention and graduation rates and reduce the number of students who switch majors. The program components include a living/learning residential community, a two-semester orientation course, intensive academic advising, and co-curricular programming. At the heart of the FYC are professional, cross-curricular academic advisers committed to student-centered, developmental advising. Currently, FYC enrolls approximately 20 percent of incoming first year students, about 700 students per year.

A sample of impacts by the FYC include the following:

- Students make significant gains in self-knowledge and knowledge and understanding of majors and careers in the first year.
- Students are much less likely to change majors, compared to NC State students who did not go through FYC.
- Students graduate as fast as and some years faster than a matched university cohort of NC State students. FYC and the College of Engineering had the largest improvement in four-year graduation rates.
- The percentage of FYC students who graduate in four years has continually increased over the past three years.
- Approximately 29-30 percent of students are on Dean’s List each semester.
- Students are more likely to be retained and have higher GPAs than a matched cohort of University students.
- Students who take linked courses are more likely to graduate in four years.

Impact beyond North Carolina

FYC has received national recognition for exemplary programs and innovative practices from the Templeton Foundation, Boyer Institute, National Academic Advising Association, USA Today, and the National Association for the First Year Experience and Students In Transition. FYC will be featured in a monograph (2007) for exemplary practice in advising undecided/exploratory students.

For more information, contact

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Educational Innovations in Science and Mathematics

The Need

A report from the National Research Council states that understanding of science, mathematics, engineering, and technology by most Americans is inadequate for full participation in an increasingly technological world. This lack of understanding reflects the level of STEM education provided to most students. As North Carolina's premier science and technology university, NC State must provide more effective, as well as diverse, opportunities for all students to study science and mathematics as early in their academic careers as possible.

Serving the Need

The College of Physical and Mathematical Sciences (PAMS) treats education as a scholarly pursuit. Our faculty conduct educational research and development that has a national impact. We improve the instruction our students receive through the application and refining of state-of-the-art teaching techniques and share what we discover with others across the country. One of the leading journals in education research has its editorial office in the College. Our faculty are sought out for their expertise in creating and evaluating state-of-the-art content, pedagogy, and instructional technology. Impacts of PAMS educational research efforts include the following:

- SCALE-UP (Student-Centered Activities for Large Enrollment Undergraduate Programs) science courses integrate lecture and lab and use discovery and collaboration to enhance learning. The approach, which reduces failure rates for women and minorities by factors of four or more, has been adopted by 50+ institutions, ranging from community colleges to research universities.
- Matter & Interactions (M&I) is a modern introductory physics curriculum teaching students to apply powerful problem-solving techniques and 3-D computer graphics to everything from planets in far-away solar systems to atomic particles.
- WebAssign is the largest web-based homework delivery system in the world. It grew from a graduate student's research project to a spin-off business on Centennial Campus. Over one million students in thousands of schools have improved their learning from the immediate feedback they receive from Web Assign.
- Chemistry Education researchers are developing lessons for the physically challenged, helping students utilize all their senses to study complex topics.

Impact beyond North Carolina

PAMS is a national leader in improving STEM education. We are taking the lessons learned in NC State's classrooms and educational research labs and creating pedagogical innovations that stimulate high-quality STEM education for K-12 and post-secondary students. SCALE-UP, M&I, and WebAssign have all been adopted by numerous schools and universities across the country.

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Undergraduate Research Program

The Need

In order for post baccalaureates to compete for admission to the best graduate and professional schools, for national fellowships, and for top employment in North Carolina's rapidly changing technology-rich economy, they must demonstrate the ability to integrate coursework and skills that lead to the creation of knowledge within their discipline. The 4.0 GPA graduate in today's marketplace is handicapped without hands-on, professionally mentored experiences.

Serving the Need

The Office of Undergraduate Research (OUR) was established in 2003 to provide undergraduates with research experiences (discovery-, inquiry-, and creativity-based learning) gained from hands-on mentorship with our nationally and internationally recognized faculty, an experience that few of the 111 North Carolina post secondary institutions can provide. Importantly, the OUR is an economic development facilitator by working to position our hands-on research scholars for employment, hopefully within North Carolina.

The Office of Undergraduate Research achieves this goal by:

- Assisting undergraduates in finding outstanding research experiences both on and off campus; approximately 15 percent conduct research or a creative project
- Assisting faculty in finding students who are eager to conduct research in their discipline
- Providing students with \$125,900 in research funding and faculty with operating supply dollars to help defray costs involved in mentoring student researchers
- Maintaining a dynamic website with tools for both students and faculty such as opportunities, best practices workshops, funding sources, seminars, announcements, on-campus symposia registration, and featured photos and achievements of outstanding student researchers and mentors
- Presenting the offerings of the OUR at campus departmental- and college-level student and faculty meetings and seminars
- Supporting a student editor-in-chief and the printing costs for the campus new *Undergraduate Research Journal-North Carolina State University*
- Providing summer, fall and spring symposia for over 600 students to present their work to the campus and general public
- Coordinating inter-institutional goals by participating in the University of North Carolina's Undergraduate Research Consortium via General Administration
- Assisting faculty in writing grants that include undergraduate research support

Impact beyond North Carolina

Talented student research scholars have presented their work at national and international disciplinary conferences, published their work in disciplinary journals, and received fellowships to work in outstanding graduate research programs across the nation. Their impact has changed the knowledge base within their disciplines. They have developed and honed these skills while learning that North Carolina is a great place to live, work, and pursue cutting edge research.

For more information, contact

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Center for Excellence in Curricular Engagement

The Need

As the state's only research-extensive land-grant university, NC State has a unique responsibility to cultivate in our graduates a strong sense of investment in and commitment to the communities and people of North Carolina. Building the capacity of future leaders and scholars to understand and effectively address the issues of our state requires careful examination and re-design of teaching and learning processes for ever-greater engagement: engagement in learning and with the broader community. Faculty, students, and community members can co-create significant opportunities to synergistically deepen student learning, enhance the work of community organizations, and advance knowledge. Connecting undergraduate and graduate students and faculty systematically with the community for "real-world" problem-solving requires substantial training and support, partnership development, and institutional reform.

Serving the Need

Through curricular engagement, students and faculty critically examine the complex issues facing local, state, national, and international communities; they collaborate with community organizations and with citizens to address community-identified issues, not only applying knowledge but learning to use their own experience and the expertise of the community to inform the ongoing construction of knowledge. The recently established Center for Excellence in Curricular Engagement grew out of the Service-Learning Program and represents NC State's commitment to:

- Expand and deepen curricular engagement opportunities across campus
- Establish NC State as a national leader in this field
- Support faculty in integrating service-learning into their teaching and conducting related scholarship
- Facilitate intra-institutional collaboration, scholarship, and faculty development
- Build statewide networks for service-learning projects and research
- Position student learning at the heart of higher education's engagement mission

Impact beyond North Carolina

The Service-Learning Program has supported projects in communities remote from campus, including student capstones in the Philippines, Siberia, Ecuador, and Thailand. The Center is convening units and individuals across campus who have an interest in integrating service-learning with international education to explore new possibilities for enhanced collaboration and thus to make such opportunities available to more students. National leaders and other campuses and higher education organizations across the state and around the country seek out opportunities to learn from and collaborate with the Center, providing opportunities for NC State to contribute significantly to the work of service-learning practitioner-scholars and thereby to impact students, faculty, communities, and institutions throughout the country.

For more information, contact

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Center for Student Leadership, Ethics and Public Service

The Need

As our communities become much more diverse and global, the demand grows for socially responsible leaders who are prepared to respond with real-world applications that solve real-world problems. Regardless of their majors, our graduates must be prepared to lead with integrity, articulate bold visions, communicate with diverse people and teams, respond positively to change, and achieve positive results that will have an impact on the people and communities of North Carolina and beyond.

Serving the Need

The Center for Student Leadership, Ethics and Public Service (CSLEPS) was created in 1998 by reorganizing existing leadership and community service functions into one center that offers a comprehensive program in leadership development, ethics training, and public service outreach to local and global communities. The Center envisions leaders with wisdom, compassion and integrity who will promote a lasting commitment to the betterment of society. Impacts of the Center include:

- 80 Leadership Development Series workshops offered each year for a total of 4968 contact hours during 2006-07. Raleigh Parks and Recreation Department employees attend as community partners.
- A variety of other leadership development experiences (Emerging Leaders Program, Visionary Leaders Certificate and LeaderShape Institute – www.leadershape.org).
- Exposure to national and international leaders through the fall ethics speaker and the annual Role Model Leaders Forum.
- Leadership for student and university-wide responses to national and international disasters (NC State raised over \$155,000 after the tsunami and Hurricane Katrina.)
- A network of approximately 135 local organizations' volunteer needs and opportunities for students to help address them
- Domestic and international service-learning programs in partnership with community-identified needs
- Service NC State, an annual service event to promote and re-engage students in service to the community (In 2006, we partnered with Stop Hunger Now and packed 153,792 dehydrated meals for Kibera, Kenya.)
- Membership in Campus Compact and participation in AmeriCorps initiatives to leverage resources and opportunities to meet the needs of our community

Impact beyond North Carolina

CSLEPS has served as a model for other universities around the country as they aspire to offer a comprehensive program for their students while partnering with non-profit agencies and other community organizations. Through our Alternative Spring and Winter Break programs, we currently have 12 service-learning partners outside of North Carolina in Arizona, Philadelphia, New Orleans, Belize, Dominican Republic, Ecuador, Ghana, Guatemala, Mexico, and Sri Lanka. In Spring 2008, NC State will host the ACC International conference on *Transforming International Education through Service-Learning*.

For more information, contact

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The General Hugh Shelton Initiative for Leadership Development

The Need

Values-based leadership development is one of the most pressing needs of society. Recent high profile cases of corporate scandals and personal and institutional breaches of ethics highlight the need to provide instructional opportunities for the university community. Numerous studies of workforce issues document the need for universities to produce students who embrace personal integrity and business ethics, show initiative in solving problems, work collaboratively and cooperatively, and communicate effectively. In General Hugh Shelton, the university has the active involvement of a values-based role model whose professional and personal life has been characterized by the highest standards of integrity.

Serving the Need

NC State created the Shelton Leadership Initiative to inspire, educate, and develop values-based leaders committed to personal integrity, professional ethics, and selfless service. Four core programs function to develop faculty and staff of the highest integrity, integrate students with the community, educate students according to the highest ethical standards, and build a commitment to addressing complex social issues and ethics:

- The annual Shelton Leadership Forum attracts 700 university corporate partners, faculty, and students to seminars on values-based leadership in the private sector, K-12 education, higher education, and communities. Speakers have included world-renowned experts in leadership development such as Stephen Covey, John Maxwell, Gen. Shelton, Jim Kouzes, and The Honorable Bill Cohen.
- The Shelton Leadership Challenge Institutes are intensive conferences for high school students who learn to apply the principles of honesty, integrity, respect for diversity, and compassion through classroom instruction and social responsibility projects. To date more than 400 students are graduates.
- Scholarships provide students with outstanding leadership credentials and recognition and incentives for further personal growth and leadership development. Seven scholarship endowments are valued at \$2 million.
- Eight University Honors Program students participating annually in leading community engagement projects.

Impact beyond North Carolina

The Shelton Leadership Forum has attracted national speakers and attendees. Shelton Leadership Challenge Institutes participants include high school students from four countries, with contracts to expand the institutes to New York and Alaska. The Shelton Leadership scholarships are national in scope and provide recipients opportunities for study abroad and other global enrichment opportunities.

For more information, contact

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Athletics Department Community Outreach

The Need

Due to the tremendous popularity of collegiate sports and the role model responsibility that accompanies it, NC State coaches and student-athletes are in a unique position to meet needs of youngsters of all ages who need encouragement and leadership, non-profit organizations which need publicity and fund raising help for their worthy causes, and people in less fortunate circumstances who need a helping hand.

Serving the Need

The activities below demonstrate the NC State Athletics Department's commitment to making a difference to the people of our state and beyond:

- A commitment to service is one of the four components of our Life Skills program called ImPack. Activities include:
 - Spring Wolfpack Blitz: One week annually, student athletes (S/As) visit elementary schools in Wake County to speak on academics, character, and fitness.
 - S/As visit schools at various times to read to students and give talks on the issues listed above.
- Student athletes have sponsored a number of other events, including
 - Winter Gala: proceeds donated to Coats for Kids
 - Youth Education Through Sports: S/As involved in life skills training for youth who attend an NCAA Championship event (Soccer Cup)
 - Adopt a family at Christmas: S/As donate their own money to purchase gifts for needy families
 - Annual Christmas Toy Drive by S/As at games.
 - Habitat for Humanity: S/As participated in building a house in Raleigh
- The Athletic Department and coaches also sponsor a number of outreach programs
 - Academic Support Program for Student -Athletes (ASPSA) sponsors a 10-week Wake County middle school reading promotion, Book'n with the Pack.
 - ASPSA sponsors a Leadership Conference conducted by S/As for middle school students
 - Through the Character Through Education Program, co-sponsored with the *News and Observer*, NC State coaches write essays describing how their S/As personify a positive character trait; the program covered 32 counties; and 2,000 teachers, principals and counselors
 - Charity Ticket Program: Free game tickets are made available to charitable organizations, typically youth-related. Donated tickets are also provided as a fund raising tool for charities.
 - Many requests are filled for player and coach autographs for items used in charity auctions.
 - Football has a major commitment to community service under head coach Tom O'Brien. Team members recently served lunch at the Raleigh Rescue Mission.
 - The annual Lee Fowler Charity Golf Classic has raised nearly \$100,000 to fight Lou Gherig's disease.
 - Coach Kay Yow and Women's Basketball sponsor the GWIS program (promoting girls and women in sports). Coach Yow, long battling cancer, initiated the Hoops for Hope game to benefit breast cancer research.

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ARTS NC STATE

The Need

The arts fulfill a need internally and externally to the university: for the complete education of our students and for outreach to our communities. Studies have shown that students who participate in the arts are four times more likely to be recognized for their academic achievement, and those who take four years of art and music classes while in high school score 100 points better on the SAT than students who take only a half year or less. The non-profit arts industry in North Carolina produces \$723 million in revenues, \$32 million in federal and state taxes, and creates 6,669 full-time jobs. In addition to the price of tickets to exhibitions and performances, audiences spend \$22.87 per person on related businesses (hotels, restaurants, etc.). The arts create vibrant communities, express identity, heritage, and communicate across cultures.

Serving the Need

ARTS NC STATE comprises the six Visual and Performing Arts at NC State, including the Craft Center, the Dance Program, University Theatre, the Music Department, Center Stage, and the Gregg Museum of Art & Design. The following examples are among the many ways these organizations serve the needs in our communities.

- Center Stage School Matinee Series provides an average of ten curriculum-based performances reaching 8,000 students annually and serves Triangle K-12 teachers with resources for classroom teaching.
- The Craft Center brings a strong tradition of N.C. craft-making to over 1,200 students and community members annually, contributing to the 6,100 N.C. craft artists who each year bring \$538 million in revenue to our state.
- The Dance Program has participated in four seasons of performances with the North Carolina Dance Festival, presenting work in the N.C. communities of Boone, Asheville, Greensboro, Raleigh, Wilmington, and Charlotte.
- The Raleigh Civic Symphony Association works collaboratively with the Music Department in offering two orchestras, combining students and community members performing repertoire found no where else in the greater community.
- The Gregg Museum of Art & Design, renowned for its collection and exhibitions of internationally significant artists, offers internships for undergraduates and provides resources for a number of courses taught in other colleges of the university.

Impact beyond North Carolina

Many Gregg Museum exhibitions have been selected to travel to prominent museums and galleries around the country. The Music Department was one of only eight university departments across the country invited this year to be a part of Tanglewood II, a 40th anniversary gathering of the greatest musical minds of our generation. The Dance Program has participated in the American College Dance Festival for more than fifteen years and has been selected to perform at six national biennial AC DFA Galas, bringing recognition to NC State as one of the centers of excellence among the national college dance world.

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Engineering Entrepreneurs' Program

The Need

In a global economy, the growth of private industry and the transfer of intellectual property to commercial industry are critical to maintaining the economic strength of the US. While college students learn the fundamentals of engineering and technology and participate in research projects, most are not taught ways to transfer that knowledge and innovation into viable commercial products. Creating a connection between innovation and commercialization is key to teaching students how to develop new businesses, increasing employment opportunities in North Carolina.

Serving the Need

In 1993, NC State initiated the Engineering Entrepreneurs Program (EEP). The program director, an entrepreneur himself, developed the idea for the program from his experience as a technology entrepreneur and commitment to undergraduate engineering education. The goal of the program is to teach engineering and computer science students skills in product development, organization, management, finance, marketing, and entrepreneurship. Today the program is a multidisciplinary program open to undergraduates from all disciplines. The EEI program:

- Educates and trains undergraduates in the “art and science” of new product development and entrepreneurship in the technology industry
- Improves the recruitment and retention of students into the engineering and science disciplines
- Involves undergraduate students from all levels and all engineering and science disciplines in the prototyping of new products
- Teaches students skills in leadership, management, project planning, marketing, sales, operations, organizational behavior, financials, corporate formation, business planning, and intellectual property

Impact beyond North Carolina

More than 300 students have completed the EEP, working in teams to turn creative concepts into marketable products. Examples of successful former students include:

- Donald J. Barnes, who joined the founding team of Red Hat and helped build it into the world's leading open source software company, ranked in 2006 by Business 2.0 as the nation's 2nd fastest growing technology company
- David Anderson, who co-founded PeopleClick, an HR software company based in Raleigh which employs 340 professionals and is positioned for an IPO
- Scot Wingo, who co-founded and sold Stingray Software, then co-founded AuctionRover.com, which sold for \$166 million. His third company, Morrisville-based ChannelAdvisor, currently employs 220 and plans to add 100 new engineering, sales, and account management jobs in 2007.

Each year EEP students travel to Silicon Valley during spring break to learn from industry professionals and successful entrepreneurs. The EEP continues to grow and to serve as NC State's premiere program for undergraduate entrepreneurship in engineering and new product development.

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Entrepreneurship Education Initiative

The Need

Globalization, technological advances, and substantially increased competition have changed the nature of our workplace. Developing students prepared to compete in this rapidly changing environment is essential. Entrepreneurship education is critical to maintain our leadership position in industry, universities and the society. Students trained as entrepreneurial thinkers will be the leaders and innovators of the next generation.

Serving the Need

The Entrepreneurship Education Initiative (EEI) of the College of Management has developed an innovative model to educate undergraduate students in the arena of entrepreneurship. Students from all areas of study throughout the university have the opportunity to earn a minor in entrepreneurship. A high level of integration of the business community, experiential learning, and personal growth and development are cornerstones of the program. The uniqueness of this initiative lies in the development of individuals as opposed to the development of projects. Common wisdom understands that investors invest in the individual/ management team. The focus of the program is to develop students into entrepreneurial-minded men and women. The EEI provides the skills, knowledge and experience necessary to assist students to succeed through the following:

- The curriculum in the EEI is not merely a series of classes, but rather a process supported by both classroom and experiential components.
- The process begins with the basics and takes continuous steps forward to accelerate the learning curve, reduce the number of mistakes that are inherent in the entrepreneurial process, and, most importantly, create the opportunity for students to excel.
- As a result of developing individuals, our students graduate from this program with the ability to apply their skills and knowledge in numerous areas of entrepreneurship in a multitude of endeavors.
- Alumni are informed and updated about activities, speakers, competitions, and events to further stimulate interest in these programs, continue their relationship with EEI, and develop a sense of ownership of the EEI. This ensures that our current and future students always have access to a large number of experienced individuals and potential mentors.

Impact beyond North Carolina

The impact of EEI's philosophy will be seen in future years as NC State students become founders and management team members of entrepreneurial ventures and corporate entrepreneurs. The results of these efforts will be seen through increased revenues, employment opportunities, and business opportunities throughout the US and extending globally.

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The Prague Institute

The Need

Today both social and environmental issues transcend international borders. Our future leaders need to be able to work productively with a diversity of cultures and operate as global citizens in the global marketplace. As the European Union continues to grow and eastern European economies begin to reach their potential, opportunities for collaboration in the sciences, business, and the arts will continue to expand. Until the creation of the Prague Institute, NC State did not have a permanent international center. The presence of this Institute enables NC State to compete with its national peers with regard to keeping and attracting the best students in the state, who often see international experience as being critical to their future.

Serving the Need

For 14 years the College of Design has offered a summer program in the Czech Republic for College of Design students. In January 2005 the College of Design began leasing space in the center of Prague and established the Prague Institute. From that time the Institute has offered courses on a year-round basis using both the College's faculty and Czech faculty to provide NC State students with a unique and broadening educational experience. In January 2007 the facilities of the Institute were doubled in size and were made available to all NC State students. At that time offerings were broadened to include courses in the sciences and humanities, and special programs for the College of Management and Physics were developed. Today, the Prague Institute continues to grow:

- Facilities can accommodate 40 students each semester.
- Educational offerings reflect and build upon Prague's unique central European location.
- In addition to general university requirements, special programs are offered in architecture, urban design, international business, industrial design and the arts.
- Planning is underway to accommodate course offerings related to the new Master of International Studies program of the College of Humanities and Social Sciences.
- As the Institute grows and matures, it will serve as a key contact point for faculty seeking to broaden European contacts and research programs and provide unique educational experiences to both graduate and undergraduate students.

Impact beyond North Carolina

This spring the Institute hosted the International Conference on the Outcomes of Architectural Education, attended by representatives from Europe, South America, Great Britain and North America. Plans are currently under way to host a number of other international meetings including conferences on landscape ecology, children's health and the environment, and accommodating disabilities.

For more information, contact

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Women in Science and Engineering Village

The Need

Science and technology companies in North Carolina and the US demand diversity among their staff in order to meet the challenges of the 21st century. These companies look to NC State to provide a diverse pool of prepared graduates including women and minorities. NC State, as a land grant institution, has an obligation to provide education to all citizens, especially women and persons of color seeking engineering degrees. The College of Engineering is especially committed to providing opportunities and support for women to achieve degrees in engineering.

Serving the Need

For almost four years, the Women in Science and Engineering (WISE) Village has collaborated with partners at NC State including the Colleges of Agriculture and Life Sciences, Physical and Mathematical Sciences, Natural Resources, Textiles, and University Housing to provide an integrated living and learning program which bridges classroom and out-of-classroom experiences. The WISE Village combines a group living experience with resident, upper-class mentors who assist in the transition to university life. Programs for the WISE community are designed to promote academic success, foster the formation of lasting relationships with fellow students, professors and mentors, and provide out-of-classroom experiences. The WISE Village is a supportive environment in which women engage in focused inquiry within their disciplines and develop the skills and talents necessary to become successful students and professionals in STEM fields. Activities and outcomes of the WISE program include the following:

- The BRIDGE program is an early arrival program for the new WISE students each fall. The students come to campus early to participate in programs designed to increase competence and confidence for women majoring in science and engineering.
- WISE provides upper-class mentors for each new student. These mentors work closely with new students for their entire first year.
- WISE provides academic and social programming for first and second year students. Academic tutors are provided three nights a week in calculus, chemistry and physics.
- A Speaker Series brings campus and local professionals to discuss research and industry.
- Community service events are planned each month to help give back to local organizations, such as the Food Bank, Alternative Fall and Spring Break trips which focus on service to communities, and study abroad opportunities.
- WISE works closely with other on-campus partners such as the Center for Student Leadership, Ethics and Public Service and the Women's Center to provide participants with opportunities to attend local and regional conferences such as Women in Leadership Conference, the LEAD Conference, and LeaderShape,
- WISE has forged corporate partnerships with companies such as Alcoa and Square D. Alcoa has funded program mentors while Square D has funded undergraduate research awards offered each year to students and faculty.
- According to assessments of the WISE program, women in WISE are retained in sciences and engineering at a higher rate than women not in WISE.
- WISE is a recruiting tool for both in-state and out-of-state students. WISE hosts a spend-a-day in February which highlights the benefits of being in the program.

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The OPT-ED Program

The Need

As late as 2004-05, only 1.9 percent of American doctoral students within the STEM disciplines (science, technology, engineering, and mathematics) were African American, and only 4.3 percent were members of any underrepresented minority (URM). To fully tap North Carolina's talent pool and properly educate the next generation of North Carolinians, NC State has developed programs to increase diversity and promote a more inclusive environment in both doctoral education and the professoriate.

Serving the Need

NC State has partnered with NC A&T and UNC-Chapel Hill to develop the North Carolina Alliance to Create Opportunity through Education (OPT-ED). Funded by the NSF Alliances for Graduate Education and the Professoriate (AGEP), OPT-ED has as its goal expanding the number of minority PhDs in the STEM disciplines and encouraging them to pursue academic careers. Besides the three partnering universities, OPT-ED provides a formal network for NSF-funded programs across North Carolina, including the NC-Math Science Education Network (NC-MSEN), Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), the NC-Louis Stokes Alliance for Minority Participation (NC-LSAMP), the Center for Research Excellence in Science and Technology (CREST), and NC TABS for community college students. Individually and collaboratively, OPT-ED participants encourage underrepresented minority students, from middle school through graduate school, to pursue doctoral degrees and academic careers in the STEM disciplines. Joint initiatives include:

- OPT-ED Alliance Day, a national conference for students from middle school through graduate school (919 students from 13 states attended in 2007; 3000+ since 2001)
- OPT-ED mentoring workshops for current and future faculty (103 from 15 N.C. institutions attended in 2007; 300+ since 2000)
- OPT-ED graduate student "Crosstalks," networking/professional development dinners held three times a year targeted at URM students in North Carolina

At NC State, specific programs developed under the auspices of OPT-ED include:

- Undergraduate and Graduate Research Experiences (200+ since 2000)
- Visit NC State Days (600+ participants since 2000)
- Future Faculty Recruitment Program (approximately 20 prospective faculty since 2005)

Impact beyond North Carolina

Although the OPT-ED institutions and programs are based in North Carolina, many of their activities involve URM participants from across the country. For example, OPT-ED Alliance Day has evolved into a national conference. In addition, the summer research experiences available through OPT-ED have served students from Hawaii to Puerto Rico. Finally, students who earn their Ph.D.s as a result of OPT-ED will become professors at colleges and universities not only in North Carolina but across the nation.

For more information, contact

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Building Future Faculty

The Need

To help prepare our students to live and work in a multicultural world, NC State needs a faculty that is demographically diverse. Presently only four percent of our faculty is African American, less than two percent is Hispanic/Latino, and less than one percent is Native American. People of color make up 32 percent of the North Carolina's population. A diverse faculty engages and inspires students from all population groups, provides role models, expands the horizons of all students, and prepares students to live in a multicultural society. Faculty diversity also ensures that research addresses questions of importance to all segments of our society. For example, research in women's health exploded after female researchers became involved. In addition, a diverse faculty is more likely to conduct community outreach activities to benefit all segments of our society.

Serving the Need

Begun in 2006, N C State's Building Future Faculty (BFF) Program presents intensive workshops on preparing for academic careers to a select group of 10 to 12 graduate students of color. The students attend information sessions on faculty life and expectations of faculty. They visit with the faculty and department head in their discipline to have one-on-one discussions about research interests, career goals, and the necessary preparation to reach their goals. Impacts include the following:

- Two BFF participants have joined the NC State faculty: Milton Welch, Assistant Professor of English and Africana Studies, and Marc Dudley, Assistant Professor of English.
- One BFF graduate has joined the faculty of Florida State University: William Oates, Assistant Professor of Mechanical Engineering.
- One BFF graduate is serving as a post-doctoral scholar at the University of California at Berkeley: Timothy Thornton, Statistical Genetics.

Impact beyond North Carolina

The graduate students and post-doctoral scholars who participated in the 2006 Building Future Faculty program came from universities in nine states outside of North Carolina: Howard University, University of Michigan, Michigan State University, University of Alabama, Florida State University, University of Florida, Georgia State, Georgia Tech, the University of Chicago, Rensselaer Polytechnic Institute, University at Buffalo, University of South Carolina, Virginia Tech, University of Virginia, and Virginia Commonwealth University. Our graduates will go on to academic careers all over the US.

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Statewide Undergraduate Engineering Education

The Need

Ongoing assessments of the US' need for an expanded technical workforce continue to be in the news. Organizations such as the National Science Foundation, the National Academy of Engineering, and the American Society for Engineering Education (ASEE), as well as numerous professional disciplinary organizations, describe a consistent and challenging situation. The changing demographics of the nation's workforce, coupled with recent enrollment patterns across the country, clearly indicate that engineering enrollment and graduation rates are not keeping pace with the increasing demand for engineering talent. As pointed out in a recent ASEE publication, although there has been a modest increase in the number of engineering degrees awarded over the last five years, enrollments are down for the second year in a row. Less than five percent of all undergraduate degrees nationally are awarded to engineers today, compared with eight percent in 1985. Expanded accessibility to engineering education statewide in efficient and effective ways is important for North Carolina.

Serving the Need

The College of Engineering has expanded access to undergraduate engineering education in North Carolina through both pre-engineering transfer (2+2) programs and dual-degree (3+2) programs with partner institutions. Currently NC State has over 35 such programs in place that allow students either to initiate their engineering education locally before transferring to a 4-year institution or to use bi-lateral course transfer to complete a technical degree at their original institution and an engineering degree from NC State. Programs and ten-year average enrollments include:

- Review and revision of the community college curriculum with a pre-engineering focus to accommodate efficient student transfer to 4-year engineering schools
- 2+2 engineering transfer agreements with 12 community colleges (53 students/year)
- Specific 2+2 and 3+2 agreements with 10 UNC system institutions (24 students/year)
- Specific 3+2 programs with several HBCU's and women's colleges (10 students/year)
- Two bachelor of science degree programs available at remote locations –one at Craven Community College and one at UNC-Asheville (40 graduates to date)

Impact beyond North Carolina

The unmet need for degreed engineers is a national issue. Since NC State is typically one of the top five Bachelors of Science in engineering degree producers nationally, the impact of our programs is clearly on a national and global scale.

For more information, contact

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Engineering Online

The Need

The US Department of Labor predicts an increase in the number of professionals needed in areas related to computer and mathematical science, construction, and other engineering fields. Many individuals cannot attend on-campus classes because of work, family, or geographical constraints but still want to complete an undergraduate or graduate degree or take courses while employed. Bachelor degrees are required for most positions, and graduate degrees can assist in the development of a productive and competent engineering workforce in North Carolina.

Serving the Need

The College of Engineering has been delivering credit courses and the Master of Engineering program to the citizens of North Carolina and throughout the US since the late 1980s. Ranked by *US News & World Report* as the ninth largest online engineering graduate program in the nation, the College now offers nine online graduate programs. The Master of Engineering and Master of Civil Engineering programs were ranked as the #1 Best Buy. Special undergraduate 2+2 programs have been established in partnership with UNC Asheville, UNC Wilmington, Lenoir Community College, and Craven Community College, Havelock campus. Impacts of the Engineering Online program include:

- Opportunity to balance work and family life while enrolled in a college course
- Access to graduate and undergraduate distance engineering and computer science courses that can lead to the completion of an undergraduate or graduate degree
- Opportunity for engineers and computer scientists to acquire advanced skills in their discipline or in a new area that meets the needs of their jobs through credit or non-credit courses
- Nine online Master's degree programs in various areas of engineering and in computer science without on-campus residency or thesis requirements; 1020 students enrolled in 2006-07
- Online non-credit professional engineering review series to help individuals prepare for the professional civil or mechanical engineering exams
- Two complete undergraduate degree programs, one in Asheville and one in Havelock, allowing students to remain employed while working towards the completion of an undergraduate engineering degree (235 students enrolled in 2006-07)
- Certificate programs for individuals who wish to update or expand their competencies in computer programming or complete pre-requisites for the Master of Computer Science degree (722 students enrolled in 2006-07)
- Preparatory classes needed for entry into an on-campus engineering degree program
- Patent Examination Certificate Program that will help North Carolina industries develop internal expertise concerning the patent application process

Impact beyond North Carolina

EOL graduate courses and degree programs are available around the world to anyone who has an undergraduate degree in engineering from an accredited institution. Employees from North Carolina-based companies anywhere in the world have the same opportunities to participate in the graduate programs as do their colleagues in North Carolina. EOL can help companies retain, retrain and recruit engineers and computer scientists needed for their organizations.

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Leading, Connecting, Transforming

Creating Innovation in K-20 Education

The University of North Carolina Tomorrow

Section 2

The Friday Institute for Educational Innovation

The Need

Global economic forces, propelled by rapid diffusion of information and communication technologies, create an urgent demand for a scientifically and technologically literate citizenry and workforce. Twenty-first century K-16 classrooms must prepare learners and workers to find, create, apply, assess, and transform knowledge. To this end, educational institutions are attempting to transform the ways and means by which students are prepared for this world of complex, lifelong learning.

Serving the Need

The William and Ida Friday Institute for Educational Innovation, founded in 2004 and housed in a state-of-the-art facility adjacent to the Centennial Campus Middle School, is a unique public-private partnership that integrates research, technology, and cross-sector collaboration to enhance education and support economic development. Dedicated to advancing education through innovation in teaching, learning, and leadership, the Institute brings together the talents of students, teachers, and education leaders, as well as research scientists, community leaders, and business professionals to identify and create innovative solutions to pressing challenges of twenty-first century education. Impacts of the Friday Institute include these:

- Leading the development and implementation of broadband network connectivity to all K-12 schools in North Carolina
- Supporting the development of K-12 online education in North Carolina through the work of the NC Virtual Public School
- Evaluating the state-wide impact of K-12 technology infusion in the classroom
- Providing professional development for teachers in 21st Century classrooms delivered both on-site and via technology
- Assisting partner school districts in selecting technology resources to facilitate innovative teaching and learning
- Developing school administrators as innovation leaders who can adapt to changing education climates and ready teachers, schools, and students to succeed
- Conducting innovative, cross-disciplinary research on topics such as the use of artificial intelligence to create high-performance learning environments
- Serving as a destination for state and national business, education and government leaders to come together to develop solutions for today's educational problems

Impact beyond North Carolina

The Friday Institute is a unique showcase for educational research and innovative outreach. Research findings and proof-of-concept solutions are disseminated at national and international conferences and provide a model for scaling and deployment beyond North Carolina. Cross-sector partnerships include work with federal agencies such as the US Department of Education and the NSF, partner education institutions, national and international non-profits and corporations.

For more information, contact

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Innovation for 21st Century Teaching and Learning Partnership

The Need

North Carolina has a continuing need for middle school science and mathematics teachers who are well grounded in subject matter knowledge and content pedagogy and are able to use 21st Century skills and technologies in their classrooms. This need has been verified by numerous surveys and discussions with the superintendents of high poverty school systems in northeast NC, as identified by the US Department of Education. School leaders in these districts need assistance to implement innovation efforts to improve student achievement.

Serving the Need

The two-part Innovation for 21st Century Teaching and Learning Partnership (21CTL) was formed in 2006 at the Friday Institute for Educational Innovation with six school districts to define, stimulate, and support innovative classroom practices in rural eastern NC public schools. A Leadership Academy has been developed to assist a team from each school district to develop and deploy products that will support innovative practices. The Middle School Mathematics and Science partnership assists middle school teachers in these districts to strengthen their own mathematics, science, and technology knowledge so that they can better prepare students for challenging classes in high school and beyond. Impacts of the 21CTL include:

- Summer professional development institutes with license renewal credit provided to middle school mathematics and science teachers on-site in schools; school-year follow up workshops hosted by the Friday Institute; and professional development for school district administrative leaders and assisted working sessions with follow-up in the school districts
- Research on teachers' implementation and adoption of data-rich environments
- Partnerships developed with leading technology companies (IBM, Nortel, and Vernier Software and Technology) to integrate technology that businesses use for work and children use for entertainment with classroom educational content
- Advice and assistance for school districts to design "future-ready" classrooms by integrating technology such as graphing calculators and science sensors for data collection
- Research on implementation of these innovative practices developed by leaders
- Dissemination of curriculum products through state conferences and NC DPI

Impact beyond North Carolina

The 21 CTL project provides a national model of how to engage with school systems to help them provide "future-ready" learning experiences for their students. The team at the Friday Institute is actively disseminating findings via workshops and the Institute web site, as well as at regional and national conferences.

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Kenan Institute for Engineering, Technology and Science

The Need

With the landscape of extramural funding for quality science research and education initiatives of universities shifting increasingly toward partnerships between industry and the state and federal governments, the role of the Kenan Institute for Engineering, Technology, and Science becomes increasingly important to enabling the success of new university-based research and education partnerships and programs.

Serving the Need

The Kenan Institute supports and leverages partnerships that, in addition to generating new knowledge, use that knowledge to generate capital, jobs, and new technologies of immediate benefit to society. Institute activities are focused on supporting four major initiatives: high technology basic research, science and math K-12 education partnerships, technology commercialization and entrepreneurship, and science and technology policy.

Impact beyond North Carolina

The Kenan Institute stimulates multi-institutional and multi-disciplinary teams involving government, university, and corporate partners to solve scientific and societal problems, generate technology-based economic development, and bring together the public and private resources necessary to engage successfully in addressing the emerging issues of our time. Specifically, the Kenan Institute supports the facilitation of program collaborations and proposal development for centers and institutes and engages the very best investigators in high-impact, high-visibility initiatives. Examples of Kenan Institute programs and partnerships with high impact include the following:

- The Kenan Fellows Program, which engages teachers in developing cutting edge curriculum materials while providing professional development opportunities. 93 percent of all Kenan Fellows have continued their teaching careers in North Carolina classrooms.
- The Institute for Emerging Issues, which has led major programs in tax and finance policy research, higher education policy, and energy policy.
- The North Carolina Space Initiative, which has guided analysis of the N.C. Aerospace Industry Cluster and leveraged over \$15 million in space related research funding since 2001.
- A partnership with the NC Biotechnology Center to establish the Collaborative Funding Grants Program. CFG grants continue to receive follow on funding for years after initial research and report a cumulative average ratio of return for all grants of approximately \$27 per dollar awarded.
- Over \$13 million of funding leveraged by the Institute in fiscal year 2006-07.

For more information, contact

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The Science House

The Need

Our state and nation face a crisis: we have a severe shortage of qualified K-12 science and mathematics teachers. We must retain our teachers and produce new teachers at much higher rates. In addition, we do not attract and prepare enough students in STEM disciplines to fill current and future workforce needs. These shortages jeopardize our economy, our security, and our leadership in discovery and innovation.

Serving the Need

The Science House annually reaches more than 3,500 teachers and 28,000 students in all 100 counties of North Carolina, through teacher training, content courses, school-based assistance, curriculum materials, and student science activities. The Science House helps teachers teach better so that students learn better. Hands-on learning and using up-to-date laboratory teaching technology often model processes and technology found in the workplace. Strategically located in Lenoir, Edenton, Fayetteville, Jacksonville and Asheville, satellite offices serve many of the most resource-poor school systems in the state. Some impacts of The Science House include the following:

- The Science House's programs equip teachers with more effective methodologies and tools, increase teacher retention, and encourage teachers to serve as role models and change agents within their schools and school systems. In many rural counties, there may be only one high school science teacher. Science House staff may be that teacher's only link with other educators in mathematics and science, providing support and mentoring that is key to retaining teachers.
- These teaching strategies fire students' natural curiosity and inspire their interest in science, in higher education in STEM disciplines, and in choosing science-related careers. For example, 92 percent of high school students who have participated in the Bennett's Millpond project in northeastern North Carolina are attending a four-year college, compared to the area's average of only 54 percent. Of these college-bound participants, 70 percent plan to major in a STEM discipline, significantly higher than the national average of 21 percent.
- As a result of Science House projects, schools and school systems have invested substantial funds for more science teaching equipment, and their teachers have won grants for innovative teaching initiatives and to train other teachers. School systems have called on The Science House to partner on long-term science teaching improvement programs, working with teachers throughout the year.

Impact beyond North Carolina

Founded in the College of Physical and Mathematical Sciences sixteen years ago, The Science House has served as a national model in linking research universities with K-12 schools. It has led teacher professional development programs in North Carolina, South Carolina, Virginia, Kentucky, Arizona and Texas, and has hosted national conferences on K-12 outreach from university science departments. Science House staff and faculty hold positions of leadership in state and national science and science education organizations.

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K-12 Engineering Outreach

The Need

According to the National Science Board 2006 Science and Engineering Indicators report, the need for engineers has grown at a rate unmet by the production of engineers from US universities. In addition, the report notes that “the performance of US students in elementary and secondary schools (in science) may raise concerns.” Students are graduating with very little ability to solve unfamiliar problems. This trend affects females and ethnic minorities disproportionately and is expected to place the US at an increasing economic disadvantage compared to other countries, where increasingly more students are studying engineering and related subjects. In addition, in this country the focus on low achieving students has resulted in fewer learning opportunities for high achieving and gifted students, who traditionally choose engineering at a higher rate. Combine these facts with the public’s general lack of knowledge about what engineering is and what engineers do, and the need for an active engineering outreach unit is overwhelming.

Serving the Need

The K-12 Outreach group was formed in 1999 in the Office of Academic Affairs of the College of Engineering. Since then, the program has impacted an average of 5000 students and 500 teachers in N.C. annually. Staff participate in local, state and, national collaborations to advance science, technology, engineering, and math instruction in K-12 schools. Impacts of the program include:

- Two National Science Foundation programs placing engineering graduate and undergraduate students in K-12 schools as co-teachers. Data show that participating in this program has retained women and minority students in engineering and encouraged female and minority students to consider graduate school at higher rates.
- Elementary and middle school engineering camps with 600 students in seven years; attendees were 40 percent female, 30-60 percent from underrepresented groups, and included a large Native American attendance.
- Science curriculum reform for all elementary schools in Wake County, a district of over 105,000 students; staff development and curriculum development for engineering magnets in New Hanover, Wake, and Pender counties
- Various K-12 teacher workshops on inquiry teaching, curriculum integration, engineering
- On-campus visits by 500 K-12 students per year from around North Carolina
- Engineering on the Road, which takes real life, non-stereotypical engineering involvement to 25,000 K-12 students in North Carolina using undergraduate engineering students in tiered mentoring approach
- Family math/engineering nights at churches and schools where parents who have never been to school before attend; workshops on navigating middle and high school math have attracted 4000 people

Impact beyond North Carolina

The K-12 Outreach program has established partnerships with the Boston Museum of Science, the National Academy of Engineering, the American Society of Engineering Educators, the Institute for Electrical and Electronic Engineers, the College Board, and several other national and international organizations which produce active projects with impacts across the nation and the world.

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Kenan Fellows Program

The Need

The State of North Carolina has a two-fold challenge related to the instruction of science, math, and technology in its public schools: a statewide shortage of qualified teachers and a need for relevant, meaningful curriculum.

Serving the Need

In order to address these challenges, the Kenan Fellows Program for Curriculum and Leadership Development enhances teacher professionalism and leadership by encouraging outstanding North Carolina teachers to develop innovative curricular resources in collaboration with the private sector, public schools, and institutions of higher learning. Kenan Fellows also participate with state education leaders in “fireside chats” which provide a forum for dialogue on key issues of relevance to education within North Carolina. Exceptional classroom teachers selected as Kenan Fellows engage in a two-year fellowship in partnership with scientists and university faculty, including two intense six-week summer sessions when fellows participate in professional development and work with their mentor to develop innovative curricula based on current statewide classroom needs. Professional development provided for the Fellows targets leadership and other areas such as advocacy, grant writing, and inquiry-guided instruction. During the summer and throughout the school year fellows work with mentors on their curriculum projects, which upon completion are disseminated to teachers across the globe via project websites, presentations, and publications. According to an independent evaluation of the program:

- 93 percent of all Kenan Fellows have continued their teaching careers in N.C. classrooms.
- Kenan Fellow websites have attracted more than 300,000 “hits” by more than 128,000 visitors.
- Kenan Fellows make statistically significant gains in leadership skills such as mentoring new teachers/coaching experienced teachers, writing curriculum, and providing professional development to teachers, as evidenced by pre- and post-test data. In fact, by the end of the program, 100 percent of Fellows believed they were highly competent in these areas.
- The Fellows program has expanded beyond the Triangle area to include teachers from Guilford, Lee and Iredell counties.
- The Fellows program has developed a strategic plan to expand the program across North Carolina. The initial expansion will focus on the Advantage West, Northeast, Eastern, and Southeast Economic Partnership Regions which, taken as a whole, include North Carolina’s most economically disadvantaged school districts with much higher teacher turnover rates and inadequately diversity relative to large minority student populations.

Impact beyond North Carolina

The Kenan Fellows program is an innovative approach to teacher development and retention and curricular innovation. The model is attracting attention outside the state.

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Distance Education Programs to Prepare Teachers and Educational Leaders

The Need

North Carolina has a severe shortage of teachers, educational leaders, and capacity for instilling 21st Century knowledge and skills in its public schools and community colleges. The demand for teachers exceeds the supply generated by the University system by over 200 percent each year. Similar shortages exist among the ranks of school administrators, and predictions indicate that as many as half of all community college senior leaders will retire in the next five years, leaving the state's schools and colleges with limited ability to develop in future students and the workforce the capacity for knowledge work required by the global economy of the new century.

Serving the Need

The College of Education has increased and enhanced its programs and services to provide even higher levels of teachers and leaders of quality for North Carolina schools and colleges. The College also has taken seriously the challenge to provide even greater access through distance education and to address the needs of rural and underserved areas of the state.

- The NC TEACH program, an alternative licensure program to prepare adults transitioning from other careers into teaching, has enrolled over 140 candidates at its off-campus location in Apex, NC. In 2007-08 three new cohorts will open in Fayetteville, Sanford, and Rocky Mount. By partnering with local community colleges and school systems to provide recruiting and teaching venues, NC State's NC TEACH program will have an enrollment of 150 teachers annually. Data on graduates of NC TEACH indicate that the NC State program is highly successful in producing teachers who remain in the classroom at substantially higher rates and for longer periods than other alternative licensure programs.
- The Master of School Administration program prepares candidates to be school principals in off-campus cohorts in Wake and Durham counties. By partnering with the schools and districts in Wake and Durham Counties, the university provides greater access and affordability for future school leaders by offering classes, supervision, and support at or near the students' workplace and providing a means to increase both the number and quality of school leaders who will take positions as assistant principals and principals in the partner school districts.
- The Department of Adult and Higher Education provides a complete distance education doctoral program for cohorts of future community college leaders in Charlotte, an area with NC's largest community college (Central Piedmont) and a number of community colleges in the surrounding area.

Impact beyond North Carolina

The College of Education prepares teachers, leaders, and other educators in STEM and other critical areas for the schools and community colleges of North Carolina. The College is a leader in carrying the NC State traditions of extension, engagement, and service to the citizens of the state and region.

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NC State Confucius Institute

The Need

China is growing in importance to North Carolina both as a trading partner and as a world power. A growing number of companies in the state have established operations in China (e.g., Cisco, IBM, and Red Hat), and Chinese-owned companies are establishing new firms or taking control of existing ones (e.g., Lenovo's purchase of IBM's personal computer business). In addition, educators at all levels have begun to examine Chinese educational practices to determine what the US can learn from China, particularly in encouraging students to excel in mathematics, science, and engineering. There has also been an explosive growth in interest among North Carolina schools in establishing Chinese language and culture courses and connecting with partner schools in China so that students in each country can learn to communicate and work together.

Serving the Need

The NC State Confucius Institute, which opened in April 2007, was established to address each of the needs outlined above. The Institute, the 7th established in the US and the first in the southeast, is a partnership between NC State, Nanjing Normal University, and the Office of Chinese Language International of the Chinese Ministry of Education. The goal of Confucius Institutes worldwide is to enhance intercultural understanding through opportunities to learn about Chinese language and culture. Nanjing Normal University will provide visiting faculty to work in the Institute, and the Office of Chinese Language International will provide initial financial support and a library of 3-5,000 multimedia and print materials for the Institute. The NC State Confucius Institute has a number of short- and long-term plans to broaden understanding of Chinese language and culture, including the following:

- Teaching non-credit Chinese language courses for adults and students through the McKimmon Center and supplementing current Chinese language instruction offered by the Department of Foreign Languages and Literatures
- Providing professional development opportunities for K-12 teachers of Chinese, including workshops, access to instructional materials, and opportunities to visit China
- Working with the Department of Public Instruction and other agencies to increase the number of licensed teachers of Chinese in the state
- Partnering with local schools developing Chinese language and culture programs, including identifying faculty members who can serve as classroom resources
- Encouraging student and faculty exchange between NC State and Nanjing Normal University, particularly in fields such as teacher education in STEM disciplines
- Providing orientation and consulting for North Carolina individuals and companies interested in visiting or doing business in China (e.g., executives and NC State leaders participating in a Research Triangle Partnership delegation to China in May 2007)

Impact beyond North Carolina

In addition to opportunities to broaden knowledge and understanding about China in NC, the Institute links NC State to a network of international Institutes who will share ideas and collaborate on programs.

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English as a Second Language

The Need

The burgeoning number of immigrant children coming to the state has resulted in a shortage of ESL educators. North Carolina has one of the fastest growing immigrant populations in the country, and the need for ESL teaching professionals is not expected to diminish any time soon. The ESL Teacher Licensure Program provides training to both undergraduate education majors and currently licensed North Carolina teachers who are seeking to add ESL to their credentials. The need for citizens of the world to become proficient in English continues to climb, as English has become the international language in many professional circles across the globe. The ESL program also offers a 5-week intensive Summer Institute in English that attracts students from around the world.

Serving the Need

The ESL Licensure Program is unique in North Carolina, with all courses offered both on campus and via distance education. This two-track format enables teachers state wide to expand their professional expertise and become skilled in educating English learners. Continued professional support for ESL teachers is embedded in the annual ESL Symposium, which includes a Literacy Institute and workshop presentations by nationally recognized experts. The ESL e-newsletter, *The Globe*, also provides educators an opportunity to stay current on local, state, and national issues, as well as best practices.

Impacts of the ESL program include:

- A \$1.25 M US Department of Education Title VII Grant enabled 260 candidates, representing 63 counties in North Carolina, to be trained in the field. Candidates in the program have delivered over 400 staff development training sessions, helping to build capacity within school districts.
- Licensure candidates mentor ESL families to support them in their adaptation to life in N.C. and the US and report on the progress of the mentoring sessions as part of their training.
- 353 students have traveled from around the world to attend the Summer Institute in English for five weeks of language study. The Institute is a partnership between the Department of Foreign Languages and the Office of Professional Development at NC State that combines language instruction with rich cultural activities. Many of the Summer Institute students remain in the area to attend NC State, Duke University, or UNC- Chapel Hill, while others return to their native countries to continue their studies or seek employment in their chosen fields, with their English skills much improved.

Impact beyond North Carolina

The Summer Institute in English has attracted cohorts of students from overseas institutions including Hiroshima Shudo University, Nagoya University, and Shizuoka Sangyo University in Japan and the University of Seoul in South Korea.

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Elementary Education and Teaching Program

The Need

North Carolina has a severe shortage of teachers and teaching capacity for instilling 21st Century knowledge and skills in its public schools. The demand for teachers exceeds the supply generated by the University system by over 200 percent each year. The shortage is especially acute in key STEM areas such as mathematics and science, leaving the state without the teaching resources to develop the numbers of students with 21st century skills required for life and work in the global economy.

Serving the Need

The College of Education in 2005 developed an innovative program resulting in a Bachelor of Science in Elementary Education and Teaching degree. The first students entered the program in Fall 2006 and will graduate in Spring 2008. This program will add 60 elementary education teachers per year to the state's teaching corps. Further, these elementary teachers will be well prepared in mathematics and science, and will develop in their students sound foundations in mathematics, science, and global perspectives. Impacts of the Elementary Education and Teaching Program will include the following:

- 60 new elementary education teachers per year who are well prepared in mathematics and science content. Their second academic concentration is math, science, or global perspectives; they take the same calculus and basic science courses as students in engineering and the sciences. In addition, they have two mathematics methods courses and two science methods courses so they will be able to teach the content effectively to their students.
- Teachers who graduate from this program are “classroom ready.” The students have internships in schools each semester in their sophomore, junior, and senior years and spend the senior year in the same school with the same teacher or teaching team, starting in August when the teachers report. Each student will have nearly 1000 hours in classroom experience when they graduate. The cohorts provide over 10,000 hours per year in tutoring and other classroom assistance to the Partnership schools.
- Students progress through the program together in a cohort model, taking their classes as cohorts and developing technology and collaborative skills as they progress through the program. This model supports development of the 21st century skills of collaboration, technology integration, and using data to make decisions regarding teaching and student learning.
- Substantial numbers of applicants and a high caliber of applicants; the program already is the largest in the College of Education, with over 155 students enrolled with an average SAT score over 1130.

Impact beyond North Carolina

The quality and quantity of elementary teachers well prepared in STEM disciplines and well prepared to teach them to their students will increase in the state and region. The program serves as a model for others.

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Cultural Correspondents K-12 Outreach Program

The Need

With today's knowledge-based global economy, it is crucial for students in North Carolina to understand other cultures and to interact successfully with diverse groups, both here and abroad. These skills are especially important as students from North Carolina universities compete for positions in the global marketplace. In order to fully develop these competencies, however, students must begin their international education at the K-12 level and continue through their higher education careers.

Serving the Need

Through a wealth of culturally diverse and academically focused study abroad programs, the Study Abroad Office (SAO) at NC State is facilitating opportunities for over 700 NC State students to develop intercultural competence and global knowledge each year. Realizing the need for earlier and more widespread international education efforts at the K-12 level, the SAO launched the Cultural Correspondents K-12 outreach program in Spring 2007. This innovative program uses web conference technology to connect NC State study abroad students with public elementary school classrooms in North Carolina. The SAO partnered with Johnson Street Global Studies Elementary in Guilford County and the North Carolina Center for International Understanding (NCCIU) to develop this initiative. Cultural Correspondents collaborate with elementary teachers to present weekly web conferences that enhance the existing K-12 curriculum. The web conferencing technology allows elementary students to see their CC partner via web cam, view their photos and presentations, hear their stories, and ask questions. Once fully established at NC State, the Study Abroad Office will help facilitate the expansion of the Cultural Correspondents program across North Carolina K-12 districts and university study abroad programs. Benefits of this program include:

- Providing opportunities for K-12 teachers to weave international perspectives into existing curricula
- Helping textbook concepts come alive for K-12 students through tangible, real-life international experiences
- Enhancing study abroad students' engagement with host cultures in preparation for weekly topical presentations
- Collaborating with NCCIU to fulfill an objective of the state-supported North Carolina in the World Action Plan for K-12 international education
- Utilizing web-based distance education technology for the shared benefit of international education

Impact beyond North Carolina

As one of the first initiatives of its kind, the Cultural Correspondents program has the potential to expand beyond North Carolina to facilitate K-12/study abroad partnerships across the country and around the world. NC State will help lead this expansion and provide training for global partnerships.

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Distance Education Programs for Military Personnel

The Need

North Carolina is home to seven US military installations and one hundred National Guard armories, involving more than 250,000 personnel. The 2004 *North Carolina Statewide Military Impact Summary* funded by the General Assembly for the NC Advisory Commission on Military Affairs concluded that “six percent of the state’s Gross State Product (total goods and services) or \$18.1 billion is attributed to the military sector in North Carolina.” Educational opportunities are considered a primary factor in the decision-making process to retain or relocate military bases within states. Providing access to quality, affordable education also encourages military personnel to remain in the state upon completing their military service, adding economic benefits to the state as part of a trained workforce.

Serving the Need

To ensure North Carolina’s recognition as a military-friendly state, the General Assembly in 2004 authorized in-state tuition rates for active duty military personnel and their families stationed in North Carolina. NC State has developed several programs specifically geared to military personnel, in addition to numerous degrees, certificates, and courses available through Distance Education. Impacts of Distance Education initiatives for the state’s military population include:

- 44 degrees, certificates, and subject specializations available through NC State’s Distance Education providing learning opportunities to military personnel wherever they are located
- DE courses and training for Troops to Teachers, a program to train lateral entry teachers upon completion of their military service
- Participation in UNC Online, the Military Education initiative, and the UNC Consortium, an effort to establish a UNC presence at each military installation and to publicize educational opportunities available through distance education
- BSE in Mechatronics and Aerospace Engineering, offering military personnel and NavAir employees a site-based program in partnership with Craven Community College in Havelock
- Leadership in the Public Sector, an online undergraduate degree completion program begun in 2007, specifically developed for military personnel and NGOs
- A four-course sequence in Persian language and culture developed by NC State’s Department of Foreign Languages and Literatures, geared toward military personnel and NGOs working in the Middle East

Impact beyond North Carolina

Distance Education opportunities provide education and training for military personnel and their families that extend beyond their tour of duty and time in the military. Wherever they locate, or whatever career they choose, military personnel will be well served by the education received through online initiatives. North Carolina’s reputation for quality educational opportunities will help enhance its global presence as a source of responsive, timely training and economic opportunity.

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STEM Education Initiative

The Need

Growing recognition that the US needs to produce high quality scientists, technologists, engineers, and mathematicians has most recently been presented in the National Academy's *Rising Above the Gathering Storm* and the President's 2006 State of the Union address. As North Carolina's science and technology flagship institution, NC State addresses this concern across the entire education spectrum, from "K through Gray." Our new STEM (Science, Technology, Engineering, and Math) Initiative combines the university's capabilities in undergraduate and graduate STEM disciplines, education research, teacher training, and community outreach.

Serving the Need

Since starting work in January 2007, the Initiative has initiated and coordinated collaborations between many campus personnel and resources. We have met with the College of Education's administrators and faculty, NC State faculty representing STEM undergraduate and graduate disciplines, the Science House, and the Faculty Center for Teaching and Learning. We are seeking innovations from similar initiatives across the nation and have been meeting with their leaders. Combining NC State's commitment to service with its various outreach programs will provide the tools, technologies, and materials that teachers and students need to keep STEM education new and rewarding and produce graduates who are ready take their place in the high-tech global economy or provide the best STEM instruction to our nation's young people. Impacts of this new initiative include:

- Co-funding new faculty positions focused on discipline-based educational research and application in the STEM departments. Searches have begun in the Chemistry and Marine, Earth, and Atmospheric Science Departments.
- Funding fellowship projects involving teams of STEM faculty members, education specialists, and practicing teachers. We will support a biotechnology genetics lab where pre-college teachers can work with NC State researchers on DNA sequencing projects.
- Supporting doctoral students interested in STEM teaching innovations and education research.
- Sponsoring scholarly programs that promote high quality STEM education. We have supported talks by national leaders in this area and have begun planning a national conference on discipline-based education research.

Impact beyond North Carolina

The STEM Education Initiative is directly involved in improving STEM education at NC State as well as at other colleges around the country. One project alone has been implemented at more than 50 other campuses. Following through with this effort, the faculty of the College of Education and the STEM disciplines are working to take the lessons learned in NC State classrooms and labs into pedagogical innovations that stimulate high-quality STEM education in pre-college classrooms as well as prepare new teachers for N.C. and beyond.

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Virtual Computing Laboratory

The Need

In today's high-tech world the assertion is that the world is flat, but the argument is true only for those who have access to technology. Geographic, social, and economic factors influence whether people have access to the technology that drives the world's education and commerce. It is clear that cyberinfrastructure will shape economic prosperity in the 21st century, just as highways and power lines did in the past. It is an essential and transforming tool for enablement and education of our students and workforce and for enhancement of our global competitiveness.

Serving the Need

In 2004, NC State initiated its Virtual Computing Laboratory (VCL) project developed by the College of Engineering and the NC State Information Technology Division. The VCL serves thousands of N.C. State on-campus and distance education students, providing access to computing applications that were previously inaccessible. The VCL concept is currently under evaluation by UNC-GA, and joint installations are being put in place with ECU, NCCU, UNC-Greensboro, and UNC-Chapel Hill. As part of the IBM Virtual Computing Initiative, VCL is being released as an open source environment for delivery of services designed to meet mobility and diversity needs of a new generation of learners. It offers students a huge range of computing experiences preparing them to be competitive in the global marketplace. As it expands to the K-12 and community college environments in NC, the VCL will truly level the playing field and bring new meaning to the term "learning with technology." The VCL:

- Eliminates geographic and economic discrepancies in the quality of educational access to computing
- Produces dramatic improvements in the value and outcomes of information technology (IT) investments
- Bridges the digital divide, making technological tools and resources available to students at all educational levels, in all parts of the state or world, and on all campuses
- Enhances distance education, making rich resources accessible beyond the campus boundaries, and promotes exploration of diverse media to accommodate diverse learning requirements
- Allows students and faculty to tap into the power of high-end laboratories directly from their laptops or computers from anywhere in the world in a secure, user-friendly way. Complexity is determined by the user.
- Provides a uniquely simple, secure, flexible, reliable, scalable, and economical approach to mapping and managing user application and service needs to available local or distributed software images and hardware resources
- Allows adherence to strict vendor licensing requirements while providing a cost-effective way for students and faculty to gain access to high-end applications needed for courses or research

Impact beyond North Carolina

As part of the VCL, NC State is building a broad VCL community with universities in other states, and VCL use was tested from Europe, Asia, and South America.

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North Carolina “Learn and Earn Online”

The Need

Accompanying North Carolina’s robust population growth is a transition from an agricultural and manufacturing economy to a knowledge-based economy. This change requires increased education for high school students as they enter the work force, enabling them to contribute to and share in the state’s economic prosperity. Grounding in subject areas crucial to success requires alternative learning resources for high school students. This need cannot be addressed adequately within the public school systems due to a critical shortage of qualified teachers in the key areas of math, science, and technology.

Serving the Need

Distance education learning opportunities in key subject areas help prepare high school students for college admission. NC State’s Flexible Access credit courses have been offered to high school students through Distance Education for more than a dozen years in a variety of subject areas. The program expands course offerings to students across North Carolina through the Learn and Earn Online program, an initiative included in Governor Easley’s proposed biennial budget for 2007-09. A collaborative effort among the state’s K-12 public schools, community college system, and the UNC system, Learn and Earn Online will provide courses in subjects not available in high schools to help prepare students for college-level studies. NC State’s participation in the Learn and Earn Online initiative has projected enrollments of 1,000 high school students in Spring 2008, 2,000 in Fall 2008 and 3,000 in Spring 2009.

Online courses taught to high school students:

- Provide learning opportunities in key content areas for high school students enrolled through Academic Enrichment Opportunities (AEO), helping meet requirements for college admission
- Supplement studies for students at the North Carolina School of Science and Mathematics with courses unavailable at NCSSM
- Familiarize students with technologies they will use in college and in their future careers
- Encourage lifelong learning for high school students as a means to upgrade skills or to prepare for new careers

Impact beyond North Carolina

Distance education can help produce a trained work force in biotechnology, analytics, and other knowledge-based initiatives and help broaden North Carolina’s impact on the national and global economy. Leveraging the ability of professionals to adapt to changing circumstances through continued distance education opportunities facilitates participation in new directions for research, policy, and economic development.

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NC LIVE: Statewide Information Access

The Need

For years, public and academic libraries across North Carolina have tried to provide knowledge-based services that deliver accurate, accessible, and appropriate information to all North Carolinians as a way to ensure their success in the classroom, at work, and at home. In the early 1990s, individual institutions attempted to deal with this situation in a piecemeal fashion, without taking advantage of the virtual and scalable nature of digital environments. Barriers to widespread access to rich information collections included the user's physical location, lack of adequate assistance and support, and the lack of availability of reliable and accurate information content. Despite the increasing availability of digital technology and the ubiquity of the Internet as a resource by the mid-1990s, statewide information equity remained elusive. North Carolina was developing a "digital divide" that threatened to splinter its residents into information "haves" and "have nots."

Serving the Need

As a land grant institution, NC State's heritage and mission stress collaboration, outreach, service, and enhancement of quality of life through education and knowledge dissemination. It was in that spirit in 1997 that the NC State Libraries (as one of the lead organizations with UNC – Chapel Hill from the UNC system) joined the public libraries of North Carolina, the North Carolina Community College System, the North Carolina Independent Colleges and Universities, and the State Library of North Carolina to form NC LIVE. NC LIVE provides all North Carolinians equal access to an extensive range of online reference and research resources previously unavailable to them via the open Internet. These resources enhance statewide education, economic development, and quality of life. The NC State Libraries contributes much of the necessary infrastructure (personnel, space, operational support, and oversight) that enables NC LIVE to deliver on its mission, and the following outcomes have resulted:

- 24x7x365 access to the highest quality resources supporting education at all levels, including distance learning; workforce development and training; and health and wellness programs
- 100 percent participation in the program from all member libraries across the state
- Usage increases averaging more than 20 percent per year, totaling nearly 200 percent since FY 1999-2000
- Millions of dollars of savings for North Carolinians through group purchasing

Impact beyond North Carolina

As NC LIVE enters its second decade, it has brought together the power of its partners and members to answer questions, inspire new questions to be asked, enable interactions that build understanding, and promote engagement that changes the lives of North Carolinians. NC LIVE has changed, and will continue to change, the way libraries deliver value across the state and around the world, and it serves as a model of statewide cooperation for those wishing to venture into the world of multi-jurisdictional digital library development.

For more information, contact

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Leading, Connecting, Transforming

Growing and Sustaining the
Nation's Energy and Environment

The University of North Carolina Tomorrow

Section 3

Nuclear Reactor Program

The Need

With rising prices of oil and calls to reduce greenhouse gases, the nation has turned to alternative sources, including nuclear energy, to meet its energy needs. In addition, the medical community requires innovations in nuclear medicine, mammography, and other medical imaging technologies to improve human health, and the scientific community needs improved nondestructive examination facilities for forensic and materials research. Without adequate research and teaching facilities in nuclear engineering, these societal needs cannot be met.

Serving the Need

In 1950, plans for the first university-based nuclear reactor in the world were initiated at NC State. In 1953, the first generation reactor went critical and started operating, and by 1972, the PULSTAR reactor was inaugurated as the fourth generation nuclear reactor. With 1.0 megawatts of power, the PULSTAR represents the only university-based large reactor in the southeast. Using the PULSTAR and its associated forensic and materials nondestructive examination facilities, the Nuclear Reactor Program fulfills the fundamental educational, scientific and technological needs of students, faculty, scientists, and general community users at the local, regional, national and international levels. The NRP is a nuclear science center comparable and to the capabilities at US national centers and laboratories. Impacts of the Nuclear Reactor Program include the following:

- Providing nuclear engineering education to support fundamental education in basic nuclear reactor physics and operations
- Training and licenses nuclear reactor student operators to provide additional experience in nuclear reactor operations and engineering
- Serving as a center for applying nuclear elemental analysis and forensics capabilities, including neutron activation analysis, gamma-ray spectrometry, and neutron imaging in support of state-affiliated departments, universities, and industry
- Serving as a center for the application of radiation beams in the nondestructive examination of materials and includes the only reactor-based intense positron beam in the US and a state-of-the-art neutron powder diffractometer, which are used in materials nanophase characterization
- Supporting the role of NC State as a leading university in the field of neutron science, including the development and operation of the only reactor-based ultracold neutron source in the US to be used in fundamental neutron physics research and applications

Impact beyond North Carolina

In response to the US Department of Energy's Innovations in Nuclear Infrastructure and Education (INIE) program, the NRP established and remains the lead of the Multi-University Southeast INIE Consortium (MUSIC). Through MUSIC, with support of the US DOE reactor sharing program, the educational mission of the NRP has been extended to offering internet-based reactor laboratory courses to nuclear engineering students at the University of Tennessee and Georgia Institute of Technology.

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Biofuels from Woody Biomass Feedstocks

The Need

As energy consumption has steadily increased, demand for crude oil has escalated worldwide, especially in the developing countries. It is also expected that the price for oil will not decrease to the levels seen in the 20th century. North Carolina has no in-state sources of oil or natural gas and must import all of its fuels from outside the state, at a cost in excess of \$20 billion per year. As a result, development of alternative sources of energy will be critical, especially from renewable resources. Ethanol is a source of renewable energy produced by the fermentation of sugars from various sources of biomass. As the demand for ethanol increases, it is critical that the resource base be broadened to include sources of biomass that are more readily available in North Carolina, such as loblolly pine, fast growing hardwoods, switchgrass, coastal Bermuda grass, and various agricultural residues. North Carolina ranks ninth in the nation in timberlands with forests covering 57 percent of the total land area.

Serving the Need

NC State is conducting research and technology development that will enable this new biofuels industry. The research and development is aimed at improving the specific chemical and enzymatic processes that will enable the economically viable production of biofuels from biomass. These research and development goals include:

- Identification of lower cost and high volume biomass including developing genetically modified trees with high cellulose and low lignin
- Identification of the impact of various biomass feedstocks on the economics of a bioenergy production facility
- Development of low cost pretreatment technologies that can be easily implemented in both existing and greenfield bioethanol plants
- Development of technologies for higher sugar recovery from biomass using improved enzyme mixtures, high consistency hydrolysis, and enzyme recycle
- Identification of profitable uses of the co-products from ethanol plants
- Development of techno-economic process models that can be used to study and optimize ethanol production technologies
- Development of new technologies that will facilitate high efficiency gasification processes in a paper mill or biomass power plant
- Assistance to companies in North Carolina to evaluate and design processes for producing bio-energy

Impact beyond North Carolina

With its long growing seasons, abundant rainfall, and ample sunlight, the southeastern US has the most productive tree and biomass production and collection infrastructures in the country. Sustainable production and cost effective collection of woody biomass have been practiced in the southeastern US for almost a century. Any technologies developed at NC State that increase the efficiency of ethanol production would positively impact rural economies throughout the southeastern US.

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The North Carolina Solar Center

The Need

North Carolina currently spends \$15 billion each year for fuel to make energy. Coal, oil, and uranium are not indigenous to NC, and each has its own set of environmental, security or human health issues that complicate their continued use, whether it is climate change, air quality, or waste disposal. However, biomass from farms, windpower at the coast, and solar energy are abundant indigenous resources for N.C. to tap. Today, thousands of our citizens, farmers, and businesses are more aggressively pursuing the use of such resources, whether for environmental reasons or because of rising prices at the pump. Education, technical assistance, training, and public policy are all critical to making sustainable energy part of North Carolina's future.

Serving the Need

In 1988 the NC State created the NC Solar Center as a focal point for research, extension and engagement on solar energy technologies and building practices. Today the Center encompasses renewable energy and energy efficiency technologies in the building, power, transportation, and industrial sectors. Impacts include:

- Providing technical assistance and information on tax credits and other incentives to over 3000 N.C. consumers and businesses for energy improvements each year
- Administering the NC HealthyBuilt Homes Program on behalf of the state; as of April 2007 there are 129 homes under construction, 61 certified homes built, and 72 builders working in the program in 21 counties across N.C. An additional 3600 homes to date are committed to participate in the program
- Providing policy analysis and technical assistance to a variety of state officials and other agencies, including NC GreenPower, the NC Strategic Plan for Biofuels Leadership, the NC Biomass Council and the NC Climate Change Commission's technical workgroups
- Managing (with Mississippi State) the Combined Heat and Power (CHP) Southeast Regional Application Center to provide technical support, including support to nearly 100 MW of power projects, along with regular workshops for potential consumers
- Conducting over 100 on-site renewable energy and efficiency audits at N.C. facilities through the Industrial Efficiency Program and nearly 20 workshops to train facility managers on efficiency technologies
- Proving \$1.6 million of state and federal funds as small grants to agencies and businesses across N.C. for clean transportation infrastructure projects
- Hosting over 100 K-12 school and community college tour groups at the Solar House, a fully functional residential demonstration home of renewable energy technologies
- Providing technical training to over 200 homeowners, business facility managers, builders, and renewable energy companies to build industry infrastructure in the State

Impact beyond North Carolina

The Center's national policy projects include the Database of State Incentives for Renewables and Efficiency (DSIRE), an online searchable database of all the renewable energy and efficiency incentives available in the US that gets over 100,000 unique web visitors each month.

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Cooperative Tree Improvement Program

The Need

North Carolina has approximately 436,000 private landowners, many of whom sell timber to supply our citizens with paper and wood products. Because of rapid urbanization and development, more wood must be produced on less land than ever before. Intensely managed forest tree plantations provide this important raw material for our state's economy, as well as a critical income stream for landowners. A key component of intensive plantation management is the ability to plant trees that have been bred and selected for broad adaptability to the region's climate and soils, rapid growth rates, good stem form, and resistance to pests. Developing the genetic base for this planting stock is a monumental task, because of the long generation times of trees and the large amount of land required for genetic tests.

Serving the Need

More than 50 years ago, NC State partnered with industrial firms, forest landowners, and state agencies across the South to form a cooperative research, breeding, and testing program. Over the last five decades, members of the NC State-Industry Cooperative Tree Improvement Program have made dramatic improvement in the productivity and value of forest plantations. Because of this partnership, NC State is a recognized world leader in research on forest genetics, tree breeding, technology transfer to landowners, and education of undergraduate and graduate students in forestry and related disciplines. Impacts of the Tree Improvement Cooperative include:

- \$16 million in direct funding to NC State to carry out program activities
- In-kind breeding, testing, and research activities by members valued at \$170 million
- Genetically improved planting stock that makes up 65 percent of the nation's total annual tree planting activity.
- \$200 per acre in present value to landowners that utilize improved planting stock
- 287 peer-reviewed journal articles by the program's faculty, students, and staff
- \$6.8 million in competitive grants received the last 10 years
- 214 graduate students who have completed their degrees working with the program faculty
- 64 post-doctoral researchers and visiting scientists from 34 countries and five continents who have studied with the program
- Annual undergraduate and graduate course offerings to students across the campus

Impact beyond North Carolina

The Tree Improvement Program has established NC State as the world leader in forest genetics and tree improvement. The economic benefits to landowners, large and small, extend to much of the southeastern US. The former students of the program have radiated out to important positions in federal and state agencies, industrial firms, and academia throughout the world, furthering the knowledge and leadership of our university and state.

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EnvironMentors

The Need

Natural resources as a field contributes significantly to the economy of North Carolina, the nation, and the world. Several hundred thousand jobs are available in natural resources; however, in the next 5-10 years more than 50 percent of the work force in natural resources will be retiring. There are not enough professionals in the pipeline to fill these vacant positions. Traditionally, natural resources professionals have been primarily white males. There is growing need and interest in diversifying the workforce and in preparing our students to work in a global economy and be open to differences.

Serving the Need

In Fall 2007, the College of Natural Resources (CNR) joined the National Council of Science and the Environment (NCSE) in piloting a high school mentoring program entitled EnvironMentors. EnvironMentors is a pre-college program geared toward juniors and seniors from underrepresented groups to partner them with a Natural Resources professional, where they develop a research project and compete for scholarships. The overarching goal is to get the students into natural resource fields, but getting them to college regardless of what discipline they choose is also important. CNR has collaborated with the Colleges of Engineering and Physical and Mathematical Sciences to work with 15 students from Garner Magnet High School. Impacts of EnvironMentors include:

- Improved relationship between CNR and Wake County Schools
- Increased exposure for CNR and other natural resource-related disciplines
- Increased exposure for Wake County students to learn about NC State
- Cultivating a pipeline from Garner Senior High School to CNR and NC State
- Growing interest in expanding EnvironMentors to additional schools (Southeast Raleigh chapter starts Fall 2007)
- Increased opportunities for faculty, staff and students to offer community service to surrounding communities

Impact beyond North Carolina

EnvironMentors is a national model, the only one of its kind that focuses on natural resources but is not limited to traditional natural resource disciplines. The program started in Washington, DC; next year, the students from Washington will be able to participate in part of the yearly program at NC State. North Carolina students have the opportunity to compete nationally for scholarships and acceptance into universities countrywide. Successful experiences with EnvironMentors will improve the quantity and quality of incoming natural resource students and eventually feed the growing demand for natural resources leaders in the nation and the world.

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Forest Biomaterials Center

The Need

The need for basic science and technology in the areas of biomass and biomaterials has become increasingly pronounced due to concerns over increasing fuel prices, green house gas emissions, and associated global warming. All these issues have created a tremendous interest in the science and technologies that promise the sustainable production of materials, chemicals, and energy from domestic resources. In this respect, our abundant forest resources in North Carolina have the unique ability to supply some of the state's and nation's needs. NC State's Department of Wood and Paper Science fosters the promotion of education, science, and technology that enables the production of chemicals and materials from our forest biomass feedstocks.

Serving the Need

The Forest Biomaterials Center at NC State provides the nucleus for research in North Carolina so that our chemical and polymer industries reduce their dependence on fossil fuels. In turn, it will be possible to realize benefits of increased energy security, economic development, and improved environmental quality. This research and education program is focused on the development of the chemistry, material science, and manufacturing technologies that can transform our forest biomass to chemical and polymer feedstocks. The department is planning a graduate education program aimed at bridging the gap for this new economy by training the future professionals for a bio-based society. Impacts of the Forest Biomaterials Center include:

- Creation of a new NC State-based open-access online journal, "Bioresources," with the mission of advancing the information flow in this area
- Creation of a series of graduate courses in biomaterials and bioenergy and publication of an internationally recognized book *Materials Chemicals & Energy from Forest Biomass*
- Initiation of research activities that capitalize on the organization of the plant cell wall at the nanoscale aimed at new cellulose based nanomaterials and stimuli-response intelligent fibers and coatings
- Development of new analytical tools for the study of biomass and biomaterials
- Development of new technology that permits the total solubilization of wood for the production of completely new advanced wood based materials
- Work with local industrial partners to define the fundamental interactions between biomass and enzymes that can be used to produce bioproducts

Impact beyond North Carolina

The use of large amounts of available biomass will create a healthier and more prosperous environment. Using biomass as a source of carbon for our material and energy needs decreases the emission of carbon dioxide gas that contributes to global warming.

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Energy for a Sustainable Environment

The Need

Energy is the world's biggest industry. Balancing North Carolina's energy security in the 21st century with economic growth and environmental sustainability will require technological breakthroughs in multiple areas, closely coupled to realistic economic analyses and acceptable social policy changes. Fundamental advances in this field will draw heavily on expertise in the physical and mathematical sciences.

Serving the Need

Faculty and students of the College of Physical and Mathematical Sciences (PAMS) partner across campus to study energy production, distribution and usage and the environmental impacts of energy utilization. Specific strengths that two PAMS disciplines, Chemistry and Physics, bring to energy research include the following:

- Chemical processes are at the heart of sustainable energy systems. New materials must be created for solar capture and conversion, and new catalysts are needed for the desired chemical bond conversions.
- Professor Jon Lindsey is synthesizing organic materials to mimic the sun-harnessing power of chlorophyll for a new type of solar cell. His inventions have led to the formation of start-up companies in the booming photovoltaics industry.
- In support of a future hydrogen economy, Professor Paul Maggard and an undergraduate student have worked together to blend transition metals with known photocatalysts for better hydrogen-producing reactions.
- North Carolina derives 30 percent of its power from nuclear energy and 10 percent of the uranium fuel used in US reactors is now derived from decommissioned nuclear warheads from the former Soviet Union.
- A recent PhD used the skills he learned as an NC State graduate student to become a member of the US team observing U-235 deblending facilities in Russia. The uranium hexafluoride he is monitoring today will be powering North Carolina's electrical grid tomorrow.
- Another physics graduate student is studying DVD-RAM technology to learn about computer memory applications that may have potential implications for energy efficiency across the computer industry.

Impact beyond North Carolina

Undergraduates, graduates, and postdoctoral students come from across the world to work with our researchers. Some stay in North Carolina to help drive the state's knowledge-based economy, and some return to their home countries to become leaders in industries that do business with North Carolina. Jon Lindsey's group in chemistry consists of four undergraduates, six graduates, eight postdoctoral associates, and in addition to domestic students, draws researchers from China, France, Hungary, India, Japan, Malaysia, Poland, Turkey and Vietnam.

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Biofuels from Agricultural Products

The Need

Rising energy prices, heavy dependence on foreign oil, and growing concern for the environment have resulted in increasingly aggressive nationwide research into alternative fuels. North Carolina is uniquely positioned to be a major player in biofuel production because of its abundant biomass resources and workforce capacity. In fact, the Environmental Review Commission of the North Carolina General Assembly recently released a strategic plan with this goal: By 2017, 10 percent of liquid fuels sold in North Carolina will come from biofuels grown and produced within the state. Increased production of biofuels derived from the state's agricultural crops and byproducts also could result in significant economic gain for North Carolina.

Serving the Need

Using everything from switchgrass and sweet potatoes to agricultural byproducts such as animal waste, scientists in the NC State College of Agriculture and Life Sciences are developing ways to convert biomass into clean-burning alternative fuels. A number of innovative projects are underway in the College:

- In the Department of Biological and Agricultural Engineering, researchers are working to produce biofuels from agricultural and food processing residues, agricultural feedstocks and waste management byproducts.
- Several of the College's crop scientists are researching ways to convert switchgrass, canola and hulless barley into ethanol. The second Canola Field Day, co-sponsored by the College, was held in April 2007.
- Researchers in the departments of Poultry Science and Animal Science are exploring ways to use animal waste byproducts as a source for biofuels.
- In the Department of Horticultural Science, faculty are working to genetically engineer sweet potatoes to contain a starch-degrading enzyme that accelerates conversion into ethanol.
- The College will play a central role in developing a Golden LEAF-funded pilot plant at the Lake Wheeler Road Field Laboratory that will convert feedstocks into ethanol. Plant construction is expected to begin in summer 2007.
- Dean Johnny Wynne is actively involved in the development of the Environmental Review Commission's report, "Fueling North Carolina's Future: North Carolina's Strategic Plan for Biofuels Leadership." Wynne also is advocating for the establishment of a field laboratory in Duplin County that would expand the university's biofuels research.

Impact beyond North Carolina

The College's work in developing biofuels could generate breakthroughs that result in greater energy independence, a cleaner environment and a stronger economy for North Carolina and beyond.

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The American Home at NC State

The Need

Housing construction is one of the largest uses of forest products in the US. In fact, the majority of the estimated 18 million new homes built over the next decade will use wood-frame construction and a variety of wood-based products. In North Carolina alone, there are nearly 3.5 million housing units, and new housing starts continue to increase each month. In terms of the economic and employment impact from housing construction, North Carolina's industry contributes almost \$28 billion per year to its economy and generates more than 273,000 jobs.

Serving the Need

NC State, in partnership with numerous public and private institutions, is establishing the American Home at NC State facility to advance innovation, education, demonstration, and conservation as they relate to the housing industry. The American Home at NC State will consist of a small neighborhood located on Centennial Campus that will be used to showcase a variety of homes – ranging from the affordable and sustainable to luxurious and high-tech – that are accessible to the general public. The American Home at NC State will also foster a multidisciplinary approach in studying and communicating advanced housing concepts, technologies, and practices. We will use the facility for activities such as:

- Continuing education for professional builders, building code inspectors, designers, architects, housing manufacturers, building material suppliers, and do-it-yourselfers
- Training for coastal builders regarding proper construction techniques and advanced new methods such as fastener technologies and extreme weather-safe room construction
- Educating the general public on issues such as landscaping, sustainable land use, preservation of trees and topography, rainwater collection and water quality, and designing for native wildlife
- Researching new sensing systems and materials for houses in order to make them self-diagnosing and self-correcting
- Teaching home builders new construction methods that will result in new houses that are attractive, comfortable, safe, affordable, durable, efficient, disaster resistant, and sustainable

Impact beyond North Carolina

A few demonstration and research houses have been built in other parts of the country. However, there is no comprehensive center anywhere in the US dedicated to exploring and explaining the broad spectrum of interior, exterior, and neighborhood housing issues. We expect that the American Home at NC State will have both regional and national profile and importance.

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Leading, Connecting, Transforming

Advancing the Health and Well-Being
of Our Citizens

The University of North Carolina Tomorrow

Section 4

Antiviral Fabrics – LaamScience

The Need

Recent concerns about the spread of “Bird flu” (H5N1 avian influenza) have resulted in massive efforts to develop contingency plans in the event of a pandemic. During the 1918 Spanish flu, 25-30 percent of the world’s population fell ill and more than 40 million people died. The bird flu is much more lethal and, although it has not yet developed the ability to spread easily among people, it is expected to develop this ability. If 30 percent of the US population fell ill, 90 million people would require medical attention, causing massive disruption of business and crippling the economy. Drugs and vaccines developed to combat the current strain of bird flu will likely not be effective against the strain that develops the ability to spread between people, and it will take approximately six months after the start of an epidemic to develop new vaccines. Thus, an interim solution to reduce the spread of disease could have a several billion dollar impact on North Carolina’s and the US economy.

Serving the Need

LaamScience, Inc. was formed in 2006 after the founder presented results on his research into antiviral textiles at an event sponsored by the Economic Development Office. It occupies laboratory space in Research Triangle Park and has raised over \$1,300,000 in equity. It has been featured in more than 30 publications. *Readers’ Digest* labeled it a “Top Medical Breakthrough” (March 2007). LaamScience is developing this technology for personal protection via simple dust masks that inactivate viruses, thus greatly reducing the spread of infection. The North Carolina Biotechnology Center and LaamScience are sponsoring research within the College of Textiles on Centennial Campus utilizing the College’s pilot plant and testing facilities. Impacts of this collaboration with LaamScience include:

- Course material regarding the benefits and disadvantages of antimicrobial textiles developed for and presented to NC State students, the local community, and through extension short courses
- Expanding research in the College of Textiles based on this technology to improve effectiveness, to improve manufacturing capability, and to introduce it into new areas
- New products based on this technology incorporating nonwovens from the Nonwoven Cooperative Research Center on Centennial Campus
- A joint material development trial with WakeMed Hospitals underway for upholstery, wall coverings and privacy curtains

Impact beyond North Carolina

LaamScience is in negotiations with several Fortune 500 companies to implement this technology worldwide in masks, air filters, upholstery, and even paint.

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The Initiative for Inclusive Design

The Need

Low-income communities, people with disabilities, and families and children at risk are the focus of the Initiative for Inclusive Design. In North Carolina, 21 percent of individuals have been identified as having a disability. More than 60 percent of North Carolina adults are obese. Increasing numbers of children are suffering health problems (overweight, sedentary lifestyles, ADD, ADHD) that can be ameliorated by design interventions in their healthy daily environments. The development of model affordable housing is imperative to support the needs of a fast-growing and aging population.

Serving the Need

The Initiative for Inclusive Design serves the needs of North Carolinians through the work of the Center for Universal Design (CUD) and the Home Environments Design Initiative (HEDI). Impacts of the units include the following:

- In the last year the Center for Universal Design responded to more than 683 referrals providing specific technical assistance, distributed 2,073 publications and more than 8,500 Web site downloads/month, and provided information for almost 558,000 visitors through the Center for Universal Design Web site.
- The Center developed an ADA video training series for the US Department of Justice and has published numerous planning guides on universal design for public facilities, temporary events, children, health care and fitness facilities.
- The Initiative is working with the Duke University School of Medicine to develop tools to protect ultrasound technicians from injury.
- In cooperation with the Lumbee Tribal Council, the Home Environments Design Initiative is working to promote quality home designs to support an increase of home ownership among members of the Lumbee Tribe. These efforts have resulted in model homes being constructed and significant progress being made with regard to solving the housing problem.
- The Initiative is conducting workshops in the Lumbee community to inform children about potential careers in design and architecture. In addition the group is expanding its work with grassroots organizations to create other affordable housing models in the Triangle.

Impact beyond North Carolina

The units have worked collaboratively with federal, national and international organizations, including US Department of Justice, National Endowment for the Arts, National Association of Home Builders, Habitat for Humanity, National Easter Seals and Andrus Gerontology Center. In 2007, the Center for Universal Design signed an agreement of cooperation with the Beijing Institute of Technology, China. In addition, the work of the Center for Universal Design has been recognized in *The New York Times* for its nationwide impact.

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Remote Computer Access for People with Vision Impairments

The Need

There are over 54 million people with disabilities in the US, and this number is growing. Millions of baby boomers are developing age-related impairments; hundreds of thousands of newly-disabled veterans are seeking employment opportunities. Students and others with disabilities are demanding their rights to full inclusion in educational, economic, and employment opportunities offered by the rapidly evolving global cyberinfrastructure. The idea of individual accommodations as a substitute for accessible IT resources is no longer acceptable.

Many governments, including the US, have passed legislation to ensure equitable access to online information and resources for people with disabilities. Often, the reality is different, especially for vision-impaired computer users who depend upon text-to-speech “screen readers” or screen magnification for independent learning and work. The new remote access computing paradigm, which is being adopted widely in business and education, is a recent example of the ongoing need to find solutions to accessibility in the early stages of development. Without these efforts, new barriers to access and success for people with disabilities will be erected.

Serving the Need

NC State’s IT Accessibility Team has a growing national reputation for finding or creating proactive accessibility solutions that can be deployed widely from a central IT organization. Accessibility was included during the early stages of development of the Virtual Computing Lab (VCL), which enables remote access to a wide assortment of high-end computer lab environments and software applications. However, there were significant technological barriers for people using screen readers and screen magnification to access the Microsoft Windows or Unix/Linux environments.

Initially, the IT Accessibility Team, which includes a programmer who is blind, collaborated with major assistive technology vendors to test and deploy solutions using MS Remote Desktop Protocol (RDP) to access the Windows environment. The team then addressed the accessibility issues with the Unix/Linux environments. To solve the remote access problems, the team developed a new application called the Remote Access Bridge (RAB) which acts as a conduit for information being processed on the remote computer so it can be “read” by the text-to-speech engine on the local computer.

Impact beyond North Carolina

NC State Virtual Computing Lab technology, which has the potential to be a powerful component of the emerging global cyberinfrastructure, is now accessible to anyone—regardless of disabilities. JAWS, WindowEyes, and SuperNova screen-readers now work with Microsoft’s remote access technology. Both IBM and Sun Microsystems are exploring the Remote Access Bridge (RAB) solution to enable their new screen readers to operate for remote computing. Perhaps even more far-reaching, the RAB has the potential to make it possible for people who are blind to collaborate with people who are sighted while using a shared remote environment.

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Probiotics and Human Health

The Need

Consumers recognize the importance of probiotics and prebiotics: substances in foods that provide health benefits such as improved digestion, a stronger immune system, and reduction of lactose intolerance symptoms. Dairy foods, notably yogurt, have long been recognized as a probiotics source. Drinkable yogurt sales rose 18.4 percent to \$7.76 billion between 2005 and 2006, making it the fastest-growing food category, with sales of more than \$1 billion worldwide.

Serving the Need

NC State University's Food Science Department has a long history of probiotics research and product development, including the development of Sweet Acidophilous Milk. NC State's Southeast Dairy Foods Research Center participated in a collaboration with the California Dairy Research Foundation, Dairy Management, Inc, and Danisco USA, Inc. to sequence, assemble and annotate the complete genomic sequence of *Lactobacillus acidophilus* NCFM, the probiotic culture used most widely in yogurt, yogurt drinks and Sweet Acidophilus Milk. Through this effort, researchers identified genes important for the survival and activity of probiotic cultures in both yogurt and in the human gastrointestinal tract. The research group made the following key contributions:

- Genetic tools, now used internationally, were developed that allow the inactivation or deletion of key gene regions, to functionally investigate the metabolic, physiological, and probiotic roles of the organism.
- Genetic regions were discovered that direct acid tolerance, bile tolerance, promote attachment to intestinal epithelial cells, antigen presenting cells, and signal communication with immunomodulatory cells of the intestinal mucosa that help direct pro- or anti-inflammatory responses.
- The region responsible for the ability of *Lactobacillus acidophilus* to metabolize prebiotic compounds was identified and characterized.
- A genetic region involved in oxalate utilization and degradation was identified. Oxalate, a component of many foods, can cause calculi (stones) in the urinary tract. The discovery suggests that probiotics may be used to lower oxalate concentrations in the GT tract and minimize calculi, such as kidney stones.
- Over ten provisional patent applications have been filed on various gene classes.
- Six doctoral students who received the prestigious \$1000 Kenneth R. Keller Award, given annually to the student in the College of Agriculture and Life Sciences with the most outstanding doctoral dissertation.

Impact beyond North Carolina

Sequencing the DNA of *Lactobacillus acidophilus* NCFM has provided the world's dairy industry with knowledge to develop probiotic foods that help improve human health. As consumer demand for probiotic foods grows, research will help the industry develop new products to support new solutions.

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Cutting-Edge Research in Biomedical Engineering

The Need

At the end of the 20th century, Americans over 64 years of age represented 12.4 percent of the population (35 million); by 2030 this count is expected to more than double (72 million), growing to be 20 percent of the US population. There is an urgent need to translate 20th century successes in genome sequencing, molecular biology, materials science, information technology, surface chemistry, and systems biology into 21st century biomedical solutions for healthcare, particularly to meet the rapidly growing care requirements of the aging of the global population.

Serving the Need

NC State and the University of North Carolina at Chapel Hill recently established the Joint Department of Biomedical Engineering to foster the translation of biomedical concepts and technologies into products that improve healthcare and create commercial value. The department educates undergraduate and graduate students for careers in cutting-edge research and clinical environments and has a strong commitment to public service and outreach. Female researchers and educators are remarkably well represented, with women accounting for 50 percent or more of its faculty, graduate students, and undergraduate majors. The department draws a wide range of scientific, engineering, and clinical talent from the two universities to move discoveries from the research laboratory bench top to the commercial marketplace, and to the clinical bedside. This cutting-edge research can significantly impact healthcare in the following areas:

- **Biomechanics/Biofluids/Tissue Engineering:** Using molecular biology, bioreactors, cyto-mechanics, engineered scaffolds, plasma treated surfaces, bio-textiles, microfluidics, and mechanobiology to engineer synthetic living tissues and produce novel biocompatible materials
- **Biosystems Analysis:** Using biomedical approaches to improve surgical procedures, to identify mechanisms of cardiac and cortical function, and to map biosystems and their responses to stimuli
- **Biomedical Imaging:** Using imaging of animal models, biological samples, or patients to assess disease or injury, to determine potential efficacy of therapies, and to better understand the pathophysiology of disease progression
- **Bioinformatics and Functional Genomics:** Measuring and modeling molecular properties (in vivo, ex vivo, and in culture), taking a new molecular perspective on biomedical engineering disciplines, and studying the interaction between technology and genome.
- **Medical Devices:** Research and development of biosensors and instrumentation for lab-on-a-chip, DNA sensing without PCR, BioMEMS, bioelectronics, and transparent electrode arrays and the development of capabilities in nanofabrication, integrated circuits, embedded microprocessors, prototyping, materials science, advanced signal processing, and robotics and intelligent machines.
- **Rehabilitation:** Using biomedical engineering capabilities in instrumentation, microsystems, and biomechanics to develop custom devices for the disabled.

Impact Beyond North Carolina

The impact of biomedical engineering research will be break-through healthcare advances for patients around the world. Other benefits will include the development of a state-of-the-art biomedical products industry in N.C. that can expand globally.

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Biopreparedness and Public Health

The Need

Recent hurricanes, global pandemics, and the dawning of bioterrorism have changed the world of medicine. Simultaneously, our economy and markets (especially in agriculture) are now global, large scale, mobile, and interdependent. Put together, these trends force medicine to face demands previously unheard of and changes in the intersection of biopreparedness, veterinary medicine, and public health. Human health, domestic animal health, and wildlife health have historically been seen as separate entities. However, the Centers for Disease Control states that 75 percent of new/emerging diseases in humans are sourced in animals.

Serving the Need

Since early 2001, the College of Veterinary Medicine (CVM) has facilitated engaging public and private partners to address these issues and develop expertise in areas such as bioterrorism, food safety/security, state/federal policy development, and zoonotic disease defense. Some impacts include:

- Creation of the CVM Animal Biosecurity Risk Management Group helping N.C. agriculture decrease risk from natural/intentional events
- Creation of the MS in Veterinary Public Health for cross-disciplinary training in public health, food safety/security, and biosafety
- Incorporation of biosecurity/disaster preparedness in classes in years one–three and as experiential opportunities in year four
- Creation and headquarters of the four-university Agricultural Disaster Research Institute
- Partner in the annual N.C. “One Medicine Conference,” helping animal and human health experts work on common issues
- Founding participant in N.C. Dairy Security Task Force which developed six-state regional operation recommendations
- Lead agency, USDA’s \$5M Food Safety Response and Research Network of over 90 researchers and 22 institutions nationally
- Lead for invited review team for National Biodefense Act of 2005 and Agricultural Biodefense Bill established by Senator Burr
- Lead agency, national competition for the >\$450M National Bio and Agro-Defense Facility federal R&D laboratory in N.C.
- 16-state Foreign Animal Disease workshop created to develop regional agricultural disaster business continuity plans

Impact beyond North Carolina

Our initiatives in biopreparedness and public health have allowed NC State to produce decision-makers in federal agencies (USDA, CDC, US Army), work with other states and federal groups in readiness and response to natural or intentional high consequence events, and become a recognized national leader.

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Electromechanics Research for Human Health

The Need

Cardiovascular disease (CVD) afflicts over 60 million people in the US and is the leading cause of death, claiming more lives (2600 per day) than the next six leading causes combined. Direct and indirect costs resulting from CVD are estimated to be \$329.2 billion per year. One common medical procedure associated with CVD is open-heart surgery. In 1999 there were a total of 753,000 open-heart procedures in the US. Over the last several decades, the use of cardiac catheters has also become a standard practice in the diagnosis and treatment of cardiovascular diseases. The American Heart Association estimates that in 2004 over 1.25 million diagnostic cardiac catheterizations were performed in the United States, as well as 1.25 million angioplasties and 615,000 stent placement procedures. These numbers constitute a 334 percent increase in cardiac catheterizations from 1979-2004.

Serving the Need

In 2004, engineering electromechanics researchers at NC State received a \$1.4 million grant from the National Institutes of Health (NIH) to develop tools for minimally invasive cardiac surgery. This research seeks to reduce cardio-pulmonary bypass times during cardiac surgery through rapid fixation of tissue and improved tissue retraction. Complementary research seeks to increase the effectiveness of existing cardiac catheterization procedures using hyper-redundant actuation to actively control the catheter's tip and body. The project has involved collaboration between student and faculty in the university's Mechanical and Aerospace and Industrial and Systems Engineering departments as well as the College of Design. Since the project's inception, researchers have developed numerous technologies, whose impact includes:

- Development of a working hyper-redundant active catheter system actuated by shape memory alloy (SMA) tendons
- Development of an automated knot-tying device for minimally invasive surgery
- Six invention disclosures
- Three provisional patent applications
- Two animal (sheep) trials at College of Veterinary Medicine to evaluate technologies
- Doctoral, masters, and undergraduate students employed at NC State as well as in NIH's MARC U-STAR program
- Prospective commercialization of technologies through venture capitalists
- Development of a method to measure the effectiveness of mitral valve repairs using explanted animal hearts

Impact beyond North Carolina

NC State researchers have collaboration with surgeons at the Academic Hospital of Maastricht (Netherlands), University of British Columbia (Canada) as well as with East Carolina University.

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The Natural Learning Initiative

The Need

Healthy childhood is essential for the successful development of North Carolina. There are 5,000 licensed childcare centers in the state serving almost 250,000 children up to ten hours a day. Research by the Natural Learning Initiative (NLI) in the College of Design indicates the majority of these environments could be designed to instill healthy lifestyles in child nutrition and physical development and help reverse the 60 percent rate of overweight and obese adults in North Carolina. Research shows that time outdoors is essential for healthy mental and social development of all children. The design of parks, school grounds, neighborhoods, and family weekend destinations has become a crucial strategy to combat “nature deficit disorder” and its associated negative health trends such as ADD and ADHD that research shows can be ameliorated by design of outdoor environments.

Serving the Need

The purpose of the Natural Learning Initiative is to promote the importance of the natural environment in the daily experience of all children through environmental design, research, training, and dissemination of information. Impacts include the following:

- Through participatory community design processes since 2000, NLI has assisted in the creation of more than 60 masterplans for healthy outdoor spaces in public housing, childcare centers, schools, botanical gardens, environmental centers, and zoos.
- NLI’s scientific research program, in collaboration with the UNC School of Public Health, is working to create the evidence base to support children’s science learning and to counteract sedentary lifestyles. This effort is sponsored by the National Science Foundation, the Robert Wood Johnson Foundation, and the National Institute for Environmental Health Sciences.
- The NLI Annual Design Institute has trained approximately 350 educators, designers, education facility owners and operators since 2003.
- More than 10,000 individuals visit NLI’s Web site every month.

Impact beyond North Carolina

The Natural Learning Initiative works in collaboration with several US university-based centers of research and community development as well as institutions in Brazil, Denmark, England, Japan, Jordan, Portugal, Scotland and Sweden. Currently, NLI is collaborating in the creation of an international Network of Excellence focused on health issues in the design of children and family environments in cooperation with the Swedish University of Agricultural Sciences, the Stockholm Public Health Center/ Karolinska Institute, the Edinburgh College of Art and Heriot-Watt University (Scotland), and the Faculty of Human Kinetics, Lisbon Technical University.

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Bio-Microelectromechanical Systems Research

The Need

With advancement in the areas of nanotechnology, biology, microelectronics, and computational methods, there is a need to integrate knowledge across disciplines to deliver useful engineering solutions in the form of devices and systems. One specific area is the integration of knowledge in microelectronics, mechanical engineering, microelectromechanical systems (MEMS), and biology to produce implantable sensors and systems for various biomedical applications. Development of these systems and devices has the potential of improving the quality of life of millions of people with various ailments and diseases.

Serving the Need

The BioMEMS working group addresses this need. The research group consists of faculty members with complementing skills in a broad range of topics working together across departmental boundaries to address the need. The need is identified through discussion with our medical community collaborators (Duke University Medical Center) and formulated through collaborative multi-departmental and multi-institutional proposals to appropriate funding agencies, while working on concept development through seed funding from several sources. The outcome of activities by the BioMEMS group include:

- Implantable biomedical devices and systems for real time disease control
- Disposable devices for point of care diagnostics
- Drug delivery systems (nanomaterials and targeted drug delivery)
- Continuous health monitoring and reporting (Wearable MEMS)
- Aid to Disabled people through sensing, actuation, and control of body functions
- Graduates with expertise in BioMEMS to meet industry demand

The BioMEMS working groups is pursuing the following research:

- An implantable sensor for intraocular pressure sensing through integrated MEMS and wireless power and communication technology. The sensor has an important application in the detection and management of glaucoma, which is a leading cause of blindness.
- A microfluidic sensing device to identify the compatibility of blood types for near bedside applications to prevent transfusion errors. The system involves the integration of microfluidics and sensor optics in a compact disposable package with automated readout.
- Microencapsulation of islet cells through device design for facilitating islet transplant for the cure of diabetes- a massively parallel microfluidics approach.

Impact beyond North Carolina

Results from this research group will have a broad impact affecting the lives of millions of people throughout the world.

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Research to Improve the Human Condition

The Need

Improving human health is an imperative that remains among North Carolina's and the nation's top priorities. In recent years, some of the most high impact scientific advances in the biological and medical sciences have occurred at the interfaces with the physical, mathematical and computational sciences. The role of the physical and mathematical sciences is central to future advances in health and medicine.

Serving the Need

With partners within and beyond the Research Triangle, College of Physical and Mathematical Sciences (PAMS) faculty and student teams are making important contributions to medical research and practice in such areas as treatment strategy, drug discovery, diagnostic biomarker identification, and targeted drug delivery systems. They are also advancing our understanding of underlying biological phenomena such as DNA structure and blood flow. Examples of high-impact research include the following:

- PAMS statisticians have developed sophisticated statistical designs for complicated clinical trials for treatments of diseases where standard clinical trial designs are inadequate. For example, HIV patients often respond better to “structured treatment interruption,” where patients cycle on and off treatment. These complex statistical methods are broadly applicable to any disease in which the treatment of patients involves multiple decisions made over time.
- A Chemistry research group uses proteomics – the study of all proteins expressed by a given genome at a point in time – to understand the biological basis of disease, discover new diagnostic markers, and develop new clinical tests. Because of the massive data sets generated in proteomics, the group's research is highly interdisciplinary involving clinicians, chemists, statisticians, bioinformaticians, and mechanical and aerospace engineers. Since 2003, this group has identified five candidate biomarkers for early diagnosis of ovarian cancer, one of which is undergoing testing in larger patient populations.
- Working with statisticians, public health experts, veterinarians, ecologists and anthropologists, PAMS mathematicians have developed predictive models to describe the spread of infectious disease across a region. These models assist in designing better control measures for outbreaks of disease or bioterrorism.

Impact beyond North Carolina

Research in this area is highly interdisciplinary and collaborative. Our scientists are working with health partners across the US including Harvard Medical School, Massachusetts General Hospital, and the Mayo Clinic. Our discoveries will facilitate advances in medicine, agriculture, biochemistry, and cell biology, impacting health for our state, our nation, and our world.

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Stem Cells for Tissue Engineering

The Need

The political and societal debate concerning embryonic stem cells necessitates finding ways of using stem cells collected from adult humans as an alternative route for stem cell research. One particularly important application for stem cells is in the treatment of tissue loss, disease, or defect. The ability to engineer and replace a patient's lost or damaged tissue would greatly improve the lives of those who suffer trauma or a debilitating tissue disease such as osteoporosis, arthritis, or organ failure. Coaxing stem cells to become specific tissue is one of many potential applications of stem cell research that is being explored around the world.

Serving the Need

The Cell Mechanics Laboratory (CML), the Tissue Mechanics Laboratory (TML), and the Tissue Engineering Laboratory (TEL) at NC State were established as core research facilities and service centers. These laboratories investigate the effects of mechanical and chemical stimuli on adult stem cell function and differentiation, with the long-term goal of engineering and testing human tissues that can withstand the biomechanical and biochemical demands of the *in vivo* environment. Currently, stem cell and tissue engineering research teams include biomedical engineering faculty, research assistants, post doctoral fellows, graduate students, and undergraduate students as well as other industrial and academic collaborators. Recent new developments in stem cell and tissue engineering research include:

- Three-dimensional (3D) poly-l-lactic acid (PLLA) scaffolds designed in collaboration with researchers in the College of Textiles to provide a biocompatible form for the cells to adhere to during growth and provide mechanical stability during the formation of new bone tissue. Researchers demonstrated that the cells were able to survive and grow on the PLLA scaffold while exposed to fluid shear stress.
- Dr. Elizabeth Lobo and her collaborators recently announced a breakthrough in stem cell research. The team is the first in the world to prove that palladin, a protein associated with the actin cytoskeleton, is present in adult mesenchymal stem cells. Since palladin is important in cytoskeletal organization, the team believes that this discovery could lead to clues about how mechanical stimuli modulate mesenchymal stem cell differentiation into bone.

Impact beyond North Carolina

Mesenchymal stem cells harvested from the patient and used to create replacement bone tissue would result in replacement bone tissue that would be completely compatible with the native bone, avoiding rejection and other issues associated with present-day bone tissue replacements. Eventually this research could lead to the development of a process to grow bone to replace damaged or lost bone in patients with osteoporosis or other skeletal defects. One of the problems with these degenerative bone diseases is the loss of mobility. By giving patients new bone that matches their native bone, some mobility may be restored. This specific case is representative of the potential to use a patient's adult stem cells to engineer needed tissues and organs.

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Center for Comparative Medicine and Translational Research

The Need

There is a critical national need to develop solutions to human and animal health problems and to address the threat of emerging diseases and bioterrorism threats. Over a ten-year period beginning in 1996, the budget for the National Institutes of Health doubled. During this time, a powerful research infrastructure was developed in the US and remarkable progress was made in our understanding of disease. To capitalize on these research advances, investigators must work together in multidisciplinary teams to bring solutions to human and veterinary patients; a process termed translational research.

Serving the Need

The Center for Comparative Medicine and Translational Research (CCMTR) was conceived and implemented by faculty who recognize that strong multidisciplinary collaborative teams are necessary to accelerate translational research. The Center was formally recognized as an official Center by the Board of Trustees in 2006. The CCMTR has at present over 80 tenure-track faculty representing 14 departments from four Colleges, with approximately 60 percent of the participants residing on the Centennial Biomedical Campus. In addition to the traditional biological disciplines found in the Colleges of Veterinary Medicine and Agriculture and Life Sciences, truly multidisciplinary collaborations come through the addition of faculty with expertise in biomedical engineering, biomedical textiles, mathematical modeling, non-traditional statistics, chemical engineering, molecular modeling and more. This brings together faculty that speak different scientific languages but share the desire to bring medical solutions to the clinic. In the short time since its inception, the CCMTR has accomplished the following:

- Provided incentives and support to encourage multidisciplinary collaborations and accelerate the translation of laboratory research to improved patient care
- Engaged external academic and corporate advisors to identify research goals and strategies
- Provided access to sophisticated research equipment
- Offered facilities and technical assistance to perform clinical trials
- Awarded seed grant money to launch new ideas and collaborations
- Hosted workshops and symposia to help faculty remain innovative and knowledgeable
- Provided educational opportunities for undergraduate and graduate students (including veterinarians) in translational research
- Developed ties with biomedical researchers at other UNC institutions
- Created a powerful research enterprise to attract corporate partners to the Centennial Biomedical Campus

Impact beyond North Carolina

While the economic impact of CCMTR-sponsored biomedical research directly impacts North Carolina, the human and veterinary health benefits have national and international implications.

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North Carolina Senior Games

The Need

By 2010, North Carolina's population of citizens age 55 and over is expected to reach two million. Maintaining and enhancing the physical health and social connectedness of seniors contributes to their happiness and helps reduce medical costs.

Serving the Need

Over 25 years ago, in response to an invitation from the North Carolina Division of Aging and the City of Raleigh Department of Parks and Recreation, Dr. Beth E. Wilson in the College of Natural Resources adopted Senior Games as a project in her Program Planning Course. Students in the course planned the event from start to finish. It was a tremendous success, and it set the stage for North Carolina Senior Games (NCSG) to develop into the largest Senior Games program in the country. Impacts in the state include the following:

- NCSG reaches all 100 counties through 52 sanctioned Local Games.
- Year-round Senior Games programs in communities throughout the state provide health promotion opportunities for older adults 55 years and older. Over 60,000 older adults participated in programs last year.
- Participation in Senior Games is life-enhancing. A recent statewide survey of participants conducted by the Parks, Recreation and Tourism Management (PRTM) Department pointed to the importance of a community-based program in enabling older adults to become and remain physically and socially active. Involvement with Senior Games was shown to motivate them to be more physically and socially active, and over 75 percent rated their present health as Excellent or Very Good compared to others their age.
- Senior Games provides PRTM students with outstanding experiential education. All students in the department are expected to volunteer at least once to assist in making the competitions efficient, safe, and positive; many volunteer repeatedly. Their volunteer work is a vital part of their education. They learn what it takes to achieve success in a large, multi-faceted program and come to understand the vitality of senior citizens and the contributions well-designed programs can make to their health and happiness.

Impact beyond North Carolina

NCSG is a model for Senior Games programs throughout the United States, because it is year-round, has a strong grassroots organization, has been evaluated every fourth year, and offers opportunities for on-going scientific research on benefits.

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New Agricultural Enterprises for a Changing Population

The Need

As North Carolina's population mix diversifies, so do North Carolinians' food interests. As a result, our state's food producers seek alternative produce and food animals to raise. For example, interest in meat goat production as a new business opportunity grew dramatically during the past six years due to increased goat meat demand by a growing population segment representing ethnic groups — Caribbean islanders, Hispanics and others — who prefer goat meat. At the same time, an increasing Latino and Asian population has fueled growth in an “ethnic vegetables” industry.

Serving the Need

NC State is a leader in meat goat educational and research programs in the southeastern US. Simultaneously, NC State's Specialty Crops Program concentrates on foods new to many North Carolinians: jicama, tomatillos, chile peppers, Oriental melons, Chinese greens, and a special sweet potato – Boniato – preferred by Asian and Hispanic markets. Our Meat Goat Program worked with a range of partners to launch a marketing organization and provide training and certification courses. The NC Meat Goat Producers, Inc. markets live goats and goat meat directly to consumers and area retail stores and restaurants, eliminating middlemen and goat traders. And the Specialty Crops Program “fast tracks” new crop development statewide. In addition:

- Educational programs target Cooperative Extension agents, commodity associations, and other ag professionals to help meat goat producers select, adopt, and successfully implement best management practices for goat production.
- N.C. producers sold about 230,000 meat goats in 2006, generating receipts of more than \$9.7 million. The industry's breeding stock inventory totals about 158,000 animals on more than 3,200 farms, worth more than \$15.5 million.
- Goat producer county information meetings always draw between 30 to 50 attendees; N.C. Meat Goat Producers membership stands at more than 700 farm families in 65 counties and four states.
- The Specialty Crops Program develops research plots to determine best production methods and identify the best varieties, simultaneously test-marketing and developing packaging, labeling, and promotional materials. The program educates growers about new crops successful in market and grower field trials. Growers who produce the crop receive growing and marketing assistance.

Impact beyond North Carolina

The Meat Goat Program is recognized as a center of excellence for research and extension in the Southeast and the US. We receive information requests from Europe, Latin America, the Middle East, Asia, and Australia. A 2004 Specialty Crops Program survey of extension agents in 32 counties indicated an \$888,000 estimated value for specialty vegetables targeted to ethnic groups.

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The Food Animal Residue Avoidance Databank

The Need

Prior to the formation of the Food Animal Residue Avoidance Databank (FARAD) in 1982, veterinarians and livestock producers did not have access to a comprehensive resource to help them prevent drug residues from occurring in livestock products. There was no active research addressing the need for flexible computational models that can predict the disposition of drug or chemical contaminants in meat, milk, and eggs following therapeutic or accidental exposure of livestock to these chemicals. The Animal Medicinal Drug Use Clarification Act allows veterinarians to treat livestock with drugs in an extralabel manner, but the law requires veterinarians to obtain appropriate and extended withdrawal times that do not result in residue violations in livestock products. Determining these extended withdrawal times requires a comprehensive database and novel computational strategies to ensure that livestock products are safe for consumption following drug use.

Serving the Need

FARAD is a multi-state collaborative program between faculty at NC State, UC Davis, the University of Florida, and USDA. FARAD has become the primary national and global science-based resource that supports the elimination of violative residues in the edible tissues of food producing animals. The following are examples of FARAD's impacts:

- Comprehensive databases of approved drugs, indications, tolerances, and withdrawal times for food animal drugs used in the US and other countries
- Comprehensive pharmacokinetic databases in which data on drugs, pesticides, and contaminants in food producing animals are standardized in format, units, and output
- Computer software, algorithms, statistical approaches, and validation strategies to allow real-time calculation of withdrawal intervals for drugs administered in an extralabel manner and for mitigating accidental or deliberate exposure to pesticides or other chemical contaminants
- Public outreach providing real-time expert-mediated food-animal chemical residue advice to producers, veterinarians, and other officials mitigating residue incidences. This system is accessible 24/7 by toll-free telephone access as well as e-mail and www.farad.org
- A network of collaborating global FARAD partners that will provide US FARAD with drug approval data in a format compatible with the US drug database. Current formal global FARAD partners include China, Canada, Taiwan, France, and England
- Training of graduate and veterinary medical students in food animal residue avoidance with special focus in computational pharmacology and toxicology

Impact beyond North Carolina

FARAD is functioning to prevent residues in food products of animal origin and has helped mitigate food safety crises arising from such events as Chernobyl nuclear fallout, dioxin contamination of milk in Europe, pesticide contamination of pineapple feedstuffs in Hawaii, flood-induced botulism poisoning in cattle, and hurricane related livestock contamination.

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In the Garden: Providing Gardeners with Information

The Need

North Carolina's population continues to grow, with more people moving to the state and becoming homeowners, creating a demand for practical information about home gardening. Home horticulture consumers need a reliable source for information to help them landscape their homes while minimizing environmental impact.

Serving the Need

The UNC-TV show *In the Garden with Bryce Lane* helps meet this need for viewers across the state by providing research-based gardening information to the public. The show, which airs twice weekly, features Bryce Lane, an award-winning horticultural science professor in the College of Agriculture and Life Sciences.

In the Garden breaks ground in several ways for NC State and UNC-TV. Part of a new partnership between the university and the public television station, the series marks the first time in 40 years that UNC-TV has broadcast a college-credit course for the university system. The program is making an impact in distance education in several ways. From retirees in rural communities to community college students and professionals, *In the Garden* is reaching a wide range of audiences. Many viewers who had never heard of distance education are now participating in the course through the weekly television show.

Television is among the most powerful media available, with the ability to reach millions of viewers at once. Distance education courses on television provide educational opportunities to citizens on all economic and social levels. Serving as both a television show and a college-credit course, *In the Garden* is carrying out the college's commitment to lifelong learning and community outreach.

In the Garden reaches an average of 100,000 viewers each week, with the following impact:

- The show has dramatically increased the visibility of NC State's Introduction to Home Horticulture course. Since the premiere of the show/course, the number of students enrolled has steadily increased. The first semester the course was offered, there were only five students enrolled. In 2007, a total of 47 students are enrolled in *In the Garden* courses.
- Nearly a dozen North Carolina Cooperative Extension agents and specialists are currently using *In the Garden* as a training tool for the Master Gardeners program and to help educate citizens about horticulture.
- At least 15 high schools and 20 community colleges across the state are using the program for supplemental classroom instruction.

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North Carolina Family-Centered Meetings Project

The Need

North Carolina is a leader in establishing a form of family-centered meetings called “child and family teams.” Holding these meetings is mandated by state legislation to include families and community partners in service planning and public schools to prevent academic failure and placement outside the home. The state Child Mental Health agency supports school-based child and family teams by establishing care coordinator positions in 18 areas across the state. The Juvenile Justice and Delinquency Prevention agency has adopted a therapeutic environment approach that encourages family-centered planning. Use of family-centered meetings in the aging field is being explored.

Serving the Need

Today, the North Carolina Family-Centered Meetings Project offers child and family team (CFT) training, program support, and evaluation in child welfare, public schools, and system of care. The project, based in the Department of Social Work in the College of Humanities and Social Sciences, promotes participation of children, youth, and their families in service planning and collaboration among community organizations and public agencies to create safety, stability, and success in the home, school, and community. The program has received over \$1 million in external funding per year. Impacts of the Project include:

- Training and program support offered to child welfare workers in all 100 counties and public school personnel in 100 schools
- Program support, training, and evaluation provided to four public schools, with more entering in the next fiscal year
- Development of the North Carolina Family Assessment Scale as a practice and evaluation tool for CFTs in schools
- On-line supports for school-based CFTs, developed with the NC Department of Public Instruction
- CFT orientation developed and delivered in collaboration with family advocacy groups, child mental health, juvenile justice and delinquency prevention, public health, child welfare, and schools
- Research and evaluation findings translated into practice guidance and policy and disseminated through publications, presentations, and videos

Impact beyond North Carolina

Countries around the globe use various forms of family meetings in child welfare, juvenile justice, schools, mental health, and correctional services. Project staff are frequently consulted by groups within and outside of the US on practice, policy, and research and have made presentations on family meetings in the US, Canada, United Kingdom, Australia, New Zealand, and Netherlands.

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Determining Risk Factors for Farm Workers

The Need

Agriculture can be hazardous. Young people can be injured while working on the farm, while farm vehicles can be involved in accidents on public highways. Although official highway statistics rate farm vehicle public road crashes as relatively rare, they concern farmers, who must maneuver heavy and often slow-moving farm equipment along ever-more-crowded rural highways, putting themselves, expensive equipment, and the motoring public at risk. Research was needed to determine what could lessen the chances of on- and off-farm accidents to youth and other farm workers.

Serving the Need

Researchers in the College of Agriculture and Life Sciences have investigated the hazards and injuries experienced by youth who work on North Carolina farms, helping develop a national surveillance system for childhood agricultural injuries and guidelines for youth farm work. At the same time, North Carolina Cooperative Extension's Farm Safety Program sponsors annual statewide farm safety camps in rural areas. The camps are designed to teach youngsters safety measures to take around hazards such as farm machinery, chemicals, severe weather, electricity, railroads, and snakes. Farm safety also is taught in the College of Agriculture and Life Sciences' Agricultural Institute.

To study farm vehicle accidents on public roads, researchers compared North Carolina farms reporting a farm vehicle public road crash with farms that had not experienced an incident from 1992 to 2003. The study's results highlighted several characteristics associated with increased odds of being in a crash: non-English speaking drivers; non-family hired-help drivers; many urban commuters on the roads; non-farm vehicle public road use; farm injury history and younger farm vehicle drivers. Study results indicate the need for a multifaceted approach to farm vehicle public road safety. Helpful approaches would include:

- Increased attention to safety training for hired help and non-English speaking help who drive farm vehicles on public roads
- Slow-moving vehicle and turn lanes
- Improved road signage
- Speed limit enforcement
- Non-farm vehicle driver education

Impact beyond North Carolina

This work calls attention to the need for measures that will make farms safer for farm workers and for the public.

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Animal Welfare, Ethics and Public Policy Program

The Need

Few issues provoke such emotional debate or give rise to so many public concerns as animal welfare. To fully appreciate the immediate relevancy and impact of animal welfare, one must only consider the extent to which animals touch our lives on a daily basis, from the food we eat, the products we consume, the services animals render, and the companionship and love they provide. With population growth and urban expansion, man and nature interact and collide on a frequent basis. Given the complexity of this problem, how can man and animals coexist with respect and to their overall mutual benefit? This is a life or death issue for animals and humans alike.

Serving the Need

In an attempt to comprehensively address the complex issues and sometimes disparate needs of both animal and man, the Animal Welfare, Ethics and Public Policy (AWEPP) Program has created three Areas of Excellence: Animal Welfare, Behavior, and Community Practice/Shelter Animal Medicine. These areas reflect the AWEPP Program's faculty strength but also of immediate needs within veterinary medicine and society as a whole. Operational elements of each Area of Excellence include public service programs, education and engagement activities, research, and public policy development. Impacts of the AWEPP Program include:

- Preparing, planning, and responding during animal emergencies and disasters in North Carolina and across the United States
- Reducing recidivism and abandonment of pets through our Community Campus Partnership and Shelter Animal Medicine Programs, continuing education and public awareness campaigns
- Decreasing an individual's propensity for violence through our Veterinary Intervention Project, which is an education exploration of the link between animal abuse and domestic violence
- Leading the state and nation in informed public policy research and development on animal welfare issues such as animal fighting and abuse, pet overpopulation, food supply and safety, and livestock housing and welfare
- Educating professional veterinary students in all aspects of shelter medicine, as well as providing a solid foundation in basic clinical skills and a sense of duty towards community involvement and civic service
- Leading a multi-institutional collaborative research effort to develop statistical estimates of companion animals housed in the United States sheltering system

Impact beyond North Carolina

The Animal Welfare, Ethics and Public Policy Program's novel curricular offerings, community service programs, applied and basic research projects, continuing education seminars, and public outreach highlight the varied role that animals play in society. Through AWEPPP's leadership, NC State has the unique opportunity to shape the ongoing dialog on many animal related issues at a nation wide level and bridge the gap between science, ethics and public policy.

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Improving Nutrition for Limited-Resource Families

The Need

Adult obesity and overweight cost the state of North Carolina \$2.14 billion each year in direct medical costs. Families with limited income, especially those with young children, need knowledge to help them provide nutritious meals that help adults and children maintain a healthy weight.

Serving the Need

For more than 40 years, the Expanded Foods and Nutrition Education Program (EFNEP), coordinated by North Carolina Cooperative Extension, has worked with limited-resource families on nutrition issues. In six-session courses, EFNEP trainers use hands-on learning activities to teach participants to stretch food dollars, improve eating habits and practice food safety principles. Educational efforts such as the 4-H EFNEP's "Professor Popcorn" curriculum are designed especially for youth. The program targets low-income youth, providing them with hands-on learning in simple food preparation along with information about the nutrition needs for their age group.

During 2005-06, Cooperative Extension's EFNEP program served the following groups:

- 6,950 program families
- 12,720 youth
- 27,707 individuals in program families
- 6,384 families enrolled in food assistance programs
- 1,219 additional families, who received food assistance as a result of EFNEP

EFNEP's follow-up evaluations of participants show that the instruction encourages behavioral changes in managing food budgets and practicing healthy eating and food safety. These changes can lead to healthier lives, with fewer incidents of heart disease, diabetes and obesity-related illnesses. Reduction in such diseases can result in tremendous cost-savings for private health insurance as well as Medicaid and Medicare.

Impact beyond North Carolina

Data from more than 5,200 program graduates indicate that:

- 91 percent improved food resource management practices such as meal planning, price comparison, food stability and grocery list use
- 94 percent improved nutrition practices such as making healthy food choices, limiting added salt in food and encouraging children to eat breakfast
- 79 percent report improved food safety practices such as thawing and storing foods properly

These results suggest that EFNEP's model has potential to improve health and nutrition among limited-income families across the US.

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Initiative for Product Development and Entrepreneurship

Robotic Heart Surgery Tool

The Need

Ideas need expertise to become viable products. Design expertise can be the catalyst that transforms ideas into products that contribute to society and become economic drivers. An example of such a transformation is the interdisciplinary research effort developing tools that will decrease the time it takes to perform surgical procedures for critical cardiac patients, including bypass. This decrease in time will result in an increased survival rate for patients undergoing critical surgical procedures.

Serving the Need

The goal of the collaborative research between the College of Design and the College of Engineering is to develop an automated knot-tying tool that allows for faster fixation of knots in Minimally Invasive Surgery (MIS), while retaining the features of visual and haptic feedback, strategic flexibility, and the assured resistance to loosening that conventional surgeon's hand-tied knots provide.

Knot-tying in traditional suture material with laparoscopic or robot-assisted tools leads to increased operation times and a need for increased surgical skill. An increase in surgery time is especially critical for cardiac surgeries involving cardiopulmonary bypass. Patient mortality rates increase with the time during which the heart is arrested, especially with older patients. This leads to the double bind between the need for speed – which the access and visibility of traditional open-heart procedures allow – and the requirement that the MIS patient be comparatively young and healthy in order to survive the increased heart/lung bypass times required for MIS.

While increased cardiopulmonary bypass times may have a minimal effect on young or otherwise healthy patients, increased heart arrest times often make elderly or compromised patients poor candidates for MIS. Furthermore, older patients and otherwise unhealthy patients make up a majority of candidates requiring surgical procedures.

Impact beyond North Carolina

This research will impact people globally by improving surgical treatment survivability of patients in the future. The impact of faculty members in two well-known colleges at NC State collaborating also capitalizes on the knowledge base at NC State.

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Nutrition and Human Health: The NC Research Campus

The Need

Traditional North Carolina industries such as tobacco and textiles have declined in recent years, and with this decline, the jobs that underpinned many of the state's communities disappeared. Perhaps nowhere in North Carolina is this trend more apparent than Kannapolis, a once-thriving textile town where the closing of textile mills eliminated thousands of jobs. New industries are needed to provide jobs and revitalize North Carolina communities.

Serving the Need

College of Agriculture and Life Sciences programs figured into the equation when David Murdock, Dole Food Co. owner, decided to revitalize Kannapolis with a \$1.5 billion investment that will create the North Carolina Research Campus. The campus – which will enhance fruit and vegetable production, food safety and farm business management – will include the NC State Institute for Fruit and Vegetable Science, where research, education and extension programs will focus on agricultural commodities such as high-value fruits and vegetables. NC State's role in plant biology – improving the nutritional content and horticultural characteristics of fruits and vegetables and performing research on important issues in food safety, crop production and disease resistance to develop superior plants and plant products that will reach consumers as new or improved varieties or products – is pivotal to the campus' work. When Dole opened a new salad packaging plant in Bessemer City in early 2007, Richard Dahl, Dole president, said the company is concentrating operations in North Carolina in part because of the opportunity to partner with NC State and the College of Agriculture and Life Sciences.

Impact beyond North Carolina

The development of the North Carolina Research Campus at Kannapolis is expected to create 35,000 jobs. But beyond jobs, we will learn from the research at the campus what we need to eat – the nutritional content of our foods -to live longer, healthier lives. And we will develop foods with this nutritional content. And while people around the world will benefit from this knowledge, North Carolinians are likely to benefit most directly. Through our Extension programs, the College of Agriculture and Life Sciences will help North Carolinians use the research from our Institute for Fruit and Vegetable Science to grow new high-value fruits and vegetables. Dole Food Co. will provide a market for those crops.

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Leading, Connecting, Transforming

Economic Development,
Community Outreach and Social Equity

The University of North Carolina Tomorrow

Section 5

BioPharma Management Initiative

The Need

Arguably the most important technology of the next 20 years is biotechnology, a term used to describe an ever expanding set of tools originally developed in academia and now applied to product development. It is complex, ambiguous, fast-moving, highly entrepreneurial, science-driven, expensive, and ethically-charged. This technology impacts ~\$2 trillion GNP in the US. The first to embrace this technology was the pharmaceutical industry, but it was followed quickly by the industries of nutrition, agriculture, and industrial products. The RTP area is playing a major role in these industries. It is the largest life science park and the third ranked life science cluster in the US. The greater RTP area is home to \$1.5 billion in life sciences research funds/year and a total of 528 companies employing 29,000 life scientists. For both the US and the RTP area, there is a pressing need for skillful and effective managers for BioPharma.

Serving the Need

The BioPharma Management Initiative in the College of Management (COM) was designed to teach relevant management tools, identify new tools, and establish an organic network of contacts within the life sciences. The curriculum provides students fluency in the biotechnologies and how they impact business models and an understanding that management of the impact of these technologies occurs across entire company, not just R&D, of the structure, legal and regulatory functions, and public policies issues inherent in BioPharma companies, and of the processes required for partnering between the small biotech firms and Big Pharma, Big Bio, and/or Big Medical Device companies. Outreach activities of the BioPharma Initiative have impacted the RTP area in the following ways:

- Co-sponsoring an annual BioPharma Forum with the NC Biotechnology Center
- Working with the Entrepreneurship Initiative at COM to evaluate new life science ideas for commercialization potential
- Working with the Center for Innovation Management Studies at COM to provide tools to BioPharma for managing the process of innovation
- Bringing experts from local BioPharma companies to lecture (>15 in 2007)
- Providing teams of MBA students to BioPharma companies to address key issues/problems for them (>9 practica in 2007)
- Serving as committee members/panelists for the Council for Entrepreneurial Development, NC Biotechnology Center, Small Business Innovation Research program, Annual BioTech meetings, and Venture Capital Investment Competition

Impact beyond North Carolina

The BioPharma Management Initiative is the only program of its kind in the US. It is recruiting students from other tech-rich states and countries for its program and is exporting its special curriculum to these same regions. It is presently working with faculty from Spain, Portugal and Chile.

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Integrated Circuit Design: The Next Generation of Computing

The Need

In the world of gaming and fast computers, integrated circuit designers create the magical chips that give game boxes the speed to produce the lightning fast video stream and the realistic action that challenge the players. They are also the ones that explore the next generation of computing, pushing to expand the capabilities of computers. Producing a highly qualified workforce to feed the high tech industry is important to the economy of the Research Triangle area and to North Carolina, helping to attract companies like Qualcomm, nVidia, Rambus, RFMD, and Analog Devices that offer excellent work environments and highly competitive salaries.

Serving the Need

NC State's College of Engineering has been producing chip designers that have attracted the attention of some of the best-known companies in the industry. Each year the faculty graduate more than 150 students trained in digital and analog design and verification, as well as CAD tool design. Designing chips for high performance computing requires an expert knowledge of circuitry, a familiarity with the properties of silicon chips, a vivid imagination, a healthy dose of curiosity, and a professor with these same qualities. Impacts of the chip design program include the following:

- NC State graduates in the innovative chip design program create a specialized work force for a highly competitive industry.
- Several recent graduates working for Rambus were part of the team that designed the interface between the graphics processor and the main processor in the Playstation 3. allowing the two processors in the game box to communicate rapidly and making the gaming much more realistic.
- Professors in the program are involved in the industry, giving presentations at most of the major chip design companies and at conferences and seminars.
- The program web site offers tips on what courses to take and why master's and Ph.D. degrees are important in the chip design world.
- NC State's Analog Alliance facilitates industry-university cooperation in the education and preparation of students in highly technical areas, including analog, RF, microwave, digital and mixed code circuit design, and other areas.
- NC State maintains and distributes two tool sets used widely by industry and academia. The NC State Physical Design Kit is a complete chip design flow used internationally to design integrated circuits with more than 2,000 active users. The NC State Spice2Ibis tool is used by over 3,000 companies to help design their chips.

Impact beyond North Carolina

Graduates of the NC State College of Engineering chip design program are highly sought after by industry leaders. Through industry-university cooperation, the chip design program is able to further the goals of delivering high-quality circuit education to students in the College of Engineering and producing top engineering graduates ready to work in a highly technical field. These graduates become the chip designers that continue to improve circuitry for a technology-dependant nation.

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The Institute for Nanotechnology

The Need

Nanotechnology, the creation of materials at the near-atomic level, has been identified as a key future technology with the potential to profoundly impact our economy, environment, and society. It is expected that by 2015, products developed through nanotechnology will generate \$1 trillion globally and create two million jobs. Advances in nanotechnology research and the creation of new and enhanced nanotechnology-related businesses, have the potential to spur economic growth and develop products of value for the residents of North Carolina and beyond. In 2006, Governor Easley's Task Force on Nanotechnology and North Carolina's Economy reported a pressing need "to develop a diverse critical mass of nanotechnology research, development, education, and outreach expertise in the state."

Serving the Need

NC State University is well prepared for significant fundamental and applied nanotechnology breakthroughs. To create long-term groundbreaking nanotechnology research, education, and outreach in North Carolina, NC State is in the beginning stages of planning for an Institute for Nanotechnology. The effort, coordinated from an office on Centennial Campus, to date involves faculty in Agriculture and Life Sciences, Education, Engineering, Humanities and Social Sciences, Physical and Mathematical Sciences, Textiles, and Veterinary Medicine. Key objectives for the Institute are to coalesce the university's nanotechnology-related activities and provide NC State with a cohesive identity in this area; to advance research, education, and outreach activity related to nanotechnology; and to serve the public by developing products of value for people in the state and throughout the world. Anticipated impacts of the Institute include:

- Developing major team-driven research proposals that could support groundbreaking research in nano-biotechnology, nanotechnology for energy and the environment, nanomaterials and nanomanufacturing, and other areas of interest
- Enhancing current nanotechnology undergraduate and graduate courses and developing new courses and programmatic options, such as new nanotechnology degrees and minors
- Cultivating partnerships between industry and university researchers, graduate students, and undergraduate students
- Developing a web site to share information on the university's nanotechnology research, educational programs, and events with local, state, and national/international audiences
- Sponsoring visits of nanotechnology leaders to NC State and presenting lectures within departments active in nanotechnology
- Partnering with organizations on campus to share knowledge on nanotechnology with K-12 teachers and other educators

Impact beyond North Carolina

We are dedicated to seeking partners and collaboration for the Institute nationally and internationally.

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Advanced Manufacturing Technologies

The Need

The shift of manufacturing jobs overseas has been well publicized, as have the risks to the economy and national security associated with this shift. As an example, the US military budgets for spare parts exceed \$3B annually, yet the erosion of manufacturing capacity has led to order fulfillment lead times for forged or cast parts that can approach one year. The majority of manufacturing lost overseas is devoted to mass-produced goods. With mass produced goods, importers are able to fill warehouses with products that are shipped to customers when orders are placed. Cost and delivery lead-time are therefore quite low. For the foreseeable future, it will be very difficult to recapture these traditional manufacturing industries. However, not all goods are mass-produced. Advances in manufacturing technology are beginning to make customization of products technologically feasible. It is very difficult for overseas manufacturers to economically produce custom goods, hence there is an emerging opportunity to develop an advanced manufacturing base in North Carolina that is largely export-proof. Significant opportunities exist in aerospace, biomedical, automotive, and other industries.

Serving the Need

NC State is widely recognized as a leader in the field of advanced manufacturing technologies that enable mass customization. The College of Engineering acquired the first Electron Beam Melting (EBM) machine in the world, capable of quickly producing complex metal parts without expensive molds or dies needed with conventional manufacturing. NC State is the only university in the United States with this capability. NC State is also purchasing the first large format EBM machine in North America. Current Advanced Manufacturing efforts involve:

- Collaborating with design engineers at Cherry Point Depot on certifying the process as an acceptable alternative to forging titanium parts that are so difficult to obtain.
- Conducting new material R&D on behalf of aerospace part supplier DRS Tamsco
- Working with orthopedic surgeons to develop procedures needed to design custom bone implants that can be fabricated via this process

Impact beyond North Carolina

Research and development efforts taking place are having a global impact. For instance, NC State researchers have:

- Worked with NASA and Boeing engineers to develop advanced high performance materials such as a high temperature alloy being considered for use in rocket combustion chambers
- Fabricated custom titanium bone implants for a biomodeling company in Colorado and a dental implant company in Texas

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Center for Environment Farming Systems

The Need

To stay competitive in a global agricultural market, small farmers are turning to high-value products such as sustainably raised crops, meats, and dairy products. The market for organic foods is one of the nation's fastest growing, with demand for organic products up 20 percent each of the last ten years. The production practices used for these products are considered "sustainable" because they are economically viable, ensuring that resources – including land – will be available for long-term use.

Serving the Need

Growers who are new to sustainable and organic production need help understanding best practices. In order to meet this growing need, the Center for Environment Farming Systems began programming in 1996 to conduct research, education, and outreach programs in a variety of sustainable agricultural practices. CEFS, based at the Cherry Research Farm in Goldsboro, is a partnership among NC State University, NC A&T State University, and the NC Department of Agriculture and Consumer Services.

CEFS focuses on the production of pasture-based dairy products, grass-fed beef, hoop-house pork, and organic produce as well as long-term agricultural research. In addition, the Center offers the following opportunities:

- Summer internships at the Small Farm Unit for graduate and undergraduate students to work and learn
- Apprenticeships for producers who want to learn sustainable practices first hand
- A variety of grower workshops on sustainable practices
- Marketing opportunities, such as Community-Supported Agricultural partnerships with corporations that connect urban consumers with local sustainable producers
- The NC Choices program, which links consumers with producers of sustainably raised pork
- Information on producing and marketing organic grains
- A Web-based organic production guide for growers
- Public education and outreach efforts, including CEFS's fall Harvest Festival and public lectures by notables such as Carlo Petrini of Slow Food International and Fred Kirschenmann of the Leopold Center
- In 2006, CEFS sponsored 13 workshops, which drew more than 450 attendees, including 40 Cooperative Extension agents from 24 counties.
- The Center's first-ever Fall Festival, a family fun and educational event, drew more than 700 participants. CEFS had nearly 3,000 visitors in 2006

Impact Beyond North Carolina

Organic and sustainable agricultural markets are important across the US and around the world. CEFS research and outreach programs are potential national and global models.

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Engineering Partnerships with N.C. Military Bases

The Need

North Carolina ranks third among states in active US military personnel. North Carolina's six major military bases contribute nearly \$18B to the N.C. economy each year. The Naval Air Depot at Cherry Point and the US Coast Guard Air Station at Elizabeth City have a critical need for a network of vendors to supply aircraft parts for aging aircraft. There is a shortage of aircraft parts including structural, electrical, engine, and hydraulic parts and systems that remain unfilled because of the lack of companies capable of manufacturing replacement parts. As a result, the military cannot achieve its objective of rapid and extended deployment throughout the world when combat aircraft are grounded awaiting critical replacement parts.

Serving the Need

NC State is building partnerships with the military bases in North Carolina, the Navy, Air Force, Coast Guard, and private corporations to create new knowledge in maintenance science and technology and transfer that knowledge to the military and its contractors for the economic benefit of the state. An infrastructure is being established to nurture the creation of aerospace firms in North Carolina to become future military contractors. Specific objectives include the following:

- Develop a central repository of engineering and manufacturing expertise to enable aerospace firms to become qualified to manufacture certified aircraft parts
- Provide certification assistance to aerospace companies for manufacturing military aircraft parts
- Develop agile manufacturing and rapid prototyping technologies for the cost-effective manufacture of aircraft parts on short notice
- Develop test and manufacturing facilities for parts fabrication and design test verification
- Attract future aerospace companies to relocate in North Carolina, facilitate the creation of new companies to address the manufacture of aircraft parts and create new hi-tech jobs in North Carolina
- Establish new educational programs for training a new generation of hi-tech workers in the latest advances in maintenance science and engineering
- Partner with Lenoir Community College and Craven Community College Institute of Aeronautical Technology to increase the pool of highly trained aircraft engineers

Impact Beyond North Carolina

The immediate outcome of this project will be to provide the US military with a network of supplier companies that can manufacture certifiable parts for aging aircraft. The long-term outcome will be the creation of a vibrant aerospace industry in NC.

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Minority Business Construction Program

The Need

Late in 2000, N.C. voters passed the largest capital program in the state's history for universities and community colleges. This enormous amount of construction required participation by every sector of the construction community and at the same time provided an important opportunity. A largely underutilized sector that needed to grow in both participation and capacity was minority owned contractors. In 2001, the General Assembly passed a law that reinforced the minority participation goal of ten percent through a bolstered good faith effort.

Serving the Need

NC State has focused on developing its Historically Underutilized Business (HUB) Construction Program since March 2002. The university's goal is to provide minority owned businesses equal access and opportunity to participate fully in all aspects of the University Construction Program; to prohibit discrimination against businesses on the basis of race, color, national origin, or gender; to promote and encourage full and open access to contracting opportunities among the various vendors and contractors that wanted to do business with the university. In addition, NC State wanted to exceed by a substantial margin the ten percent goal and increase particularly the participation percentage, size and number of African American owned businesses. NC State has become a leader in the state in developing innovative HUB programs to exceed the goal that include:

- Development of a database of minority contractors and design firms for use by prime contractors seeking subcontractors and lead design firms seeking consultants; the database electronically distributes upcoming design and construction advertisements.
- HUB Academies to help minority contractors learn more about state bidding and other processes; six HUB Academies have been conducted around the state modeled after the one cosponsored by NC State.
- Three HUB Academy graduates combined forces to form an alliance called the Academy Contractors, allowing them to successfully bid larger projects.
- NC State HUB Manager helps strategize with prime contractors to make them aware of opportunities to optimize solicitation of minority contractors.
- NC State HUB Advisory Committee, established in 2002, is made up of constituents that can help guide HUB efforts and provide strategies.
- HUB participation currently stands at 19.1 percent, nearly twice the state's goal.
- NC State's African American participation rate was 5.1 percent (UNC System average-3.9 percent).
- NC State's Hispanic participation rate was 3.1 percent (UNC System average-2.5 percent).

Impact beyond North Carolina

NC State is demonstrating to other universities across the state and beyond the importance of promoting minority business construction opportunities. NC State ranks sixth in the UNC system and first among historically white universities in the category of total contracts awarded to African American contractors in the total amount of construction dollars spent. The program not only sets a standard for construction but also further confirms NC State's commitment to diversity.

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The Institute for Advanced Analytics

The Need

Today we live in a world where almost everything we do generates, as a by-product, a stream of digital information processed and stored in databases. Enterprises of every size and purpose now have an unprecedented opportunity to quantify, analyze, and act upon data about their operations using powerful software tools and networked computers. The promise of effectively using this wealth of data to make timelier and better decisions has given rise to the “analytics” paradigm: a scientific view of the world that holds the collection, analysis, and use of factual information as fundamental to understanding reality and making sound decisions. Our economic, social, and political wellbeing requires that we advance our ability to prepare and analyze massive data sets. Educators, leaders, managers, and policy makers—people at all levels, engaged in both public and private enterprises—must use analytical tools to meet the challenges of an information society.

Serving the Need

The mission of the Institute for Advanced Analytics is to promote graduate education in the emerging field of analytics. Its objective is to educate the citizens of North Carolina and beyond in the concepts, methods, software tools, and applications of analytics that have direct and practical relevance to employers and create innovative professional degree programs of substantial size and preeminent quality that will ensure that NC State is recognized as the world’s leading center for the study of analytics. The Institute, founded in 2007 and based on Centennial Campus, offers the first graduate degree in analytics in the North Carolina, the Master of Science in Analytics (MSA), which draws upon faculty expertise in seven colleges to create a novel multidisciplinary curriculum. Within a few months of its authorization:

- The number of prospective students inquiring about the MSA degree surpassed 400 (60 percent from outside of North Carolina, and 20 percent from outside of the US).
- The program will meet its first year target to admit a minimum of 30 students and double enrollment in the second year.
- The program is on the path to become the largest graduate degree program at NC State within five years.

Impact beyond North Carolina

Although it is a newly established unit, the Institute already has attracted widespread attention to NC State. Numerous employers from outside of North Carolina have contacted the Institute to establish partnerships and recruit our students. The Institute has also received inquiries from other major universities in the US and abroad to learn more about the MSA degree and how it might be emulated at their own institutions.

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Nonwovens Cooperative Research Center

The Need

The textile, apparel, hosiery, and textile machinery industry is one of the largest employers in North Carolina, the largest manufacturing employer, and a \$35 billion contributor to the state's gross domestic product. Many labor-intensive segments of this industry are threatened by cheap low-cost foreign labor. The United States is the world's largest producer as well as consumer of nonwoven goods, with exports double the amount of imports. Nonwovens production continues to grow at seven percent per year in the US. North Carolina leads the nation with 32 core nonwoven companies, but as competition grows these companies need to continuously add new products and employ new technologies for production to remain competitive.

Serving the Need

The Nonwovens Cooperative Research Center was established in 1991 as a State/Industry/University Cooperative Research Center with a seed grant from the NSF. The Center now has over 70 members from leading industrial companies and research centers. Part of the recently created Nonwovens Institute, this Center provides research, development, and testing support to the nonwovens industry through its state-of-the-art pilot plants and research labs.

- In the past three years alone, 17 new or expanded nonwovens companies have chosen to locate in N.C. to be close to the Nonwovens Cooperative Research Center, creating over 1,000 new jobs and investing over \$400 million in capital.
- 15 of the top 35 nonwovens companies now have a location in North Carolina.
- The world's largest producer of nonwovens has its North and South American headquarters in Durham.
- PGI Nonwovens, one of the world's leading companies in the hygiene, wipes, medical, industrial, and specialty markets, recently relocated its corporate headquarters to Charlotte.
- INDA, the trade association representing the nonwoven fabric industry, has located its headquarters in Cary.
- The Center is engaged in leading-edge research, creating new materials for the Navy, Air Force, and Army as well as for protection of our first responders.
- Two leading apparel companies have created small research labs on NC State's Centennial Campus to develop new products based on research from the Center.

Impact beyond North Carolina

The Nonwovens Cooperative Research Center now has members representing the leading companies in the world. Companies from Israel, Japan, Germany, and Denmark have recently opened new facilities in North Carolina. The Nonwovens Institute offers graduate-level certificate programs through distance education available worldwide. Companies throughout the United States and in several other countries fund research in the Center and license intellectual property in nonwovens technologies from NC State.

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Developing Aquaculture in North Carolina

The Need

Aquaculture is increasing at a rate of more than ten percent per year and is recognized by the US Department of Agriculture as a major growth area for US agriculture in the 21st century. Indeed, the United Nations Food and Agriculture Organization predicts that half the seafood consumed by adults of the next generation will be farmed. With abundant intellectual, land, and water resources, North Carolina is well positioned to play a major role in a global transition to seafood farming, to produce new and genetically superior strains of farmed fish and shellfish and to reap the economic benefits of aquacultural growth.

Serving the Need

Just a decade or so ago, North Carolina aquaculture consisted of trout in the mountains and a few catfish ponds elsewhere in the state. Thanks in large measure to aquaculture research and extension programs in the College of Agriculture and Life Sciences, North Carolina now produces hybrid striped bass, tilapia and Southern flounder. College of Agriculture and Life Sciences researchers pioneered methods of raising hybrid striped bass in ponds. Aquaculture is North Carolina's fastest growing agri-food business. The farm gate value of North Carolina aquaculture products along with feed and processed products is approximately \$55 million annually. NC State has:

- Established a national breeding program for hybrid striped bass, which potentially could expand striped bass farming tenfold
- Developed a new waste treatment technology that is being adopted by the tilapia industry that virtually eliminates environmental impacts
- Established the first production facility for flounder, a fish with twice the market value of some established species
- Begun to develop superior strains of trout and flounder

Impact beyond North Carolina

North Carolina is currently the second largest producer of rainbow trout in the US, while raising hybrid striped bass in ponds is the fourth largest type of fish farming in the country. Tilapia farming is also growing rapidly, with North Carolina now supplying more than ten percent of domestically farmed tilapia. Other species farmed in the state include catfish, eels, crawfish, clams and oysters. Species with excellent promise for substantial economic returns include Southern flounder and sturgeon for caviar. In all these areas, College of Agriculture and Life Sciences research and extension programs are leading the way, providing opportunities for economic development.

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High Performance Computing Partners

The Need

Scientific computing is fundamental to today's science and technology research and instruction. Computational models enable modern weather forecasts, predictions of climate change, design of aircraft and automobiles, development of nanotechnology, assembly of genomic data, insight into chemical and biological processes, and countless other areas of inquiry. Many of these models can run on individual student and faculty computers; most, however, require significantly more computational power such as that provided by mid-range high-performance computing (HPC) clusters. Some researchers obtain grant money to purchase HPC hardware and require graduate students to run the equipment. Meanwhile, their campuses may struggle to fund resources to meet general HPC needs for research and instruction.

Serving the Need

NC State's centralized HPC services provide intermediate-level computational resources—hardware, software, and staff expertise—to meet academic computing needs that exceed the capability of a personal computer but do not require the extreme capabilities of a true supercomputer. The HPC Partners Program offers a radically new model for funding and operating these highly reliable HPC services. Unlike the typical HPC service model on most research university campuses, with NC State's centralized HPC Partner's program:

- Most HPC hardware resources have been purchased by research faculty
- Faculty members buy HPC resources which are pooled with other HPC resources in central data centers; expert support frees faculty's assistants from this burden
- Faculty have first priority access to the cycles they have purchased; unused cycles are shared with other campus HPC users
- The HPC infrastructure is adapted to meet a wide variety of needs, including the rapidly expanding Virtual Computing Lab
- Available cycles are dynamically managed to optimize the use of resources

With an annual budget of a little over \$1M, more than 50 percent of which comes from the HPC Partners Program, NC State's HPC centralized services support more than \$70M in currently active research grants. These resources are also open to faculty and students campus wide and for distance education. In addition to individual faculty members, NC State research centers and other UNC System campuses are also HPC Partners.

Impact beyond North Carolina

NC State's HPC services support the education of tomorrow's scientists and engineers, as well as research for national agencies such as DOE, DOD, NIH, and NSF. HPC provides the infrastructure for the Virtual Computing Lab, which is anticipated to have broad impact beyond North Carolina. Other research institutions are interested in the HPC Partners model. The University of Georgia successfully adopted the model, and the DOD's Defense University Research Infrastructure Program now encourages grant recipients to adopt NC State's HPC Partners Program concepts for their HPC cluster management and support.

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Supply Chain Resource Cooperative

The Need

Supply Chain Management (SCM) is the management of flows of physical goods and information driven through collaborative enterprise relationships. With the increase in offshoring, every company operating in North Carolina, from banks to telecom to pharmaceuticals, is struggling to manage their globally fragmented supply chains. These companies are experiencing a significant shortage of qualified managers and analysts to manage complex international webs of logistical, procurement, manufacturing, and offshoring activity driving business today. Increasingly, many are looking to NC State for qualified undergraduate and graduate students to fill this need.

Serving the Need

In 1999, the College of Management chartered the SCRC and its vision: to be a resource to enable partner companies to achieve supply chain excellence by a) bringing business problems into the educational experience, b) facilitating engagement of students and faculty with companies, and c) creating a pipeline of future supply chain managers. Impacts of the SCRC initiative include the following:

- Faculty and students have performed over 200 student/faculty projects including over 1,000 individual student-project experiences, many of which involve interacting electronically with multi-cultural partners all over the world.
- Over ten faculty/company projects have supported faculty research interests.
- Projects have involved over 40 international company sponsors and participants.
- Projects have been included in ten courses plus independent study projects.
- SCRC has developed internship opportunities for all full-time MBA's in SCM as well as other concentrations.
- Over 50 recruiting events have been organized by the SCRC.
- 100 percent of full time MBA's concentrating in SCM have been placed. Students and recruiters cite project experiences as key in driving placements.
- Starting salaries for OM/SCM MBA's range from \$50K-\$100K.
- A number of research grants and scholarships have been generated by companies such as Caterpillar, Duke Energy, John Deere, and others.

Impact beyond North Carolina

The SCRC has grown from its origins into a major internationally recognized center of excellence for research, extension and knowledge. SCRC past and present member companies include a number of global Fortune 500 companies, including ABB, American Airlines, Bank of America, Bayer Biologicals, Bechtel, British Petroleum, BridgePoint, Cardinal Health, Caterpillar, Chevron, Cendant, Curtiss Wright, Duke Energy General Motors, GlaxoSmithKline, Goodrich, Halliburton, IBM, Indus International, John Deere, Milliken, Nortel Networks, Sonoco, Menlo Worldwide, Sealy, Shell Oil, Halliburton, Progress Energy and Solectron.

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Technology Transfer and Innovation Leadership

The Need

As the global economy and human welfare grow increasingly dependent on the generation and dissemination of knowledge, universities are natural resources for innovation that makes a difference. The global community is in need of disease management, therapeutics, improved food crops, diagnostic tools, advanced medical devices, and environmental solutions. How do we transfer breakthrough innovations to the global community? Research, coupled with a solid technology transfer program, is essential for commercial outcome and the successful conversion of knowledge to the private sector.

Serving the Need

Our Strategic Vision states, “NC State University will transform lives and improve the human condition through innovation and discovery.” The Office of Technology Transfer (OTT) supports that mission by leveraging the university’s academic discoveries to the public for the greater common good. NC State researchers focus on thousands of projects that ultimately benefit our region, state, nation, and world. The OTT serves as the conduit that gets these discoveries into the hands of external resources to make our innovations available publicly. NC State has built over 650 partnerships with the non-university sector to deliver breakthrough innovations to the global community, including the following:

- Improving human lives through advanced medical technologies
 - Liquidia, an NC State start-up, is developing anticancer drugs designed to attack specific types of cancer without affecting healthy cells.
 - Trana Discovery is working to shorten the time between drug discovery and availability to fight infectious diseases more efficiently.
 - Biomedical Engineering researchers are developing bone tissue creation technologies for patients with osteoporosis and skeletal defects.
- Improving food crops to ensure fresh produce gets to market
 - SmartFresh, a commercialized product conceived at NC State is being registered globally to improve food availability and quality. The produce industry has called the SmartFresh Quality System the most important advance in years.
- Preserving where we live and the way we live
 - Green technologies developed at NC State are improving the environment and providing enhanced products for consumers. In March 2007, US EPA approved an insect repellent compound patented by NC State as child-safe with efficacy results rivaling the chemical, DEET.

Impact beyond North Carolina

The Technology Transfer program at NC State is recognized nationally as a leader in the effective promotion of academic discovery to the private sector. The Office of Technology Transfer benefits the region, state, nation and beyond by stimulating economic development via new products, new companies, new jobs, and ultimately, improvements to the way we live.

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Technology Entrepreneurship and Commercialization Program

The Need

Between 1997 and 2004, the UNC System invested approximately \$1 billion per year in research through universities, with an equal amount expended by the private sector in the state. Our challenge in North Carolina, as it is around the world, is transforming this investment in research into economic value for the citizens of the state. Economic value from this research comes in the form of new products that result in new businesses and new jobs.

Serving the Need

Two major components are required to transform research into economic development: 1) the skills and capabilities to identify viable technologies and translate their capabilities into marketable products, and 2) entrepreneurs to build and manage these opportunities. Since 1995, the Technology Entrepreneurship and Commercialization Program (TEC) has taught scientists, engineers, and managers how to do just that, within graduate and executive education programs. Using the TEC Algorithm, a process developed from an NSF/Kenan Institute grant, TEC has been building new high-tech, high-growth companies while training the business leaders of tomorrow. Today, TEC's Accelerating the Commercialization of Technology (ACT) project is supporting UNC system technology transfer offices throughout the state with their intellectual property assessments and commercialization efforts. The New Business Creation Initiative (NBCI) is taking the next step by founding and launching new high tech startups. Impacts of the TEC program, including ACT and NBCI, include:

- More than 380 new jobs created
- More than \$170 million invested in TEC-supported companies
- More than 250 trained engineers, scientists and managers in North Carolina
- 20 new companies supported
- Alumni including six CEO's, one CFO, five Board Directors, two VP's of Business Development
- Assessment of technologies for eight campuses across the state from Wilmington to Western Carolina, with one new company launched
- Corporate innovation system "interventions" for eight N.C. companies
- Training and support for local entrepreneurial organizations such as CED and NCBC
- Ongoing consulting for innovation management and technology commercialization

Impact beyond North Carolina

The TEC program is supporting a nation-wide COTEC project in Portugal where 12 universities are participating in TEC-like programs. Three high growth companies have been launched in three years. TEC-like courses are also being offered at Ohio State University and in Ireland, Slovenia, and England. South Korea and South Africa will also have Algorithm-based courses in 2007 and 2008.

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Textile Protection and Comfort Center

The Need

Protection from chemical, biological, medical, thermal, radiological, ballistic, and respiratory threats requires a comprehensive understanding of hostile environments, operations, materials, product design, and product testing. Protecting our first responders (fire, police, and medical) in national and local emergencies as well as all military personnel is a national priority. Technical textiles are the most vigorous sector of North Carolina's textiles complex, and the military and security sectors are reported to be the largest economic segment in the state.

Serving the Need

The Textile Protection and Comfort Center (TPACC) is a recognized world leader for research in protective textiles, clothing, and ensembles. The Center's impact extends far beyond textiles, creating technology that saves lives and prevents injuries to military, law enforcement, emergency responders, medical personnel, and the public. The Center has unique facilities on the Centennial Campus for research, development, and testing the full range of personal protective equipment, including the only university-based fire manikin test chamber and Man in Simulant Test Chamber in the US. Over 200 companies have utilized its facilities to enhance user comfort and protection for everyday apparel, sportswear, outdoor gear, and protective clothing. Hundreds have attended its symposia on protective technologies, new basic research has been done, multiple materials and products have been developed or facilitated, and standard test methods have been developed and validated. The Center also educates undergraduate and graduate students who conduct research, develop new materials and equipment, and validate performance standards. Impacts include:

- Development of a new firefighter turnout suit under the first university Homeland Security grant
- Symposia on protective clothing and equipment for industry and government personnel
- New tests for materials and protective ensembles and advanced sensors
- Standards developed through ASTM, NFPA, ISO and other standards groups
- Testing and validation of the performance of protective gear
- Developing new materials for protection applications

Impact beyond North Carolina

TPACC has conducted research and testing for companies, technical organizations, and government agencies (DHS, DARPA, NIST, NIOSH, NIH, NTC, the Army, Navy, Air Force and Marines) throughout the US. Research and exchange have included US academic partners and international students, faculty, and industrial collaborators from Finland, Germany, France, Germany, Switzerland, the UK, Canada, Australia, New Zealand, and Japan.

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Golden LEAF Biomanufacturing Training and Education Center

The Need

As one of the top three commercial biotechnology regions in the United States, North Carolina is challenged to meet the personnel needs of our growing biomanufacturing industry. North Carolina's new Golden LEAF Biomanufacturing Training and Education Center (BTEC) at NC State University is ensuring the growth of the biotechnology industry. We are creating new paradigms and offering unique education and training to create the workforce of the future.

Serving the Need

BTEC will open its doors Fall 2007 on N C State's Centennial Campus. With over 85,000 square feet, the \$45 million BTEC will be the largest facility of its kind in the nation, simulating a cGMP biomanufacturing operation capable of producing biopharmaceutical products and packaging them in an aseptic environment. It also features classrooms, laboratories, building, and process utilities to support educational programs:

- 63,000+ gsf laboratory training space
- 9,000 gsf of high-tech classrooms
- Three scales of bioreactors
- Bioseparation and protein purification process operations
- Aseptic processing facilities
- Remote learning and data acquisition capacity on process scale equipment
- Numerous bench-scale labs to enable learning in next-generation biomanufacturing technologies

At BTEC, students will analyze, interpret, and control experimental results and learn to utilize data-mining to direct their research and scientific studies. To provide students with opportunities to access the unique BTEC facilities, three new programs have been created:

- BS in Bioprocessing Science
- BS in Chemical and Biomolecular Engineering with a Biomanufacturing Science concentration
- Minor in Biomanufacturing

Each curriculum is specially designed to ready students for careers in the biopharmaceutical, vaccine, and commercial enzyme industries as well as traditional biochemical process industries and the emerging renewable energy industries related to biofuels.

Impact beyond North Carolina

In partnership with innovative programs at NC Central University (BRITE) and the NC Community College System (BioNetwork) and industry collaborators, BTEC will expose students to the only curricula in the country that offer degrees, majors, minors, and related to bench- and large-scale applied biotechnology.

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Providing the Workforce for the Bio-Industries

The Need

Bio-industries are booming in North Carolina, and along with that explosive growth comes a need for skilled workers. The statistics add up: there are 20,000 North Carolinians working as biotechnologists in the pharmaceutical and biopharmaceutical industries, and more than 2,500 new employees may be required annually, according to the North Carolina Biotechnology Center. According to Ernst & Young, the state has the third largest biotechnology industry in the US

Serving the Need

The College of Agriculture and Life Sciences continues to develop innovative courses and degree programs that are producing the next generation of scientists for emerging bio-industries:

- The new Bachelor of Science degree in Bioprocessing Science offered by the Department of Food Science prepares students for careers in bio-industries through formal training in the fundamental sciences as well as hands-on lab experience. The first class of students enrolled in spring 2007.
- The new degree program will produce graduates trained in basic sciences such as chemistry, engineering, microbiology and biotechnology. They will also learn good manufacturing practices and standard operating procedures through lab experience at the Golden LEAF North Carolina Biomufacturing Training and Education Center (BTEC) on N.C. State's Centennial Campus. These state-of-the-art labs simulate those in biomufacturing companies, giving students real-world work experiences.
- BTEC will offer a full slate of courses in 2008, after construction of the facility is complete. These offerings include microbiology courses to be taught by College of Agriculture and Life Sciences faculty.
- In an effort to reshape freshman biology education, the College recently launched a hybrid Introductory Biology course that divides instruction between at-home Web learning and classroom time. Breaking the mold of the standard freshman "intro" course, hybrid BIO 181 is taught in small, 30-student sections in which hands-on group activity replaces traditional classroom lecture. Students receive lessons through an interactive Web site and apply that knowledge in guided classroom exercises.

Impact beyond North Carolina

By creating innovative courses and degree programs that are relevant and responsive to a changing global economy, the College is generating a highly skilled workforce ready to contribute to new and developing industries.

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NC State's Economic Development Partnership

The Need

North Carolina needs and expects NC State to play a critical role in its economic transformation and in the accrual of economic benefits to all North Carolinians. Despite many gains, 22.7 percent of all jobs in North Carolina do not pay enough to lift a four-person family out of poverty. Simultaneously, North Carolina has become a metropolitan state with 43 percent of its people amassed into urban hubs. Outside these areas of relative prosperity, and still within them, many citizens work in low-skill occupations typically characterized by low wages, few benefits, and limited mobility.

Serving the Need

In 2003, NC State was the first North Carolina university to seize the opportunity to create an economic development office. Today, this Economic Development Partnership (EDP), informed by regionally organized strategies in high priority industry clusters, is leveraging university resources and expanding NC State's capacity to start, grow, retain, and recruit higher-skilled, higher-paying jobs and related corporate investments. Simultaneously, the EDP has successfully grown the University's research, education, and extension enterprises. Impacts include:

- Over 3,500 new or retained jobs and \$360 million in new investment in both urban and rural counties by companies such as Spuntech (Israeli), Freudenberg (German), Vescom (Dutch), and MeadWestvaco, Credit Suisse, and Fidelity
- New development on the Centennial and Centennial Biomedical campuses
- Assistance for Colleges to recruit and fund undergraduate and graduate students, grow the numbers of industrial consortium members, develop new industry-sponsored research opportunities, and expand their national and international reputations and marketing efforts. Specifically, while working with the EDP and economic development partners, the Nonwovens Institute has grown from 42 to 70 industrial members, from nine to 20 graduate students, and has an annual budget of \$1.4 million and facilities valued at over \$15 million.
- Successful incorporation of NC State programs into all aspects of economic development, from K-12 education to workforce development, technology commercialization, entrepreneurship, and community advancement
- Formalization of NC State Design Extension to provide industrial and community design services to entrepreneurs (nine in Summer 2007) and communities
- Economic development internship opportunities for up to 10-15 University Honors students per year with the Department of Commerce and others
- Annual awards to recognize outstanding economic development partners

Impact beyond North Carolina

The EDP's precision marketing of NC State's colleges' resources has expanded their reputations and marketing efforts in areas such as nonwoven textiles, medical devices, biomanufacturing, and industrial design in specific countries such as Denmark, as well as worldwide.

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Centennial Campus and Start-Up Creation: Rural Development

The Need

North Carolina continues to seek ways to stabilize and support our state's rural and urban economy. The state is committed to developing and promoting sound economic strategies that improve the quality of life for rural North Carolinians, with a special focus on communities with limited resources. Entrepreneurs and small businesses are more important now than ever in our state's rural communities.

Serving the Need

One of the ways that NC State reaches our rural areas is through the promotion and support of start-up companies. Based on university research, academic technologies are spun-out into viable new companies that create new jobs, new revenue, new products, and new market sectors for North Carolina. NC State is also providing specialized, hands-on training to support North Carolina's biomanufacturing industry active throughout the state, including our rural communities. Impacts of NC State's start-up companies with a focus on rural development include the following:

- NC State start-up Biolex opened a clinical biomanufacturing facility in Pittsboro, NC, employing nearly 100 residents of Chatham County
- HOMS, LLC, a local biopharmaceutical company and NC State licensee, is headquartered in Clayton, N.C. and poised to begin large-scale production of new insect repellents for skin and textile application
- 3Tex is a spinout company from Textiles innovation that has a manufacturing facility in Rutherfordton that employs 90 people.
- Our state's biotechnology cluster has grown to be the third largest in the country, employing 18,000 people – 4,400 of whom work in biomanufacturing. The only center of its kind in the nation—Centennial Campus' new Golden Leaf Biomanufacturing Training and Education Center (BTEC)—will provide statewide education, economic development and job creation for the biomanufacturing, pharmaceutical and related agribiotechnology industries. Biomanufacturing facilities are located across our state including Clayton, Pittsboro, Zebulon, Lincolnton, High Point, Farmville, Rocky Mount, and Wilson.

Impact beyond North Carolina

Bringing about significant rural and urban economic growth in North Carolina through education and entrepreneurship allows comprehensive participation in the global economy. Empowering North Carolinians builds a stronger nation.

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Intellectual Property and US Economic Strength

The Need

The value of intellectual property is of monumental consequence to economic strategy. National and regional markets can only thrive when intellectual property rights are secure. The issuance of a US patent prevents competitors from replicating that technology, thus ensuring a competitive edge in a specific market. Take, for example, the semiconductor industry. Currently, the US is the world leader in the semiconductor industry with a market share of nearly 50 percent based on intellectual property, secured by US patents. Maintaining our domestic control of the semiconductor industry is critical to US economic strength and homeland security.

Serving the Need

NC State's Office of Technology Transfer has served the greater community for 22 years with a goal of securing academic discovery and intellectual property generated by research from the University for the benefit of the state, the region, the nation, and the world. NC State currently holds 569 US patents. These patents serve to ensure and protect a marketplace for our region and our nation in fields ranging from medical diagnostics to the semiconductor industry. Impacts of NC State's Intellectual Property Portfolio include:

- Encouraging entrepreneurship: 65 start-up companies have been created based on University Intellectual Property (e.g. LipoScience, BioMarck Pharmaceuticals, Embrex, etc.)
- Ensuring a competitive market advantage for our region, state and nation: NC State holds 569 US patents (e.g. NC State holds 191 US patents protecting semiconductor technologies supporting US control of the market)
- Improving lives globally: NC State's intellectual property evolves into new products, new start-up companies, new jobs, new market shares (e.g. LipoScience has created 90 new jobs in the region; products to market include LipoProfile® cholesterol test; OneDose™ radiation dosage monitor; etc.)

How do we know we're "Serving the Need?" NC State has been:

- Ranked 3rd regionally for Most Powerful Technology Owner
- Ranked 9th nationally among universities for Most Influential Patent Portfolio
- Ranked 12th nationally among universities for Most US Patents Issued

Impact beyond North Carolina

NC State's Intellectual Property Portfolio serves to strengthen economic development regionally, nationally and globally. In 2006, the US Patent and Trademark Office issued NC State 41 patents based on research innovation. In just one calendar year, from the labs and benches of NC State, came 41 novel ideas, methods, products, and utilities that have never been conceived before. These 41 innovations can now proceed, under the management of NC State, to enhance lives globally while ensuring a competitive market advantage for our region, state, and nation.

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The Seaboard Project

The Need

Poverty and unemployment in NC's northeast region remain the highest in the state, and recent reductions in federal agricultural programs have further distressed this rural economy. Regional economic development strategy includes public and private sector investments in the *Carolina Crossroads Music and Entertainment District* to anchor development of a tourism industry. The NC Film Office has cultivated interest from celebrated filmmakers, such as Steven Spielberg and Kevin Costner, in this picturesque area. However, the success of economic development efforts in the tourism and entertainment/film industries depends on stakeholders working together to increase the skills of the workforce. Any effort to transform this region's economy must address chronically low educational attainment levels, exceedingly poor school performance, and low labor force participation rates.

Serving the Need

Led by NC State's Colleges of Textiles and Design, the Seaboard Project includes training and education initiatives to improve employment and advancement opportunities for workers in the community. Strategic partners have been recruited to develop an innovative plan that addresses the needs of the tourism and entertainment/film industries, including William Ivey Long (four-time Tony Award-winner for costume design), Halifax Community College, the Eastern Seaboard Trust (local nonprofit), the Town of Seaboard, and two world-class theater craft suppliers in the NYC entertainment/film industry. The team completed a feasibility study funded by the NC Rural Center for the establishment of *The Seaboard School of Fashion and Costume*. Impacts of the Seaboard Project include:

- Development of a highly qualified workforce to support regional economic, including training, education, job, and entrepreneurial opportunities for local residents in the fashion, tourism, and entertainment/film industries
- Creation of local for-profit enterprises to supply local performing arts venues
- Education, internship, research, and entrepreneurial opportunities for undergraduates, particularly in theater, textiles, and design
- Research opportunities for faculty and graduate students, particularly in the areas of rapid prototyping and mass customization, and development of high performance sewn products incorporating sensors and actuators
- Promotion and support of entrepreneurial activities to transform the northeast regional economy through continued collaboration with the NC Rural Center

Impact beyond North Carolina

Located halfway between New York and Florida on Interstate 95, *Carolina Crossroads Music & Entertainment District* has tremendous potential to become a travel destination for out-of-state visitors. Local theater craft businesses can serve national performing arts market as high quality, low-cost suppliers. Applied research will benefit domestic manufacturers of sewn products in niche markets.

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Enterprise Risk Management Initiative

The Need

Enterprise Risk Management (ERM) is an important emerging business discipline that has been embraced by a significant number of for-profit and not-for-profit entities as a process that can enhance strategic planning and identify value-creating opportunities for their organizations. The practice of ERM has begun to attract the attention of regulators, financial markets, and rating agencies as they examine firms within their areas of responsibility to assess the manner in which entities are managing their portfolio of risks to achieve organizational objectives.

Serving the Need

NC State's ERM Initiative conducts research and engages in outreach activities to disseminate knowledge and provide leadership to individuals and organizations interested in enterprise risk management. The Initiative has also funded course development to provide graduate-level business education to the next generation of corporate and not-for-profit executives. Housed in the College of Management and guided by a 25-member Advisory Board composed of national ERM experts, the Initiative provides an important resource to NC State students and faculty and citizens of the state of North Carolina and beyond. Impacts include:

- A highly successful ERM Roundtable series that provides a forum for individuals and organizations to learn more about ERM. Six Roundtables are held each academic year. Attendance levels routinely exceed 200 business professionals per event. Over 2,500 executives have attended one or more Roundtable.
- Development of ERM-related coursework to be offered to College of Management graduate students beginning in Fall 2007. Students from the Financial Mathematics graduate program are expected to participate as well.
- Funded research opportunities for NC State faculty interested in ERM and an ERM Research Symposium scheduled for Fall 2007
- Creation of extensive web-based resources on ERM. The site is consistently on the first page when conducting Google searches on enterprise risk management.
- Participation on national committees and organizations developing ERM frameworks and best-practice guidance
- Partnering with the North Carolina State Banking Commission to offer advanced training to state chartered bank boards of directors
- Numerous speaking engagements to professional societies and other groups interested in learning more about ERM

Impact beyond North Carolina

The ERM Initiative is one of a few academic entities around the US focused on ERM research and curriculum development and is the only one focused on ERM as a strategic planning tool to enhance shareholder value. The Initiative has engaged with several organizations at the national and international level to further ERM as a discipline, including service on the board of ERMII—an international consortium of universities working to develop model curricula for ERM graduate education.

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Small Business and Technology Development Center State-wide Headquarters

The Need

America's small businesses continue to drive the US economy. Statistics reveal that small businesses are America's job-creators, innovators, and the path to mainstream economic activity for all segments of our society. Small businesses represent 99.7 percent of all employer firms. Over the past decade, small businesses in North Carolina and across the nation have created between 60 and 80 percent of all net new jobs each year. They employ over one half of the non-public workforce and generate more than 50 percent of the non-farm private gross domestic product (GDP). In North Carolina, there are approximately 690,000 small businesses, including 166,000 businesses with employees and 523,000 self-employed. Both existing small businesses and start ups face serious challenges in an increasingly competitive global economy and a business environment with rapidly changing product and service life cycles. They need access to high quality business development, management education and strategic action services to successfully compete and continue to grow North Carolina's economy.

Serving the Need

The North Carolina Small Business and Technology Development Center (SBTDC) has been the state's business and technology extension service since 1984. This state-wide program is administered by NC State on behalf of the University of North Carolina system. Its 17 offices across the state are hosted by one or more of the constituent institutions and provide services in all 100 counties. SBTDC's mission is to help North Carolina businesses grow and create new jobs within the state. Most services are free of charge, and all SBTDC services are confidential. SBTDC professionals help small business owner-managers and those interested in starting a business meet the challenges of today's business environment by providing them with high quality management counseling and educational services tailored to meet their needs. 2006 state-wide impacts include:

- \$226 million in incremental sales; 2,618 new jobs created
- \$24 million in incremental taxes generated with a \$10 to \$1 ROI on the University's investment
- \$1.1 billion in government contracts
- \$175 million in capital formation
- 350 students offered practicum learning opportunities.

Impact Beyond North Carolina

The SBTDC is considered by its peers and federal funding partners to be among the top SBDC's in the country. It has played a role in helping other SBDC's develop technology competencies and effective strategic plans. Its role in support of the national US DOL WIRED Initiative has resulted in the engagement of other SBDCs in this initiative.

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Center for Innovation Management Studies

The Need

Management is waking up to innovation. Barriers to competition in many industries have fallen precipitously as regulations ease and markets become global. Unfortunately a by-product of these changes has been the commoditization of these same industries. The root of the problem is the failure of these companies to distinguish themselves in the marketplace. After decades of cost cutting and restructuring, many firms are turning their attention to growth. When asked, the majority of CEOs cite “growth through new products and services” as their number one strategic objective. The next round of competitive positioning will be based on innovation, and a company’s ability to manage innovation will determine its future growth potential.

Serving the Need

Located on Centennial Campus, the Center for Innovation Management Studies (CIMS) was the first national research center devoted exclusively to the research of management of technology/innovation. CIMS is a virtual research center; its network includes ten corporate sponsors and over 100 research investigators at 55 universities. CIMS sponsors include large, international corporations (IBM, BP, and Xerox) as well as mid-size regional firms (Novozymes and MeadWestvaco) whose existence depends on their capacity to innovate. CIMS is supported by the Industrial Research Institute, National Science Foundation, and the Kenan Institute for Engineering, Technology, and Science.

CIMS offers its partners a number of tools and support:

- The CIMS Innovation Management Framework breaks innovation down into a set of disciplines that can be learned, practiced, measured, and ultimately improved; the index to CIMS Research Library represents 25 years of investigation totaling over 500 research reports, papers and artifacts.
- The CIMS Innovation Maturity Model—a web-based diagnostic tool—provides organizations with a straightforward means to identify gaps or weaknesses in their organization and to develop roadmaps for improvement.
- The CIMS Innovation Management School, offered in conjunction with the Industrial Research Institute, provides 225 of the country’s leading R&D firms with a full curriculum of short courses for improving the skills and competencies of their employees; over 1,500 individual participants at IRI meetings.
- CIMS offers its sponsors a strong influence over research priorities, fast access to CIMS’ Fellows and academic researchers (over 100 subject matter experts and 50 universities across the country) and an inside track to recruiting outstanding students from NC State.

Impact beyond North Carolina

CIMS reach goes far beyond the borders of North Carolina. CIMS academic network is international in scope and its sponsoring companies global in their operations.

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County Gateway Program

The Need

Over many decades, the NC Cooperative Extension Service relied primarily on NC State University's College of Agriculture and Life Sciences' personnel and resources. The Office of Extension, Engagement, and Economic Development (OEEED), the University Standing Committee on Extension and Engagement (USCOEE), and the Extension Operations Council (EOC) foster the capacity to serve the citizens and to learn from them in the process. However, to meet the growing demands throughout the state, all NC State colleges and programs must be involved. This evolution in scope and service has begun removing the silos separating the campus units from each other and from the state's citizens and their needs.

Serving the Need

Six years ago, NC State initiated the North Carolina Gateway Counties project to encourage broad engagement with twelve pilot counties representing a geographically dispersed cross section of conditions found in the state: Cumberland, Currituck, Dare, Forsyth, Gaston, Haywood, Lenoir, Martin, Mecklenburg, Pamlico, Transylvania, and Wake. In North Carolina, the Cooperative Extension Service (CES) has been reinvigorated through a greater degree of connection with all of the colleges at NC State. Through this broader engagement, CES field faculty can now draw on the expertise of a broader array of faculty on campus. Strategically positioned in all 100 counties and the Cherokee Reservation, CES has always been the gateway of the University to the citizens of the state. Extension field faculty in every county are now being trained to engage all parts of NC State in community improvement and urban and rural economic development. Institutional silos built up over many years now give way to a level field of engagement. In the pilot Gateway counties:

- Extension Directors, who are field faculty department heads of NC State, serve as primary contacts because of their community knowledge, political awareness, and positions within local organizations
- County Directors have established relationships with external stakeholders through advisory systems and collaborations that are essential to the engaged institution, not only for need identification, but also for targeted deliverables
- The Gateway concept provides a process and conduit for marketing and packaging total University resources to local communities and counties
- Gateway County projects have included an historical buildings study in Currituck, master planning and transportation studies in Dare, an incubator feasibility study in Gaston, and youth leadership training in Mecklenburg

Impact Beyond North Carolina

Under the direction of the Office of Extension, Engagement and Economic Development and CES, the Gateway Counties pilot project was envisioned as a national model. NC State is pioneering this model of engagement to leverage resources in county settings and create partnerships between the University and communities to help citizens achieve economic prosperity, environmental stewardship, and an overall improved quality of life.

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The Institute for Nonprofits

The Need

North Carolina is home to more than 40,000 nonprofit organizations. Like their national counterparts, North Carolina's nonprofits are faced with many challenges resulting from social, political, and economic factors. Increased demands for and the privatization of public services, the call for greater accountability, and increased competition for scarce resources are among these challenges. At the same time, the strength of the sector, as evidenced by its continued growth and professionalism, provides opportunities for increased and improved service delivery. Historically, nonprofit organizations have not received their fair share of attention from universities, which typically focus on the business and government sectors.

Serving the Need

Established in fall 2003 with a \$1 million grant from the A. J. Fletcher Foundation, the interdisciplinary Institute works with faculty, staff, and nonprofit organizations across NC State, the UNC system, the state, and beyond to achieve its mission of building the capacity of nonprofit organizations to serve the public through teaching, engagement, and the generation and application of new knowledge. The Institute, housed in the School of Public and International Affairs in the College of Humanities and Social Sciences, is guided by a 20-member interdisciplinary Academic Council. The Institute is situated off-campus on Oberlin Road; plans call for it to be moved to Centennial Campus. Impacts of the Institute include:

- More than 70 students enrolled in a new interdisciplinary minor in nonprofit studies
- A new Graduate Certificate in Nonprofit Management and a Master of Public Administration with Nonprofit Management specialization (enrollment approximately 20)
- Sponsorship and administration of faculty research projects and reports on such topics as building evaluation capacity in NC's nonprofit sector, building a child health care collaborative, community partnerships, and nonprofit gaming
- Coordinating and sponsoring the Non-Profit Career Fair at Peace College for eight area colleges and universities
- Coordinating internship and service-learning placement and evaluation of undergraduate and graduate students serving the needs of a variety of nonprofits
- Sponsoring the Community of Nonprofit Scholars, with faculty and nonprofit professionals meeting monthly to discuss research and nonprofit issues

Impact Beyond North Carolina

The Institute's threaded service learning model for undergraduates has received positive national attention through NC State Institute for Nonprofits' faculty papers and presentations, as has the published research of our Institute faculty.

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The Institute for Emerging Issues

The Need

North Carolina's leaders must have the tools to respond to changes affecting our economy and society. The Institute for Emerging Issues (IEI) helps NC State fulfill its economic development and public service missions by helping leaders across N.C. adopt a model of collective leadership that can meet challenges wherever they occur. IEI brings together N.C. leaders in business, government and higher education through an annual cycle of work where research yields ideas, ideas inform debate, and debate prepares the ground for action. At this time, IEI's main programmatic initiatives are in the areas of healthcare, tax and finance modernization, higher education and energy.

Serving the Need

IEI identifies and refines strategies for addressing pressing public policy issues through research and the convening of working groups that bring together experts and stakeholders and fostering informed debate through working groups. The annual Emerging Issues Forum (EIF) and community forums across the state yield specific proposals for action mobilize leaders and stakeholders committed to the implementation of collective solutions. Impacts of IEI's work include:

- A comprehensive quality initiative (NC Best Care) that was awarded funding from the NC Health and Wellness Trust Fund and is now under the leadership of Governor Easley's office
- Working group proposals for modernizing N.C.'s system of tax and finance and transforming N.C.'s systems of higher education
- Eight regional and community forums across the state on healthcare and on tax and finance modernization
- Two leadership summits, one on tax and finance modernization and the second on energy, environment and infrastructure
- Staff support to the Legislative Study Commission on Fiscal Modernization
- Business Committees on Fiscal Modernization and Transforming Higher Education to involve the business community in forming public policy around those areas
- The annual EIF (now in its 23rd year) which brings together leaders to debate and develop action plans around these issues
- Presentations by staff to numerous civic, community, business and government groups across the state on these issues

Impact beyond North Carolina

IEI aspires to be the premier university-based public policy institute in the country. To that end, our programs of work are carefully constructed to become models for other states as they consider public policy change. The EIF offers an opportunity for North Carolina leaders to hear from national and international figures and for them to learn about how our state is dealing with future challenges. Through their participation as speakers, the EIF has brought NC State to the attention of former presidents, fortune 500 CEO's, international diplomats and current administration members (most recently US Secretary of Education Margaret Spellings).

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NC Program for Forensic Science

The Need

Forensic scientists are often called upon by law enforcement agencies to aid in the analysis of evidence and in the recovery of human skeletal or decomposed remains. Forensic Science is a multidisciplinary science that includes disciplines such as forensic anthropology, archaeology, botany, chemistry, and entomology as well as other fields and specializations. Forensic anthropologists are called to consult on a range of cases, from those involving the remains of a single case to those involving mass fatalities such as airplane crashes or acts of genocide. Law enforcement agencies also call increasingly upon entomologists and botanists to provide insight concerning time-since-death and the postmortem interval.

Serving the Need

The NC Program for Forensic Science (NCPFS) was established in 2005 with a fourfold mission: extension, education, technical service, and research. Its technical contributions encompass many disciplines across several NC State colleges, including forensic anthropological examinations of the human skeleton of unidentified human remains; preservation, documentation, and analysis of entomological, soils, botanical, and geological crime scene evidence; forensic archaeological search and recovery; remote sensing of crime scenes; and chemical analysis of textiles. The NCPFS is the first in the State to bring together technical resources and services under one banner to aid medicolegal death investigations in North Carolina. Given the program's success, the next step is to develop and expand into a Center for Forensic Sciences. Since its establishment, the program's impacts have included:

- Conducting death investigation training workshops for law enforcement agencies
- Assisting law enforcement agencies with medicolegal death investigations
- Conducting specialized research to improve and develop forensic standards
- Hosting training workshops for local law enforcement agencies including the nationally acclaimed Bugs, Bones, and Botany[®]; a unique death investigation workshop tailored for law enforcement personnel, which provides an in-depth view of how to collect and preserve entomological, anthropological, and botanical evidence for crime scene investigations
- Contributing significantly to the investigation of several high profile homicide cases, as well as conducted specialized research, analysis, and training at the request of law enforcement agencies.

Impact beyond North Carolina

Development and improvement of forensic standards related to human identification is of great interest to the forensic community. A National Institute of Justice (NIJ) Grant was awarded to NCOFS to develop new identification criteria for complete and fragmentary human skulls. An NIJ grant submission would establish an unidentified decedent database for Cold Case Units that will be a collaborative effort between NC State University and the Georgia Bureau of Investigation.

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Diversity Community Outreach and Partnerships

The Need

The Office for Diversity and African American Affairs (OVPDAAA) at NC State increases its service to North Carolina and the nation by partnering and collaborating with ethnic, cultural, religious, and other diversity-oriented community organizations, as well as private businesses and corporations interested in diversity issues. In return, these partnerships and collaborations increase NC State's access to research and educational resources in the community. The OVPDAAA partners and collaborates with community organizations to conduct diversity related programs, research, and community service throughout the region and the state. The OVPDAAA also collaborate with and participates in community organizations to help communities respond to ongoing community issues and challenges related to diversity. In return, these organizations conduct programs that enrich student, faculty, and staff understanding of diversity and multicultural issues that affect our communities, businesses and society.

Serving the Need

To serve this need the OVPDAAA collaborates and partners with a variety of public religious, ethnic, and cultural organizations, as well as private organizations to promote diversity and mutually beneficial educational programs and activities. The following are some of the public and private organizations that partner with the OVPDAAA:

- Shaw University, Saint Augustine College, and the City of Raleigh partner with the OVPDAAA to plan and conduct an Annual University-Community Brotherhood dinner. This dinner celebrates African American contributions to the nation, recognizes a distinguished African American for contributions to North Carolina and the nation, and serves to inspire cooperation and collaboration among the partnering institutions.
- The NC Society for Hispanic Professionals and NC State University sponsor an Annual Hispanic Education Summit on the campus of NC State.
- The Clarence E. Lightner Youth Leadership Program provides resources to conduct leadership development of economically disadvantaged pre-college students on the NC State campus, including summer camps and special field trips.
- The Lost Generation Community Task Force includes NC State faculty and staff who study and recommend solutions to the increasing high school dropout and incarceration rates of African American males in North Carolina.
- The Muslim American Public Affairs Council (MAPAC) and NC State partner to enhance our understanding and the welfare of Muslims in North Carolina. NC State hosts the annual MAPAC banquet and dinner.
- The NC River States Association and NC State University partner to promote increased understanding and awareness of native Africans who live and work in North Carolina. This collaboration includes faculty from the NC State Africana Studies program and staff from the African American Cultural Center.

Impact Beyond North Carolina

These community outreach activities impact beyond North Carolina by serving as model collaborations that are mutually beneficial to the campus and to the community.

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North Carolina Language and Life Project

The Need

North Carolina is one of the most linguistically diverse states in the US, reflecting a wide variety of regional and sociocultural English dialects as well as an assortment of ancestral and immigrant languages. This natural linguistic diversity raises a number of empirical questions about the nature of language variation and its social and educational implications for students, the citizens of North Carolina, and the general public.

Serving the Need

The North Carolina Language and Life Project (NCLLP) was established at NC State in 1993 to focus on research, graduate and undergraduate education, and outreach programs related to language in the American South. The goals of the NCLLP are to gather basic research information about language varieties in order to understand the nature of language variation and change; document language varieties in North Carolina and beyond as they reflect varied cultural traditions; provide information about language differences for public and educational interests; and use research material for the improvement of educational programs about language and culture. Impacts include:

- A growing collection of more than 1,500 recorded sociolinguistic interviews
- The production of CD collections of local narratives and published trade books on particular varieties of English
- The development of new technologies for language analysis and preservation
- The establishment of an extensive program of community-based research that includes linguistic descriptions of Outer Banks English, African American English, Southern Appalachian English, Native American English, and Hispanic English
- The development of an innovative graduate studies program that uniquely combines theoretical, descriptive, and applied sociolinguistic study
- The production of local, statewide, and national TV documentaries on language variation in North Carolina and on particular dialects that include Outer Bank English, Appalachian English, Lumbee English, and Hispanic English
- The construction of museum exhibits for local communities and for the citizens of and visitors to North Carolina
- The development of a dialect awareness curriculum for middle school students in social studies and language arts throughout the state
- Workshops and presentations on language diversity for practitioners, civic organizations, and the general public

Impact beyond North Carolina

The North Carolina Language and Life Project is a national model for integrating community-based research and engagement. Sociolinguistic methodologies developed and refined by the NCLLP are influencing the field of sociolinguistics globally. Documentary videos and CDs have been widely distributed nationally and are used for sociolinguistic education throughout the world. Several states have adopted our model for public education on language diversity.

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The Hillsborough Street Partnership

The Need

Hillsborough Street, one of the most historic and important corridors in the City of Raleigh, links the State Capitol to the State Fairgrounds and connects the heart of the city to one of North Carolina's greatest institutions, NC State University. Bordering a retail district and historic neighborhoods on one side of the street and the University on the other, the area surrounding Hillsborough Street is diverse and densely populated, giving it the potential to be a prime destination and contribute to the city both economically and aesthetically.

Serving the Need

The Hillsborough Street Partnership was created to help this historic corridor live up to its potential. The Partnership comprises representatives of NC State University and the City of Raleigh, the University Park Homeowners Association, and individuals who own property and/or manage businesses on Hillsborough Street. Other participants in the Partnership have been the Triangle Transit Authority, the North Carolina Department of Transportation, and the Triangle J Council of Governments. Since October 1999, the Hillsborough Street Partnership has brought the community together to listen to its concerns and learn from its ideas. The stated mission of the Partnership is to reinvigorate life on the street. The University's goal for Hillsborough Street aligns with the Partnership's mission: for Hillsborough Street to be a vital and upbeat area for businesses, residents, and students. NC State has been committed to participate actively as a catalyst for redevelopment, demonstrating this commitment in a variety of ways including discussions of cost-sharing, construction of the Pullen Road prototype roundabout, and active participation in the Hillsborough Street Partnership. Specific impacts of the Partnership include:

- Creating a forum for discussion of town-gown relations and fostered neighborhood communication
- Linking with the College of Engineering to develop a plan for the Stinson Drive prototype roundabout and to study its success in order to make recommendations on the proposed Hillsborough Street roundabouts
- Linking with the College of Design to conduct street design studies and make recommendations on various ways to make the street more aesthetically pleasing
- Creating the opportunity for NC State to partner with the City of Raleigh in investigating redevelopment sites along Hillsborough Street

Impact beyond North Carolina

As an institution of global reach, through active involvement with the Hillsborough Street Partnership, NC State is demonstrating to other urban universities the importance of taking on roles of civic leadership at home as well as abroad.

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