

## COLLEGE OF TEXTILES ANNUAL REPORT 2007-2008

### ***Changes in Service Environment***

These continue to be exciting and challenging times for the textile industry and the College of Textiles. The surge in the price of oil, the base of most synthetic fibers, and the housing crisis have had a major impact on the industry. With housing sales down, the household textile market has been badly hit with some carpet companies reporting drops in sales approaching 50%. A recent example of the dual impact is Freudenberg, the world's largest nonwovens company and a key partner of the College of Textiles. Most of their basic fibers are oil based and their two largest markets are household and automotive. They recently announced a reduction in staff of 41 people at their Durham location.

On the other hand, new opportunities continue to create excitement in the college and industry. The recent announcement of Spirit AeroSystems to build their next plant near Kinston, NC and create a "Center of Excellence in Composite Manufacturing" with the Colleges of Engineering and Textiles at NC State University is a public recognition of the importance of fiber-based composites in high-tech manufacturing and the growing strength of NC State in this area. In the weeks after the announcement several leading companies have contacted us about joining a research consortium in composites manufacture. The growing aerospace industry in North Carolina – already over 500 companies – is an incredible opportunity for the college. Protection, medical textiles, and nonwovens continue to be growth opportunities for us. The recent reorganization in the North Carolina Department of Commerce focuses on three industry segments: textiles, aerospace and automotive. The college is active in all three.

### ***Compact Plan: Major Initiatives from Our Compact***

This spring we had a major disappointment when the Colleges of Engineering and Textiles jointly-proposed NSF Engineering Research Center in Innovative Fibrous Systems made the final eight but was not funded. We did receive NSF approval and funding for a new Industry/University

Cooperative Research Center in filtration. This will further expand our leadership position in nonwovens and bring us into new areas of medical and protective textiles.

We have continued to expand our Textile Protection and Comfort Center, and this July we will celebrate the opening of new laboratory capabilities for research in bio and chemical protective textiles funded through our \$2 million federal grant, the Man In Simulant Test facility.

Our efforts to develop a fashion and textile design program preparing our students for rewarding lives as innovative and responsible leaders in fashion and textile design including apparel, home textiles, new protective materials, industrial and automotive textiles, and medical and architectural textiles received major boosts this year. Lectra, a French company leader in 3-D design software, designated the college a Privileged University Partner (along with the Fashion Institute of Technology and Parsons School of Design in New York City) and made a gift of software valued at \$7.58 million. This week they made a new commitment of \$3.3 million in additional software in July 2008. A German company, EAT, has made a gift approaching one million dollars in weaving software. A Swiss company, Stäubli, has committed to upgrading both of our Jacquard looms to take full advantage of the new software. These gifts will enable the college to provide a textile design environment unequalled in the world. This summer we will complete a total redesign of the Digital Design Laboratory to showcase our new training and research capabilities in this area.

We have also expanded our Polymer and Color Chemistry programs with a new pre-med track and close collaboration with CHASS and CALS in creating a new Forensics Science Center.

### ***Diversity: Initiatives and Progress***

The College of Textiles continues to be a leader in diversity and is recognized for its leadership in attracting minority students. Our undergraduate class is 8% African American, 6% Asian American, 3% Hispanic but only 1% international. Our goal is to increase international undergraduate enrollment to 5% while continuing to improve our African American and Hispanic enrollment. Our graduate enrollment is 53% international. The African American Textile Society is

a strong presence in the college. The College remains one of the most diverse on campus in faculty and staff. This past year we added three new faculty members, two are female, one is international. Our EPA and staff hires continue to demonstrate our commitment to diversity. Our four new EPA hires include two females, one a Native American, and an African American. In January we hired a new College's diversity coordinator, Edward Brown. Ed is coordinating the NC State/North Carolina A&T USDA Capacity grant. This grant focuses on building industry leaders and the two campuses bring students together 3-4 times a year with visits to industry facilities. Faculty visits in 2007-2008 included field trips to the High Point Furniture Market, the Textile Tower, Cotton Incorporated, (TC)<sup>2</sup> and AATCC.

### ***Instructional Program Advances***

The college reorganized this year to bring several of the Textile Technology programs closer to textile engineering and polymer and color chemistry, and to accelerate the development of our Textile Technology textile design program. With the software and hardware gifts mentioned above, the hiring of new faculty, and our redesigned teaching lab, the textile design program is poised for substantial growth in size and reputation. The Fashion and Textile Management Degree is growing well with several new programs. Dr. Pam Banks-Lee was appointed as Associate Research Director for Education in the Nonwovens Institute. Six graduate and undergraduate courses have been developed and a graduate certificate program approved. We now offer an option in nonwovens as part of the Textile Technology Masters degree program.

The Fashion and Textile Management program faculty continued the Executive in Residence program with outstanding leaders participating. These included: Tom Travis: Managing partner at Sandler, Travis & Rosenberg, P.A., and author of, "*Doing Business Anywhere: The Essential Guide to Going Global*;" Stephen Jessup: President and CEO of WRAP (Worldwide Responsible Accredited Production); Matt Priest: Deputy Assistant Secretary for Textiles and Apparel at the U.S. Department of Commerce (OTEXA); and William Ivey Long: A five-time Tony-

Award winning Costume Designer with five shows currently running on Broadway and five new shows under contract.

**Research**

The College continues its growth in research funding (Table 1). Our research funding continues to be driven by our three centers, NCRC, TPACC and the ITT/NCSU Research Consortium. In 2007 TPACC was awarded \$1,307,079 in new funding and NCRC received new awards of \$898,282 and \$1,170,000 in membership dues for a total of \$2,068,282 in research funding. ITT graduated its 42nd MS student and will fund seven new MS students in Fall 2008. Total research contributions from ITT were over \$1.5 million in 2007-2008. The current class of ITT Fellows are interning this summer at five different companies: Milliken & Company, Glen Raven, VF, Crypton, and Highland Industries. ITT continues to attract new members for the Research Consortium, this year Mount Vernon Chemicals, Omnova Solutions, Unichem, and Bay Controls joined.

Table 1. Five-year summary of research funding activity in dollars.

|                         | 2003-2004 | 2004-2005 | 2005-2006 | 2006-2007 | 2007-2008  |
|-------------------------|-----------|-----------|-----------|-----------|------------|
| C & G Expenditures      | 4,025,027 | 4,813,713 | 4,634,039 | 4,679,539 | 6,406,500  |
| Proposals Awarded       | 4,049,266 | 5,380,662 | 6,894,866 | 6,448,553 | 6,508,970* |
| Federal (non-NTC)       | 956,101   | 476,385   | 877,457   | 3,505,734 | 2,429,432* |
| National Textile Center | 2,089,811 | 2,066,198 | 2,064,052 | 2,447,660 | 560,113    |
| Industry                | 1,003,354 | 3,268,996 | 3,892,357 | 1,539,117 | 3,003,185  |

\*This total does not include a DTRA award under negotiation of \$440,649.

The changes in Congressional rules on earmarks have been a major challenge for the National Textile Center, a consortium of eight research universities. Our faculty has responded by increasing proposals to other federal agencies (e.g., 11 to NSF, 9 to DTRA, and DOE). We were awarded 3 of the 9 DTRA proposals, a very healthy 33% yield. Our Nonwovens Institute continues to enhance its reputation as the world-leading research facility for traditional and high-tech applications of nonwovens fabric. The NCRC now has 76 members and includes almost all of the leading nonwovens companies in the world. The second phase of the installation of the staple

nonwovens laboratory is complete and planning for phase three is underway. When all work is completed, this facility will be worth over 3 million dollars and with our 15 million dollar Partners' Lab will provide the college with the unquestioned leading facilities in all aspects of Nonwovens.

**Extension**

Table 2 shows the dramatic growth of the Six Sigma program in partnership with the College of Engineering Industrial Extension Service (IES). The number of course offerings continues to grow and the economic impact of \$20.3 million as calculated by IES is due to the completion of projects completed from training in previous years as well as this year. Gross revenue for the College of Textiles increased 31%.

Table 2. Six Sigma Program Highlights

|                                    | 2005-2006   | 2006-2007   | 2007-2008    |
|------------------------------------|-------------|-------------|--------------|
| Number of workshops (total)        | 19          | 32          | 34           |
| Number of new workshops            | 6           | 10          | 5            |
| Number of training days            | 182         | 230         | 204          |
| Number of participants (Total)     | 350         | 478         | 604          |
| Economic Impact (reported to date) | \$2,800,000 | \$6,800,000 | \$20,300,000 |
| Gross Revenue to COT               | \$340,000   | \$650,000   | \$850,000    |

We continue to update our short courses, details of participation are seen in Table 3. Our new laboratory-based courses where 80% of the training occurs in the lab are a resounding success.

Table 3. Short Course Program Highlights

|                                 | 2005-2006 | 2006-2007 | 2007-2008 |
|---------------------------------|-----------|-----------|-----------|
| Number of short courses (total) | 15        | 18        | 15        |
| Number of new short courses     | 5         | 7         | 7         |
| Number of training days         | 56        | 84        | 84        |
| Number of participants (Total)  | 245       | 192       | 220       |
| Gross Revenue (Total)           | \$142,000 | \$173,000 |           |
| Net Revenue (Total)             |           |           | \$74,000  |

TexED activities in the past year supported two Ph.D. students, six M.S. students, a number of undergraduates, and are providing half the salary of a new animation designer for courses used both in the academic programs and extension. Extension faculty also teach in our academic programs. Last year 235 students in four sections took our entrepreneurship and

innovation introductory course. TextED is also providing instruction for two high-school student Summer Textile Exploration Program (STEP) “Be an Entrepreneur” sessions this summer.

The College has a number of multi-use labs. These include extension labs whose primary purpose is teaching as well as providing service to industry. Many other labs are primarily used for research. TPACC and NCRC offer specialized services to industry. Both academic departments also have labs for specialized teaching and research. These labs are grouped together for each department and are reported below. Professor Behnam Pourdeyhimi led the university-wide effort this year to redefine the old ATA agreement and create a simplified and streamlined new Testing Service Agreement (TSA) using language appropriate for such activities. This past year has seen an 8% growth in value of services offered.

Table 4. 2004-2007 TSA (formerly ATA)

|         | 04-05   | 05-06   | 06-07   | 07-08     |
|---------|---------|---------|---------|-----------|
| TexLabs | 197,530 | 110,320 | 114,744 | 190,844   |
| NCRC    | 653,788 | 473,067 | 747,879 | 628,293   |
| TPACC   | 277,735 | 173,020 | 192,750 | 233,505   |
| TECS    | 23,800  | 73,420  | 38,361  | 24,000    |
| TATM    | 21,640  | 11,300  | 19,573  | 11,200    |
| TOTAL   | 976,963 | 730,807 | 998,563 | 1,077,842 |

### ***Faculty and Staff***

Dr. Brent Smith received the Olney Medal for outstanding achievement in textile chemistry. The Olney Medal recognizes outstanding achievement in textile, polymer, or other fields of chemistry of major importance to textile science. Faculty in the College of Textiles have now received more Olney Medals than any other organization (DuPont is second) and more than all other colleges and universities combined. James Watson received a Doctor of Business Administration, the College of Textiles Outstanding Extension and Engagement Award, and the College of Textiles EPA Award for Excellence. Terry Brasier received an Education Doctorate. Dean A. Blanton Godfrey received one of the inaugural Jackson Grayson Distinguished Quality Pioneer Medals. Ms. Shane Jarvis received the College of Textiles SPA Award for Excellence. Dr. Jon Rust received the Division of Undergraduate Academic Programs Award for Outstanding

Contributions to Undergraduate Education. Dr. Jeff Joines was the College of Textiles nominee for the Board of Governors Teaching Award. Dr. David Hinks was the College of Textiles nominee for Alumni Distinguished Undergraduate Professor Award.

## **Students**

The College of Textiles has had remarkable growth in undergraduate students, 49% over the past five years. Growth in graduate students has been more problematic. Graduate applications are strong, but growth is limited by challenges in funding these students.

Table 5: College of Textiles Student Enrollment

| Year          | 2003 | 2004 | 2005 | 2006 | 2007 |
|---------------|------|------|------|------|------|
| Undergraduate | 595  | 560  | 636  | 750  | 889  |
| Graduate      | 123  | 143  | 137  | 131  | 142  |
| Total         | 718  | 703  | 773  | 881  | 1031 |

Our students continue to excel. Andy Coughlin (TE) won both the NSF Fellowship and NDSEG Fellowship to support his graduate program at Rice University. Joe Zhe was awarded an ACS Undergraduate Scholarship Award (\$1900). Joseph Barton received an internship at Princeton Plasma Physics Lab for this summer. Five students received undergraduate energy-related research awards. Paul Carruth won the 2008 College of Engineering Senior Award for Citizenship and Service. Six students won AATCC scholarships ranging from \$3,000 to \$5,000 each. Jenna Eason won a fellowship to the Nagoya University Advanced Automotive Engineering program. Two students received Young Menswear Association Scholarships valued at \$5000 each plus industry internships.

## ***Fund Raising***

The past year we celebrated 65 years of partnership with the North Carolina Textile Foundation. During the year, we focused on endowing our flagship Centennial Scholarship program (36 of 40 scholarships are now endowed). We expect to far surpass our Achieve!

Campaign goal of \$50 million this June by raising over \$67 million. Many significant hardware and software gifts (some mentioned above) were received.

### ***Administration***

This has been a year of major changes in the college with searches for twelve new people, a reorganization of our Textile Technology program, constructing new labs and upgrading others, and new assignments for a number of people. We continue to streamline our financial structure and to increase administrative efficiency.

### ***Recommendations and Concerns for the Future***

We continue to be concerned about the level of salaries for faculty and staff. Funding start-up packages for new faculty is also a challenge. Our growth of almost fifty percent in undergraduate students in the past five years has created serious challenges on class sizes, faculty assignments, and student support. The growth has not been even across all degree programs and our faculty/student ratios range from 50 /1 to 9 /1. New faculty hires funded under our Compact Plan will help alleviate the problem, but we will have to make some difficult decisions on teaching assignments. Our most important challenges are having the resources to support our program changes and expanding critical research funding sources. Many opportunities for new research directions require matching funds and serious investments. Opportunities in composites research for aerospace and automotive industries will require significant investments in new facilities, faculty, and graduate students. Environmental and sustainable manufacturing opportunities will also require new investments.

## **Appendix 1 Examples**

### **Producing World Leaders**

The College of Textiles is creating world leaders in many ways. A good example is Andy Coughlin, a recent graduate with dual degrees in Textile Engineering and Biomedical Engineering. Andy is now a first year graduate student at Rice University in Bioengineering and has been awarded a National Science Foundation (NSF) Fellowship and National Defense Science and Engineering Graduate (NDSEG) Fellowship . Andy's first research experience took place at College of Textiles under the guidance of Dr. Wendy Krause from 2005 to 2007 studying the ability of biopolymers to form nanofibers via electrospinning for biomedical applications. Andy is now investigating ways to re-engineer the adeno-associated virus (AAV) for cancer diagnostics and therapeutics.

Jenna Eason was both a Centennial Scholar and an Anni Albers scholar receiving degrees in Art & Design and Textile Technology. She was head of the Anni Albers Student Advisory Board and held many leadership positions in the College of Textiles. During her undergraduate years Jenna studied in Ghana, Prague and Southern Europe and received a Women in Textile Home Industries Today scholarship. Jenna has entered graduate school at NC State working under Professor Nancy Powell focusing on Automotive Textiles and is spending this summer in the Nagoya University Summer Program in Automotive Engineering. This program provides students with a rare opportunity to connect with current trends in automotive technology. Coursework covers the latest topics in automotive engineering enhanced by industry site visits. Topics include: future trends of the automotive industry world-wide, observation and evaluation of drivers, innovation in materials and processing, vehicle dynamics, safety engineering & crash safety, Automotive Embedded Computing Systems, communication technologies & navigation systems, energy saving & hybrid technology, recycling and life cycle design and the Toyota Production System.

Joseph Barton, an undergraduate pursuing a dual major in Textile Engineering and Physics is focusing on energy production for the future during his internship at the Princeton Plasma

Physics Laboratory, a Department of Energy lab overseen by Princeton University. This lab is devoted to increasing our understanding of natural energy sources and providing alternate energy solutions, one of America's greatest scientific challenges. Joe's career at the College of Textiles started in the summer before his freshmen year when he worked for Dr. Tim Clapp in Six Sigma. In his sophomore year he became a TA in Textile Engineering 110 and in the summers worked in the Zeis Textile Extension Education for Economic Development Center. Joe also worked with Dr. Warren Jasper and Dr. Steve Michielsen to create a device that takes real time measurements of the kinetic coefficient of friction in nonwovens. Recently he has been working with Dr. John Blondin, an astrophysicist in the College of Physical and Mathematical Sciences. He contributed to Dr. Blondin's model of high velocity shocks in core collapse supernovae using supercomputers to analyze the dynamic distribution of self gravity in the star before it explodes. Joe's work this summer at Princeton will focus on exploring fusion as an energy source by creating a computer model to study the edge effects of the plasma to optimize plasma confinement, since plasma at these temperatures can only be confined by magnetic fields. Interestingly, a Wolfpack alumna from the Nuclear Engineering Department is Joseph's research mentor, Dr. Rajesh Maingi, who received his BS, MS and Ph.D from NC State.

Many of the top students in the college get their first introduction to college life during the Summer Textile Exploration Program while in high school. Sidney Hill from Kinston, NC, is a wonderful example. Now double majoring in polymer and color chemistry and chemistry, Sidney's dream is to work for a national lab. When he discussed this with his advisor, Dr. David Hinks, the connections in the college opened up a perfect opportunity. Dr. Hinks had recently received word from a textile grad, Dr. Jacob Hooker, that Brookhaven National Laboratories, operated by the United States Department of Energy, was currently accepting applications for their summer internship program. Sidney was one of two students selected for an internship in chemistry out of 100 applications. Sidney's internship will focus on radiochemistry and chemical synthesis. More specifically, Sidney will focus on techniques for developing new radiotracers to be used for

Positron Emission Tomography. As a Caldwell Fellow, Sidney has had many opportunities to “think big” and get out of his comfort zone. He says getting out of that comfort zone has allowed him to take part in a language exchange program where members take 30 minutes out of each week to talk with someone who speaks a different language. Sidney says, “We learn from each other and learn each other’s language and cultures.” Sidney plans to graduate in 2010 with a double major, wonderful work experience, and an internship that could change his life. When asked what is the best part about being a student at the College of Textiles he said, “Definitely the relationship with people here, be that faculty, staff or students. Being part of a small college at a big university is such an advantage.” This is more evident than ever now that he’s at Brookhaven National Labs doing research under the wing of a College of Textiles grad.

### **Improving health and well-being**

Announced on June 27, 2008 is a new breakthrough by two of our partners in the NCRC, Rohm and Haas and Vescom , working together with the help of the college. The antimicrobial Silvadur™ technology that destroys germs and odors at the point of contact will be used to create interiors with bacteria-fighting properties, especially in environments that require sterile, immaculate settings. This new wall covering is environmentally responsible, exceptionally effective and virtually invisible. Vescom is a Dutch company that has located a plant in North Carolina to work closely on R&D with the College of Textiles.

LaamScience, a college spin-off company, has now moved to new manufacturing facilities in Raleigh and plans to launch their first antiviral product, a face mask, this fall. Early results from clinical trials are outstanding. This new face mask should be effective in protecting us from bird flu, SARS, and other viral infections.

### **Creating educational innovation**

The College of Textiles continues to lead in educational innovation. The TE Senior Design course taught jointly with the Colleges of Management and Design used teams of 2-3 MBA students, a graduate industrial designer, and two textile engineering seniors to design a new,

smaller catamaran boat, improve home products packaging, create an electric warmer for wheelchair bound patients, and to design an illuminated automotive headliner. All of these projects were supported by industry (World Cat, MeadWestvaco, and Guilford Mills). Students from Biomedical Engineering will join this course in Fall 2008 making it a four-college collaboration. Projects from the second semester senior design course included improving the production process for antenna reflectors for space satellites, creating a product using waste Spandex fibers, and redesigning the internal portion of the Extra Vehicular Activity suit for NASA.

### **Fueling Economic Development**

Three special research projects have been well recognized for their value in economic development in North and South Carolina. The first is building the *Textile Information Warehouse for the North Carolina Textile Industry*. The establishment of Textile Connect ([www.nctextileconnect.com](http://www.nctextileconnect.com)) provides significant information to market the North Carolina textile complex to the global marketplace, and to assist this complex in global competitiveness. Working closely with the North Carolina Department of Commerce in the design and launch of this website, graduate students continue to maintain and build this site. The second is *Building the Performance Cluster in North Carolina*: This research study provided the College with the opportunity to work closely with a number of North Carolina companies. Identification of opportunities for the College to support this industry included: specification, testing, and technical support; new product development; design and innovation of new products; new market opportunities; and dissemination of information. The third is *The State of the Union of the South Carolina Textile Industry*. The South Carolina Council on Competitiveness asked NC State's College of Textiles to identify the current industry structure of the South Carolina textile complex. Results identified the existence of a sizeable industry in South Carolina, similar but different to the North Carolina textile complex, with significant infrastructure in advanced manufacturing, chemicals, and import/export firms. This proactive approach to assist the State of South Carolina provides a roadmap for future strategic research projects, plus the marketing of the South Carolina industry. A follow-up study is funded

for 2008-2009 (*Textile Information Warehouse for South Carolina Textile Industry*), and two additional strategic research studies are targeted for future funding.

The College of Textiles is a partner with the College of Engineering and the North Carolina Department of Commerce to explore ways to expand the aerospace presence in North Carolina. The most visible success of this effort to date is the announcement by Spirit AeroSystems and the State of North Carolina to create a \$570 million manufacturing facility at the Global TransPark with a focus on excellence in composite manufacturing. This new facility is expected to create over 1,000 well-paying jobs over the next five years.