

**Engineering Education and Researches  
in the North Carolina State University:  
Finding ideas to be used in Russia**

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**Raleigh, USA**

**2004**

**Long-Long Foreword,  
Or  
What am I Doing Here?**

*Every sentence that I utter must be understood  
not as an affirmation, but as a question.*

*Niels Bohr*

The main feature of Russian educational system in the natural sciences area generally and in the field of physical and mathematical specialties specifically is its fundamental nature. This means increased attention to the classical problems and solution methods, preference to rigorous statements of the problems, the arrangement of educational courses accordingly to “historical” logic of development of a particular science, special attention to the problems arising from the inner needs of the science, the utmost in the width of the presented material.

The advantages of this system are the versatility of specialists, high level of their self-training, potentially great abilities to master adjacent professions or specialties. The disadvantages include necessity for some period of adaptation for any concrete work and the lack of skills to work in hierarchical team (lack of managerial skills, inability to head a working group, inability to concentrate on very narrow responsible field etc.)

The natural science close to the author of the application is the mechanics – one of the oldest fields of specialist training in Rostov State University. The school of mechanics formed in RSU under the leadership of famous Russian scientist, academician I.I.Vorovich (1920–2001) determined and determines now many priority directions of this science development in USSR and Russia. Up to December 2002 the Leading Council on mechanics of Russian Federation Ministry of Education worked in Rostov at the RSU. In early 2003 new Leading Council on mechanics and mathematics was confirmed. It works at RSU under the chairmanship of A.V.Belocon, rector of RSU. Rectors of Rostov State University, Kuban State University (Krasnodar), Don State Engineering University (Rostov-on-Don) were alumni of Rostov school of mechanics. Simple enumeration of main scientific achievements including discoveries of our school would take many pages.

Modern state of the school is definitely far from crisis: we continue publish scientific papers, monographs and books for students, submit dissertations, win grants etc. But a kind of feeling (or mood) that mechanics “stews in its own juice”, develops only for mechanics itself, that mechanics is interesting but very abstract science and it is far from real life arisen in last years. These moods have some influence on both students and our colleagues. It leads to the reduction in rating of mechanics both inside the faculty (for instance, when students are assigned to the chairs) and outside it (insufficient number of university entrants to this specialty).

It seems that it is very local and partial problem, and it can be solved simply by some changes in curriculum and educational courses. But on my opinion, when the same “partial” problems arise in all similar educational divisions of the University it becomes one **general** problem. That is why finding new strategies in the management of the process of reforming and modernization in “classical” natural sciences education is very important problem for the University development.

The main problem of fundamental science and education in Russia is permanent lack of funds. The governmental financing can hardly ensure the conservation of its current state and is definitely not enough for any development. Fundamental science is often unable or does not know how to finance itself. The consequence of this situation is outflow of youth from science in general, or from Russian science. That is why the University needs in new ways and methods of drawing private (non-governmental) investments to scientific researches and educational development.

The applied engineering science usually has more funds. But often it still solves its problems by means of amateurish or outdated technologies. So we need specialists that can eliminate or at least decrease the barrier between fundamental university science and everyday needs of concrete engineering practice. That is why the important question in the construction of new strategy of development of natural science and engineering education is finding the balance of intellectual and practical experiences that enable students to address a variety of societal needs.

The engineering staff of many enterprises, works and factories needs in re-training. The first reason is that this staff was unclaimed for a long period of time. The second one – the appearance the new complex software packages and means for solving complicated engineering packages at the world markets. So the introduction of modern computer software products into industrial enterprises of Northern Caucasus, setting up the system of refresher courses for engineering staff, establishment close relations between enterprises, scientific centers and high educational institutions are very important and actual problem of the University development and even of the development of the region.

Obviously that nobody's experience can give the ready recipe for decision of the enumerated problems. Moreover, the decisions that are ready to use straight away do not exist at all. In the same time, we must try to do the solving of the delivered problems as possible more quick and as possible less painful. This is why it is so important to study any someone else experience, any approach to development and improvement of the educational system. This is why we must try to use any chance and possibility to study and to analyze the other ways and methods of working, teaching, managing, planning etc. And especially it concerns such powerful, varied, and rich on ideas and highly technological USA educational system. This is why I am here.

Yet being in Russia and preparing to this trip I have formulated a set of the questions. Answers to these questions on my opinion could be helpful to create some strategies in the management and the development of mathematical, physical, and mechanical sciences and engineering in my university. These questions are enumerated below:

- What is the influence of the institution administration upon the teaching planning and methods? Who determines the changes in curriculums and how often do these changes occur?
- What new methods and forms of teaching are most popular in current US Education? Does it really use distance learning and other computer assisted learning technologies?
- How does the teaching in the field of technical sciences depend upon and reflect the needs of market? Are there special departments or divisions studying labor market and what is the status of these divisions in the universities?
- Does the curriculum of engineering departments include some courses on management and entrepreneurship?
- What methods of invoking talent youth to the scientific researches do Universities use? How can the University make studies at laboratories more attractive than working on the firms after lessons?
- Have the high educational institutions of USA purely researching divisions (analogous to our Scientific-Research Institutes)? What is their status? How do these divisions co-operate with teaching process?
- How do the universities interact with industry? Any experience of such interaction is very important for us especially in the case of private industry. "Private firm" is very new concept for Russia and possibility to study methods of receiving private (non-government) funding could be very useful.
- Another form of university-industry co-operation is an organization of refresher courses for technical stuff and engineers. Do the universities take part in such courses (on new software

packages, experimental methods etc.) or do any firm organizes teaching of its personnel independently?

- The sore point of mathematical, physical and engineering teaching in Russia is a question of the usage of pirate, or non-licensed software. Are there any such problems in USA Universities? How do they solve it and how do they interact with computer or software firms to obtain discounts and special licenses?

And they are the questions that determine a plan or structure of this study.

### **Quick Facts of NC State & NCSU College of Engineering, Or Where am I?**

*My next Work was to view the Country,  
and seek a proper Place for my Habitation...*  
Daniel Defoe, "Robinson Crusoe"

North Carolina State University<sup>1</sup> (NC State) was founded in March 7, 1887. Located in North Carolina's capital city, Raleigh, NC State anchors one corner of the Research Triangle Park that houses more than 140 organizations dedicated to innovative research and development. Duke University at Durham and the University of North Carolina at Chapel Hill mark the other two points of the triangle. This fast-growing area consistently ranks among the nation's best places to live and do business. Fortune magazine recently named the area the best place in the nation to do business, and at 2000 Money<sup>2</sup> magazine named it "The best place in America" to live. NC State Land Mass is 2,110 acres on the Raleigh Campus, plus more than 101,000 acres in research and extension farms, forests and facilities throughout the state. It consists of 10 Colleges: Agriculture and Life Sciences, Design, Education, Engineering, Natural Resources, Humanities and Social Sciences, Management, Physical and Mathematical Sciences, Textiles, Veterinary Medicine. NC State has approximately 30,000 students and more than 6,000 employees, including approximately 1,600 faculty and extension field faculty.

The university has an annual budget of approximately \$820 million and an endowment valued at more than \$312 million. It is ranked 8th among national research universities in non-federal funded research, 13th among national research universities in industry-funded research, and 31st nationally in total expenditures for research and development. NC State is ranked 1st in total research expenditures in the 16-campus University of North Carolina system, and 2nd in total state and local research funding among national research universities. NC State's expenditures for research and sponsored programs exceed \$440 million. NC State offers bachelor's degrees in 92 fields of study, master's degrees in 101 fields and doctoral degrees in 58 fields, as well as a Doctor of Veterinary Medicine degree. Fifty-five research centers, institutes and laboratories support more than 400 faculty, 900 graduate students and 200 undergraduates.

According to The Carnegie Classification<sup>3</sup> of Institutions of Higher Education NCSU belongs to Extensive Doctoral/Research Universities – institutions that *typically offer a wide range of baccalaureate programs, and they are committed to graduate education through the doctorate. During the period studied, they awarded 50 or more doctoral degrees per year across at least 15 disciplines.*

There are many different rating systems in the US Higher Education. The following table shows position of NC State in two rankings: "The Top American Research Universities" by TheCenter<sup>4</sup> and "America's Best Colleges 2004 / National Universities–Doctoral" by US News and World Report<sup>5</sup>. Positions of two neighbors universities are also included.

University	TheCenter:		US News:	
	All-National	Public	All-National	Best Values (accounts for the net cost of attendance)
Duke University	8	–	6	10
UNC at Chapel Hill	18	4	29	27
NC State	59	27	85	33

NC State has had engineering departments since 1887 when the institution was founded and has had engineering students since classes started in 1889, but a formal school of engineering was not organized until later. Much of the history of the formation of the formal engineering “school” can be tracked by simply looking at the career of Dr. Wallace Carl Riddick Jr.

Riddick joined the faculty of the “North Carolina College of Agriculture and Mechanic Arts” in 1892 as professor of mechanics and applied mathematics. He became head of the Department of Civil Engineering in 1895 and served until 1908, when he was elected vice president of the college (during this time he continued to teach civil engineering courses as a professor of hydraulics). In 1912, the football stadium was named in his honor; Riddick had served as football coach in 1898 and 1899 and served for many years as a member of the Athletics Council.

In 1916, he was named president of the college. During his administration, he was instrumental in its reorganization (the name was changed to North Carolina State College of Agriculture and Engineering), dividing it into schools with deans in charge to accommodate rapid program expansion and increased enrollment.

On May 28, 1923, the School of Engineering was formed, and Riddick was named the first dean, following his expressed desire to take on this role. During his leadership, the school grew to include 12 departments, and the Engineering Experiment Station was established. Riddick, who organized the North Carolina Society of Engineering and the Raleigh Engineers’ Club, remained Dean of Engineering until he retired in 1937. In 1951, the Riddick Engineering Laboratories building was named in his memory.

In 1987, the School of Engineering changed its name to the College of Engineering <sup>6</sup>. Nowadays it provides 18 BS, 20 MS, 16 PhD on-campus degree programs; 6 Distance Education MS degree programs. In Fall’03 it enrolls 5,670 Undergraduates and 1,673 Graduate students. In the Year’2002-2003 it provides 1,245 bachelors, 622 masters and 96 doctorate Degrees. College of Engineering is 5th in undergraduate enrollment and 7th in number of BS degrees awarded; 11th in MS degrees awarded; 12th in nation in total research expenditures (\$76.8M); 18th in nation in industry-sponsored research; 9th in number of teaching faculty (228 tenured/tenure-track faculty; 606 total faculty and research staff. 9 College faculty are members in National Academy of Engineering, it has 62 recognitions by NSF for achievements.

Next table shows global multi-criteria positions of NC State College of Engineering

Engineering School/College	“Top Engineering Colleges” ranking by graduateshotline.com <sup>7</sup>	“Top Engineering Schools” by US News and World Report
Duke University	32	30
NC State University	30	33

## College of Engineering: Programs Accreditation, Or Who Cares?

*But judges who?*  
A.S.Griboedov, "Woe From Wit"

One of main differences between Russian and US educational systems is the role of government in the managing and directing the higher education. In Russia the contents of education is completely under the control of federal government. The scheme of the education on each profession or specialty, named by "educational standard", is approximately non-flexible. It is developed or becomes firmly established in special divisions or departments of federal Ministry of Education (it usually changes it's name every two-three year but this doesn't influence it's role or activities). Educational standard contains information on amount of hours, conducted on one or another scholastic course, as well as approximate syllabus for each of the prime courses.

Higher education in the USA is the responsibility of the states. But even state doesn't influence directly on the university programs, teaching methods and graduates quality testing. These questions are in the capacity of different groups and associations. NC State as a University, for example, belongs to the Southern Association of Colleges and Schools (SACS<sup>8</sup>) and so at first it takes part in the creation of some criteria for accreditation to all types of educational activities and secondly must correspond itself to approved criteria or requirements.

In turn, the College of Engineering is a part of Accreditation Board for Engineering and Technology (ABET<sup>9</sup>). This is why there is a special position in College Administration for the interaction with ABET, preparation to and organizing the accreditation. Full text of General ABET Criteria for Basic and Advanced levels programs can be found at the ABET site. The most interesting and "ready to use" in real practical work of every teacher is set of *Criteria 3* describing an abilities that any graduates of Engineering program must possess. This set includes

- (a) an ability to apply knowledge of mathematics, science, and engineering
- (b) an ability to design and conduct experiments, as well as to analyze and interpret data
- (c) an ability to design a system, component, or process to meet desired needs
- (d) an ability to function on multi-disciplinary teams
- (e) an ability to identify, formulate, and solve engineering problems
- (f) an understanding of professional and ethical responsibility
- (g) an ability to communicate effectively
- (h) the broad education necessary to understand the impact of engineering solutions in a global and societal context
- (i) a recognition of the need for, and an ability to engage in life-long learning
- (j) a knowledge of contemporary issues
- (k) an ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

The Administration of the College of Engineering has developed the special scheme, allowing each teacher by itself during the whole process of the course studying to perform self-testing and self-estimation of the course with standpoint of its correspondence to accreditation requirements. The main goal of this scheme is to have a process and documentation that would achieve program improvement, programmatic accreditation, regional accreditation, and institutional program review. Having a slogan "*Through assessment, educators meet responsibilities to students and to the public*", this scheme much clearly defines whole formal side of the development of the new learning course, process of its approval and introducing to educational process, and then regular checking course quality and if required realization some improvements and modernization. First of all, this process begins with much

clearly specified though very labor-consuming stage of the documentation development to new scholastic course. Except creative development of the syllabus teacher fills a big amount of the electronic forms, in accordance with its contents and realization. On my opinion, the main achievement of the scheme above is that all of this electronically prepared and stored information afterwards is essentially used by students – at acquaintance with course in process of the choice of his educational path on the next semester, as well as by teachers and administration – when discussing and co-ordinating both new and old courses and dependencies between the courses. This information is also used at accreditations of each educational program. In the process of the self-verification a teacher estimates his course with standpoint of the achievement of accreditation criteria from a) to k), then his students and graduates do the same work. The result is a detailed picture that possibly too mechanically but in enough detail reflecting the role of each course in the achievement general targets of educational program.

The following table reflects the history of Engineering College development through the history of its educational programs accreditation.

<b>Year</b>	<b>Program approved</b>
1936	Mechanical Engineering, Electrical Engineering, Civil Engineering
1948	Aerospace Engineering, Chemical Engineering, Industrial Engineering
1958	Biological Engineering, Construction Engineering and Management
1965	Nuclear Engineering
1969	Materials Science and Engineering
1990	Computer Engineering, Textile Engineering
1995	Environmental Engineering

**Distance Education and New Learning Technologies,  
Or  
Do I Really Need to Live On-Campus to Write This Paper?**

*I do not fear computers. I fear the lack of them.*  
Isaac Asimov

Distance education provides educational opportunities to students who ordinarily would not be able to enroll in classes because of schedule, location or time limitations.

Distance education credit courses are the full equivalent of on-campus courses. Contact between students and faculty occurs by fax, mail, telephone, e-mail, and/or convenient meetings. On-campus meetings may be required for examinations or laboratory exercises.

Students can get their courses by Cable, by Internet and by Video. Students who enroll in cable courses view their classes on the Cooperating Raleigh Colleges (CRC) Education Channel. They can videotape their classes and view or review them at any convenient time. Recordings of currently aired cable classes may be viewed in the NC State Library Media Center on campus. Students who choose to take video courses rent a complete set of videocassettes or CD/DVD for the semester. All these courses contain recorded lectures that Full-time faculty members deliver to full-time on-campus students. Web-based, computer-interfaced classes are offered through Internet courses and become the most popular in the last years.

The NC State College of Engineering offers its own graduate Engineering Online distance education system since 1978. The main purpose of the system is to help engineers and science professionals stay current and productive in their fields without the constraints of on-campus attendance. This system designed to help them meet challenges and opportunities in a rapidly changing

world marketplace. The courses proposed are for people with a degree, or extensive experience, in engineering, mathematics, statistics, or one of the physical sciences. They enhance professional development, and can be used towards a Master of Engineering Degree, partial recognition for on-campus degrees, or in some cases, as a course work required for Ph.D. degree.

The following graduate level degree programs are being offered by the College of Engineering via distance education:

- Master of Civil Engineering
- Master of Science in Mechanical Engineering
- Master of Science in Chemical Engineering
- Master of Science in Aerospace Engineering
- Master of Computer Science

Students may also take courses as a non-degree student in the Post-Baccalaureate Studies program. It can be courses in a specific area to gain knowledge directly relevant to current job, or courses necessary to obtain professional development hours to maintain a professional license.

Special undergraduate programs are also offered in several North Carolina locations, and an undergraduate certificate in Computer Programming is also available providing skills to switch careers, get better foundations for a technical management career, or establish a competency in Computer Science. Most of the undergraduate distance courses are combined in one major Two-Plus-Two Engineering Program that allows students to complete the first two years of an engineering curriculum at some small North Carolina's universities or Community colleges and then complete their education at the NC State during last two years.

Introduction of these technologies (distance education in general and web-oriented training in particular) certainly required the solution of a whole series of the technical, organizational and administrative problems. Some of them are the following:

- What must be equipment for the record or to prepare lectures and where it to take?
- A trained personnel is necessary to do the technical job on the recording and preparation.
- A special personnel is necessary to carry out sales and marketing.
- Faculty staff must be trained to teach using Internet, to create and maintain virtual contacts with students, to use web-assisted technologies in the classrooms and laboratories.
- The contacts and co-operation with other colleges and universities are crucial.
- Money to solve the problems above: where and how to get them?

I've thought up all these questions being prepared to the meeting with Dr. Thomas K. Miller, Vice Provost for Distance Education and Learning Technologies. And I was really surprised when he informed me that they were the real and the most important problems new university division – DELTA – encountered and successfully solved or almost solved in the first year of its creation, 2000.

First of all he mentioned that last (in my list, but not on importance!) problem was solved by the Government of the State of North Carolina namely in 2000. It was the year when legislators adopted the decision that distance education had the same meaning and rights as the regular on-campus teaching. This leads to organization of new administrative division that was accommodated in the new nice building at the Centennial Campus. And this converted the semi-amateurish activities into the professional ones.

DELTA (Distance Education and Learning Technology Applications) was established at a division of the Provosts Office in July 2000 to foster the integration and support of learning technologies in NCSU's academic programs, both distance and campus-based. DELTA maintains facilities in the Library and across campus in support of faculty development, video-based distance education activities and videoconferencing. It consists of following units:

- DELTA Administration
  - Business Office
  - Marketing Services Office

- Strategic Initiatives and Partnership Development
- The Learning Technology Service
  - Technology Development
  - Online Instructional Programs
  - Faculty Development Services
  - Media distribution
  - Video Communication Services
- Distance Education Planning and Development

The administrative structure created was perfect for solving all the problems arisen.

Classroom technology standards have been drafted and published at DELTA website.

In 2002-2003 DELTA awarded 31 IDEA Grants, consisting of \$218K and 1200 hours of DELTA personnel time, for new distance education course and program development, program planning grants, resource development and equipment purchasing.

LTS Technology Development provides learning technology infrastructure for NC State, including learning management systems and the distance education student portal. This unit works closely with other groups within DELTA and across the campus to provide a technology rich infrastructure for teaching and learning.

LTS Faculty Development Services provides training and consultations in tools and technologies for faculty, staff, and graduate students engaged in teaching and learning with technology (TLT) activities. This group conducts instructional house calls, regular workshops, seminars and custom training, and provides TLT web resources. In 2001-2002, DELTA supported 420 unique faculty, staff and students engaged in instruction through The Learning Technology Service offered workshops and seminars, a 64% increase from 2000-2001.

In 2001-2002, 38 staff and graduate students graduated from the Instructional Technology Assistance Program offered by The Learning Technology Service through DELTA.

DELTA is engaging in strategic partnering through collaborations with seven colleges and a foundation, sixteen state and fifteen national alliances, three 2+2 programs, and three multi-university alliances.

3,840 NCSU course sections utilized WolfWare or WebCT (it means web-based course's syllabus, presentations, notes, home works and individual tasks, solutions etc.). NCSU offered 616 distance education course sections. Over 3,200 students participated in distance education courses in 2001/2002, more than 5,500 students took distance education classes at NC State in 2002/2003.

97% of surveyed students enrolled in distance education courses responded that their course subject was mostly appropriate or very appropriate for distance education delivery. 93% of them responded that distance education was an adequate or very good way to learn their course material.

New computer technologies sharply change many areas of modern life and so the education. Dr. Nino A. Masnari, Dean of the College of Engineering, has told me about his College so-called "student-owned computing initiative". The number of entering freshmen coming to NC State with computers has increased from 74 percent to 96 percent over the past five years. The goal of the pilot program is to explore how the use of laptop computers and wireless connectivity can enhance undergraduate academic learning in engineering. The College's goal is to integrate these laptops with Eos so that students have their own individual access into NC State's vast network of computing resources for engineering education.

Having the laptop in the classroom allowed some courses to use more inquiry-guided learning approaches by immediate pairing the lecture material with lab/hands-on experiences. Having lab-type experience at the time of lectures was the biggest benefit to students. The students could practice what they were learning immediately, instead of waiting two days when they were in a lab section to practice what they learned in a prior lecture.

The laptop sections of the courses taught during the pilot study allowed for an interactive learning environment in the classroom, which was highly collaborative, hands-on, and computer-rich. One of the most significant findings was the use of the laptop for “communal” and “interactive” learning. The laptop proved to make teamwork more effective and efficient. This technology helped increase student problem-solving ability in courses such as computer science and technically oriented courses. It is predicted that, in a few years, most students will bring mobile computing devices to college, whether the College of Engineering require them or not, and that the institution needs to prepare for the expectation of the students in this regard.

In fall 2002, a faculty forum was initiated so that faculty can discuss, present, and learn about teaching with this technology. The forum has helped faculty review technical as well as pedagogical issues so that others could learn from past experiences.

**The Engineering Entrepreneurs Program,  
Or  
Who wants to be a Millionaire?**

*Failure to prepare is preparing to fail.*

Benjamin Franklin

EEP is a College of Engineering wide program focused on the education and training NC State University College of Engineering undergraduates as the vanguard of both leaders and entrepreneurs of the technology industry, and to improve the attraction and retention of students into the engineering and science disciplines.

The EEP is a full-immersion environment for new product development that has been holistically designed to improve the overall undergraduate educational experience. This is accomplished by involving undergraduate students from all grade-levels and all engineering and science disciplines in the prototyping of new products. These new products are the ideas of seniors who are fulfilling their senior capstone design project requirements. The seniors run their design projects as virtual start-up companies that are prototyping their first products. They serve as the executives in their virtual companies where they organize, research, design, prototype, test and document their new product and business ideas. In addition to engineering and science students, participation in the EEP is open to students throughout NC State University because developing a successful new product involves more than the engineering disciplines. By having a small number of students from business, liberal arts, education, and other non-science disciplines participating in the virtual companies the overall EEP experience is made to more closely model that of product development in industry.

This methodology provides the students more in-depth knowledge of topic areas critical to successful new product and business development. These areas include leadership, management, project planning, marketing, sales, operations, organizational behavior, financials, corporate formation, business planning, and intellectual property. Lastly, high technology product developers, entrepreneurs and business professionals mentor these students and review their completed products and business ideas. EEP is fully integrated into the educational curriculum and can be used as one or as three credits our course.

On the second day of my staying at NC State I've scheduled an appointment with Dr. Thomas K. Miller as a Vice Provost For Distance Education. This appointment was planned in a two weeks. And I was very impressed when I've seen him at The Entrepreneur's Lecture not as a visitor but as a Founder and Director of the Engineering Entrepreneurship Program. His work is a fine example of how one man can change situation and create something really necessary for the whole University. Dr. Miller, an entrepreneur himself, initiated the EEP in 1993 under the sponsorship of the Southeastern University and College Coalition for Engineering Education. The genesis for the EEP came out of Dr.

Miller's personal experience as a technology entrepreneur, his passion for undergraduate engineering education, and his deep commitment to his students and their futures. Because of this, he decided to teach engineering and computer science students skills in product development, organization, management, finance, marketing and entrepreneurship. Dr. Miller knew that the lessons learned by his students would improve their chances of success if they ever took "the road less traveled" with an idea that could be turned into a business and possibly change the world. He also knew that even if they never started a technology company that these lessons would be invaluable to them throughout their professional careers.

Dr. Miller has many success stories to tell. Today more than 300 students have completed the EEP in which they work in teams to turn creative concepts into marketable products. Donald (Donnie) J. Barnes (CSC '95), a former EEP student, was the first employee of Red Hat and retired from Red Hat as a millionaire at age 27. Engineering student entrepreneurs Bill Nussey (EE '87) and Chris Evans created DaVinci Systems — one of the world's leading email products — at a time when NC State was emerging as a power in information technology. They later sold the company for \$6.65 million. Evans sold Accipter, which he also founded, for more than \$50 million. Scot Wingo (MS CPE '92) credits his success to Miller's Engineering Entrepreneurs Program. Wingo co-founded and sold Stingray Software then co-founded AuctionRover.com, which sold for \$166 million.

EEP has its own Advisory Board (EEAB) that was created in order to involve entrepreneurs and business leaders in the further development of the EEP. The EEAB is not a policy-making body, but its members serve as trusted advisors on educational, business development and funding initiatives for the EEP. Members of the EEAB assist in enhancing the perception of the EEP and participate in its strategic planning and evaluation. The expertise and insight of EEAB members will provide a unique perspective on how the EEP can continue to improve and impact the careers of young engineers, scientists and technologists. The EEP Advisory Board Member functions will include:

- Periodic reviews of the EEP' plans and curriculum to ensure that they are contemporary
- Act as informed ambassadors and advocates of the mission, goals and activities of the EEP
- Help identify and solicit corporations, foundations, or individuals, when appropriate, for the EEP
- Provide personal and/or corporate financial support for the EEP
- Educate external constituencies about the impact of the EEP on entrepreneurship and NC State University and its value in all forms.
- Support EEP activities by sharing knowledge and expertise (i.e., serve as speakers, mentors, and assist in providing internships for students.
- Develop networks and create opportunities for collaborations between the EEP and key individuals, businesses and organizations.
- Provide the Director of EEP Development with specific advice or assistance as appropriate

**Cooperative Education Program,  
Or  
How Many Programmers Does it Take to Change a Light Bulb?**

*He that would perfect his work must first  
sharpen his tools.*

Confucius

Co-op is a structured academic program designed to enhance the quality and breadth of learning by providing qualified undergraduate and graduate students the option of integrating academic study with related, work based learning.

Students enroll in alternating semesters of full-time study and full-time, paid employment. The awarding of a Cooperative Education Program Certificate requires a minimum of twelve months of full-time work and fulfillment of additional program requirements including degree completion.

Because the program meets the criteria established by the Accreditation Board for Engineering and Technology (ABET), engineering graduates may use the co-op work experience toward professional engineering license requirements. NC State's Co-op Program has received accreditation by the Accreditation Council for Cooperative Education.

The NC State University Co-op Program is structured to fit company co-op programs with undergraduate students working either three full-time alternating semesters or six part-time semesters. Master's and doctoral level students usually work only one or two semesters.

NC State has co-op agreements with 600 companies and agencies and have available for placements undergraduate and graduate students in a variety of majors.

Cooperative education can provide a student the opportunity to:

- Confirm the choice of a major and explore career fields
- Work with state-of-the art equipment in industry
- Experience corporate cultures
- Develop communications skills and discover their importance in the workplace
- Earn money for college expenses
- Improve job prospects upon graduation
- Develop career and life goals

Cooperative education offers a company or agency:

- A cost effective means of recruiting and training qualified future employees by providing the opportunity to select and test talented personnel before making a permanent commitment
- A good source of entry-level personnel
- The chance to participate in the career preparation of students through closer ties with the University

Co-op is by many means a way for employees to influence an educational process.

Cooperative education offers the University:

- Ability to build strong relationships with the business community
- Recruitment and retention of high caliber students
- Increased alumni contact through the hiring of co-op students
- Enhancement of the curriculum for students at both undergraduate and graduate levels

A student planning to take part in Co-op program must satisfy some additional requirements:

- Full-time enrollment during the semester prior to first work term
- Completion of at least two semesters at NCSU (one semester for transfers and graduate students); NCSU transcript must show grades and admission to a degree program
- Minimum Grade Point Average (GPA) of 2.25 (3.00 for graduate students)

These requirements guarantee some reliability of the Co-op process meaning that student is qualified and involved enough to definitely return to classes after working semester finished.

There is special Agency in NC State – *Career Services* – that assists students and alumni in meeting their needs relative to career development, career experiences and employment opportunities. The office strives to provide students with the tools needed to ensure a smooth transition from college to career. It works to develop and improve the professional identities of students. It partners with industry to increase opportunities for students and alumni. Many companies interview co-op students through on campus interviews using Career Services.

Co-op made a total of 478 placements in 2002-03. New enrollment was 148. Enrollment of women decreased from 19 percent to 15 percent, and minority enrollment remained at 16 percent. Minority enrollment consisted of 18 African Americans, 10 Hispanic Americans, and 31 Asian

Americans. Among the engineering graduates, 82 students were awarded Coop certificates this year. Co-op engineering students had an average grade point average of 3.31 and earned an average hourly salary of \$15.23 for the first work session.

Co-op program is an excellent example when the brilliant and really working idea becomes absolutely useless being transferred to different conditions. There are two reasons that do not allow using such idea even as experiment or pilot project in Russia. First, and less important, of them is connected with the absence of credit system and so academic flexibility in modern Russian educational system. It can be solved but on individual basis only leading to many problems for our academic services. The second, and the crucial, one is connected with 2-years general soldierly duty for all Russian youth. It is usually postponed for students but will not be for working person. So leaving university for one or even half-semester working will lead to two-years absence in classes.

The best-selling African-American singer of the 1950s and 1960s Antoine "Fats" Domino said that "*A lot of fellows nowadays have a B.A., M.D., or Ph.D. Unfortunately, they don't have a J.O.B.*" The successes of CO-OP and EEP programs cause to believe that most graduates of NC State will never encounter this sad joke.

**Research and Graduate Studies at NC State,  
Or  
How much money one can get for the filled up leaf of a paper?**

*Data without generalization is just gossip.*

Robert Pirsig

The head of the research administration in the NC State is The Vice Chancellor for Research and Graduate Studies who encourages and promotes research and graduate curricular development through partnership with the various colleges, their faculty, and staff. The units reporting directly to the Vice Chancellor are Sponsored Programs and Regulatory Compliance Services, Office of Technology Transfer, and The Graduate School.

Two primary and obviously related goals of North Carolina State University are to strengthen its position as a research university of national stature and to provide the best possible education to its students. One way in which these goals may be jointly realized is through partnerships with private and corporate sponsors, other universities, and federal and state agencies. These partnerships assume that the individual strengths can be leveraged and that new knowledge results in new technology or improved services or products that can be transferred to the public domain for the use of society, consistent with the University's land-grant mandate for outreach and extension.

One responsibility of Research Administration is to manage Centers, Institutes and Laboratories (CILs). CILs should be multi-disciplinary and must have a strong graduate educational component. They develop when groups of interested faculty obtain long-term funding for research or public service consistent with the mission of the University and not in competition with existing academic programs or other established CILs.

Another responsibility is to manage research program of the University. The Office of Sponsored Programs and Regulatory Compliance (SPARCS) is directly responsible and accountable to the Associate Vice Chancellor for Research and Graduate Studies for day-to-day management of the University's research and sponsored activities. SPARCS' primary purposes are:

- to help faculty succeed in the sponsored-research that is part of their career development,
- to minimize the University's legal risk in research agreements and activities,
- to ensure that proposals address compliance and management issues appropriately,
- to help the University and principal investigators manage intellectual properties through contract negotiations,

- to help departments obtain the financial support that is necessary for graduate student researchers, and, through negotiation, to help sponsors do expeditious and satisfactory business with the University.

Programmatic and operational responsibilities include developing and implementing all internal policies and procedures relative to research and sponsored activity, training, and support of college research office personnel on all research budgets, proposals, and agreements.

Recognition that the primary objectives associated with a robust and productive research enterprise is the transfer of knowledge and technologies, the Office of Technology Transfer (OTT) endeavors to facilitate such efforts. Through the efforts of OTT, NC State University enjoys recognition as a top-tier institution in commercialization efforts.

Through patents, licensing and other technology transfer activities, NC State gets research breakthroughs out of the lab and into the marketplace where they can fuel the economy, create jobs and improve quality of life.

NC State holds more than 380 patents for a wide range of beneficial technologies – from memory chips to blood tests that monitor cholesterol. Last year, NC State earned 48 patents and was ranked 20th nationally among universities for patents granted. In 2002, NC State earned \$3.7 million from 55 licenses. It was ranked 22nd nationally in 2002 in licensing revenue, according to survey of 143 major research universities by the Association of University Technology Managers.

NC State 1,334-acre Centennial Campus supports the highly interactive nature of innovation. About 60 corporate and government partners and business incubators have labs and offices there and work side-by-side with faculty and students. Their collaborative research benefits NC State students and the people and economy of North Carolina.

The new \$12 million Nonwovens Cooperative Research Center at College of Textiles is the most comprehensive lab of its type in the world and will help N.C.'s textile industry innovate and remain competitive. The merger between College of Textiles and the Institute of Textile Technology will bring new applied research to boost N.C.'s textile industry and provide new opportunities for student to learn new textiles management practices.

The new \$17.6 million Tobacco Genome Project will lead the way to alternative uses and new market's for the state's #1 cash crop.

Researchers at the Triangle National Lithography Center – a new partnership between NC State and UNC-CH – will produce the next generation of microchips, to allow manufacturers to produce electronic devices that are faster, more powerful and more capable.

260 faculty members are involved with Centennial Campus partnerships. 139 NC State students are employed by partners. More than 1,400 people are employed by the partners.

Some of N.C.'s most successful businesses, including SAS Institute and CREE Research, got their start in NC State labs and classrooms. More than 230 jobs have been created by start-up companies supported by NC State's Academy Centennial Fund.

NC State is ranked in the top 20 nationally for launching start-up companies based on faculty research. Among these start-ups are:

- ZettaCore, a Department of Chemistry faculty start-up, is developing low-cost memory chips
- Biolex, a Department of Forestry spin-off, is devising a way to grow pharmaceutical proteins from a common plant, duckweed
- 3Tex, a College of Textiles spin-off, has pioneered lightweight, ultra-strong fiber for bulletproof clothing.

As a major research university, NC State has taken a new look at the role private funding can play in its overall financial health. State and federal funding now provides support for only 46 percent of its' total operations...meaning private giving is more important than ever. This is why NC State has made significant strides in four years. From 1998 to the end of 2002, the value of endowment grew from \$237 million to \$312 million. The total of all gifts and pledges grew from \$67.8 million in 1998

to \$147.5 million in 2002. Despite tough economic times, NC State had a record year for fund-raising in 2002. These private gifts and pledges play a big role in enabling NC State to achieve outstanding results for North Carolina in education, economic development and the quality of life.

**Software: Licensed and “Not Exactly”,  
Or  
The Importance Of Being Honest.**

*Fifteen men on a dead man's chest,  
Yo! ho! ho and a bottle of rum.*

Robert L. Stevenson, “Treasure Island”

No. Nope. Nobody. Nothing. No comments. Absolutely. This was a reaction of all interviewed American person: professors, teachers, and university administrators, CEO of software and real estate companies and even students on the last question from my list. It seems that nobody here can even imagine the size of the usage of non-legal and non-licensed software in Russian educational system. “Do you need a police car near you to stop at the red light?” asked me Richard Holcomb, one of the North Carolina’s best-known serial entrepreneurs, currently CEO and co-founder of StrikeIron, a company offering Web Services technology. “It is the same situation”. He was supported by many people surrounding us after his excellent presentation “Has the Golden Age of Software Startups Passed?” within the framework of The Entrepreneurs’ Lectures. “It is temporary problem”, “After improving your economy it will be solved automatically”, “Pirate software is not really a problem”, that was their comments. But no ideas on solving it now. Or even on starting to solve.

This means that it was wrong idea to seek solution of the problem in the country where this problem simply doesn’t exist. But it doesn’t mean that we can stop thinking about this problem. We must do it. And we must find solution or a way leading to the solution by ourselves. Or at least try to be as honest as possible...

But I believe that even American driver will not stop at the red light in the empty crossroad when he carries his pregnant wife into the hospital. Although, who knows?

**Undergraduate Recruiting and Engineering Communications,  
Or  
Show Time!**

*I find the great thing in this world is not so  
much where we stand, as in what direction we  
are moving -- we must sail sometimes with the  
wind and sometimes against it -- but we must  
sail, and not drift, nor lie at anchor.*

Oliver Wendell Holmes

In 2002 Engineering Communications began several new initiatives within the College of Engineering’s communication plan: increasing the number of human-interest feature stories, increasing the overall number of news releases, expanding the promotion of a number of the College’s programs, producing a combined College of Engineering newsletter/Engineering Foundation annual report, creating the first electronic newsletter for the College, establishing a College-level Achieve! website, and beginning a mailer campaign of “brag facts.”

The human-interest feature stories met with great success. These features appeared in the form of “Inner Views” web releases, and magazine spreads. The number of news releases increased greatly, and media coverage increased accordingly. Expanded promotions of the College’s programs involved

Engineering Open House, the Engineering Career Fair, Senior Design Day, the College's K-12 participation, distance education, the Women in Engineering program, outreach programs, summer programs, and scholarship programs.

During spring 2003, six "Spend a Day in Engineering" sessions were offered for freshmen admitted for fall 2003 and their parents. One of these events took place during the finalists' weekend for Park and Caldwell nominees and was offered specifically for these students. Approximately 285 students and 450 parents attended the visitation days. Engineering Open House in March 2003 drew approximately 1,200 admitted and prospective high school and community college students plus parents. In the case of Open House, additional media announcements such as mailers sent to all daily and weekly newspapers in the State and increased Web postings possibly contributed to this year's record of 3,500 attendees.

Engineering Summer Programs continued its successful high school engineering orientation program through the Student Introduction to Engineering (SITE) and six specialized workshops (aerospace engineering, autonomous robotics, Wolfpack motorsports, civil engineering, computer science, and mechatronics). During three one-week sessions in summer 2002, 109 students participated in residential SITE experiences, and 214 students participated in specialized departmental experiences. Approximately 18 percent of the participants in the summer program were female students, and 15 percent were minority students.

In fall 2002, regional receptions for prospective students and parents were held in Greensboro, Winston-Salem, Wilmington, Hickory, and Raleigh. Receptions for admitted students and their parents were held in the Charlotte, Atlanta, and Washington, DC, areas in spring 2003. These receptions were jointly sponsored by the College of Engineering's Office of Academic Affairs, the NC State Engineering Foundation, and various alumni in the areas where the receptions were held. At these events, current engineering students interact with the prospective students and their parents, and faculty and administrators make presentations about the curriculum and opportunities within the College. More than 800 students and parents participated in these events.

During 2002-03 Engineering Communications worked with the Engineering Foundation staff to merge the College of Engineering News with the NC State Engineering Foundation Annual Report at the request of the Engineering Foundation's Marketing Committee. The premier issue Engineering Frontline, with the theme, "Making a Difference," was published in January 2003 and distributed to more than 40,000 alumni as well as to academic peers across the US, the University community, advisory boards, potential students and their parents, visitors, constituents, donors, and friends of the College.

Engineering Communications also produced the first electronic newsletter for the College and Engineering Foundation staff disseminated it to more than 10,000 alumni and members of the campus community. This e-newsletter, Engineering Frontline-Online, which made its launch in April 2003 and which will appear every other month, serves as a way to keep the audience up to date between yearly issues of Engineering Frontline.

In January 2003, the University's Public Affairs office asked campus communicators to produce college versions of the NC State Achieve! website to provide a way for faculty, staff, students, alumni, and friends to tell the NC State story of achievers who are committed to making a difference in the classroom, in the research lab, and in the community. Engineering Communications launched the College of Engineering "Achieve!" website <http://www.engr.ncsu.edu/news/achieve/> in April 2003.

Engineering Communications devised a public relations mailer campaign of "brag facts" for the College. This series of postcards reflects the Achieve! campaign theme and highlights the people and programs in the College of Engineering. The first issue in summer 2002 featured NSF Career award winners, and the second issue, sent June 2003, featured three award-winning faculty members.

I put here so detailed description of all Engineering College significant actions because the importance of raising the prestige of physical, mathematical and engineering sciences in Russia

couldn't be overestimated. It is especially important in the forthcoming years of demographical consequences of crisis of the middle of the ninetieth years. All these experience and all these ideas and approaches must be studied very thoroughly again and again to create something more or less adequate in Russia.

**CONCLUSIONS,  
or  
What Now?**

*“Now, you have answers?”*

*“Yes.”*

*“Just like that? When were you going to tell us?”*

*“Not just like that,” she said, holding the flute close to her face, brushing it against her chin. “Searching. Striving. Even waiting, have you not been thinking on all that you know?”*

Keith D. Jones, “The Magic Flute”

Not amateurs and part-time workers but really professional administrative and managerial structures are actually necessary for resolving rather serious and important questions of any development. This is mainly a problem of finance but in some cases (and the development of the distance educational system in NC State gives us very good example) new administrative staff can earn enough money to provide itself.

The main sources of fund rising in NC State are various grants from private industry (State and federal funding covers less than 50% of its' total operations). This is why the research administration gives its' main attention to the process of writing and submitting different requests and proposals. And it accounts not only “winners” but also all written and presented materials. Special seminars and workshops on the proposals quality are held regularly. The Electronic Research Administration – a system of automated preparation, analysis and submitting the projects proposals – is introduced into practice and its' development continues. This is the experience we must continue to study and gradually inject in the daily practice of the administration for the scientific work in Rostov State University.

I was mostly impressed by permanent wish of almost every faculty member of NC State to make their University “the best”. At least “the best in something”. Or simply put it up on one step in the one or another ranking or rating. From the point of view of Russian scientist the amount of money passing through the NC State in general and College of Engineering in particular is really huge and inconceivable. And it is very pleasant to see that no one here rests content with that achieved, everybody fights for the new degrees of development and does not refuse herewith to help weaker in material or professional sense universities and colleges.

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*My sources are unreliable,  
but their information is fascinating.*

Ashleigh Brilliant

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## Instead of the Epilogue

*'Must you?' said Rabbit politely.*

*'Well,' said Pooh, 'I could stay a little longer if it-if you-' and he tried very hard to look in the direction of the larder.*

Alan A. Milne. Winnie-the-Pooh

*This study was made possible by a grant from IREX (the International Research & Exchanges Board) with funds provided by the Carnegie Corporation of New York. The statements made and views expressed are solely the responsibility of the author.*