ENVIRONMENTAL ENGINEERING CIVIL ENGINEERING GEOTECHNICAL ENGINEERING HYDRAULICS AND HYDROLOGY ENGINEERING MANAGEMENT TRANSPORTATION SYSTEMS WATER RESOURCES SYSTEMS ENGINEERING STRUCTURAL ENGINEERING AND CIVIL ENGINEERING MATERIALS INFRASTRUCTURE INFORMATION TECHNOLOGY ENVIRONMENTAL ENGINEERING CIVIL ENGINEERING

# CEE UPDATE

CORNELL UNIVERSITY • HOLLISTER HALL • ITHACA, NY • SUMMER 1998

## The Re-engineering of Civil and Environmental Engineering

Beginning in October 1997 the entire faculty of the CEE School engaged in an intensive strategic planning effort under the visionary leadership of Professor Mary Sansalone, and with major contributions from Professors Jim Gossett, Pete Loucks, Tom O'Rourke, Linda Nozick, and Mark Turnquist. In February 1998, the ambitious and forward-looking plan received the unanimous support of the CEE faculty and a very strong endorsement from Dean John Hopcroft, who commented that the plan was "fantastic".

The plan developed by the faculty provides a statement of the vision, objectives, and goals of the School as we approach the next century. The new directions outlined in the plan build on a distinguished history in teaching, research, and service, while at the same time define new opportunities in emerging problem areas and acknowledge changing university, national, and international priorities, opportunities, and constraints.

The faculty chose to re-organize around the concept of "mission areas" (defined as important, broad intellectual areas). This strategy views the School's strengths as being not only in its core disciplines, but also in their combined contribution to important mission areas and the links between those mission areas within and outside the School.

The illustration (Fig. 1) identifies the three important mission areas within the School: Civil Infrastructure, Environment, and Systems Engineering & Information Technology. The overlapping nature of the ellipses conveys the opportunities for links between subject areas. The faculty believes that many exciting future opportunities are "in the overlaps" between the core disciplines.


*Fig. 1 Mission areas*

The plan recognizes that in the future, opportunities will be available more often to interdisciplinary groups, and it formalizes the School's activities in Systems Engineering and acknowledges that it is time for bold new educational and research initiatives in this area. In fact, the CEE School will get a new name in the next year as new curricular initiatives in systems engineering are put in place. Civil, Environmental, and Systems Engineering will soon be the words on Hollister Hall and on our letterhead.

Three broad mission areas give the School a framework for thinking about how to take advantage of opportunities, meet new challenges, and create useful as well as exciting teaching and research initiatives. To convey the fundamental make-up of these areas, a second schematic (Fig.2) represents the intellectual core areas for each mission-oriented area. Superimposed on the diagram are key approaches used in analyzing and synthesizing solutions to problems, as well as the aspects of design and construction that are important aspects of the School's educational and research mission.

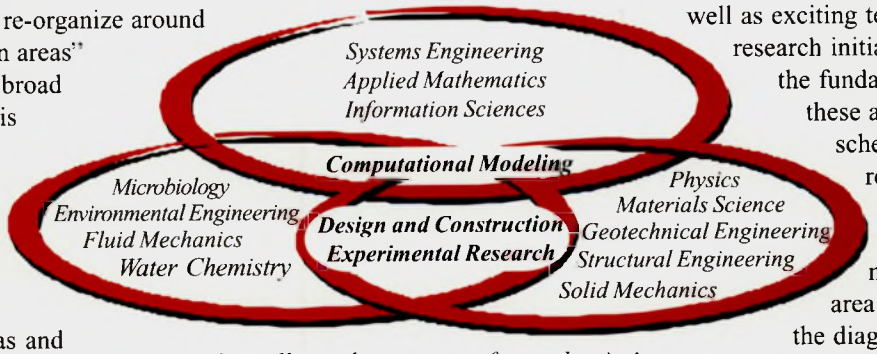



*Fig. 2 Intellectual core areas for each mission area.*

(Continued on page 8)

# A Word from the Director

*photo by Tony DeCamillo*

Your response to the revitalized CEE newsletter in the fall of 1997 was most gratifying. We received numerous compliments on its quality and the content, as well as expressions of strong encouragement to continue this means of communicating with our alumni and friends around the world.

A number of significant developments took place since the last issue of CEE Update and the content of this newsletter is, at least in part, a reflection of them. The development of the CEE Strategic Plan as a road map for the CEE School into the 21st century is the major accomplishment of our faculty. I am pleased with the overwhelmingly cooperative spirit of our faculty that made the creation of the new CEE Strategic Plan possible. Among other things, the plan is designed to help the School meet the challenges of the next century and to attain new levels of excellence and cooperation. The feature article, The Re-engineering of CEE, gives you a flavor of the creative and cross-disciplinary thinking and the bold educational and research initiatives that are the hallmark of that document. While not presenting all aspects of this comprehensive plan, the article conveys the new way of thinking and intellectual organization within the CEE School, and between the school and the rest of the College and the University.

> *"We forsee the exciting problems of the next century .... being solved by cross-disciplinary teams."*

Perhaps the most significant feature is focusing educational and research initiatives into three key "mission areas". Following this framework, resources and faculty expertise will be focused on solving important problems in these mission areas and in the overlaps between mission areas. We foresee the exciting problems of the next century in Civil Infrastructure, Environment, and Systems Engineering being solved by cross-disciplinary teams. The School's leadership role in the new NSF funded Institute for Civil Infrastructure Systems is just one example of our new cross-disciplinary directions. Following this line of thinking, our undergraduates and graduate students will need to be educated in a broader way that allows them to gain a stronger understanding of approaches to solving very large, and often much more difficult and complex problems. Initiatives within the strategic plan that call for the development of systems engineering curricula at both the undergraduate and graduate levels is designed to address this need. These curricula are being developed in cooperation with departments such as Computer Science, Operations Research, Electrical Engineering, and Mechanical Engineering. Developing a core undergraduate program with elective applications in areas such as Environmental Systems, Infrastructure Systems, Transportation Systems, Power Systems, Computer Systems, and Networks is an important objective of the plan.

In addition, we have implemented revisions to our environmental undergraduate and professional master's programs. Discussions are underway with the department of Agricultural and Biological Engineering, as well as other faculty from across the college, about the possibility of forming an even stronger, integrated, and accredited environmental program at both the undergraduate and graduate levels. We are also working with the Architecture Department to develop major and minor options for undergraduates to pursue joint study in architecture and civil or mechanical engineering. These and many more ideas are highlighted in our strategic plan. For more details go to http://www.cee.cornell.edu.

A number of our alumni and friends have followed our invitation to let us know about yourself and your life since you left Cornell. We will continue to include stories about our alumni. Please let us hear from you (see page 5).

The next "Word from the Director" will have a different picture and signature. After ten years in this position, I will step down this summer to return to full-time teaching and research. I am genuinely grateful for having had the opportunity and honor to serve this great faculty and staff, and to work with such bright students and loyal, dedicated alumni. I will always treasure the numerous friendships that I have made during this time.

Being CEE Director has been a tremendous learning experience for me and I believe we have accomplished quite a bit together over these years. I remember well, the somewhat rocky beginnings ten years ago when the School was reorganized and the Departments of Structural Engineering and Environmental Engineering were brought together under one administrative umbrella. Since that time, we have continued to enhance our solid reputation as one of the top civil and environmental engineering programs in the country. Through the continued generosity of our alumni and their families we have substantially increased our endowments and created several state-of-the-art teaching and laboratory facilities. I look forward to continue to be a member of this great CEE team, on and off campus. I genuinely appreciate all the support you have given me over the last ten years as I have worked to build a unified CEE School.

# Mike Nadler Tackles New Challenge

In 1954, Michael Nadler '56 almost left Cornell Civil Engineering to study in the ILR School. The first two years of the engineering program didn't inspire him. A classmate, Donald Graves, took him downtown to *Zinc's*, the local watering hole, and helped him change his mind. He assured him that classes became more engaging when he finished the basic curriculum. He could look forward to studying structures, hydraulics, etc., and if he stayed, he would be prepared for myriad of careers. Young Nadler stayed and survived summer survey camp, learning and applying structural analysis and behavior, and became active in the Greek system, specifically, Delta Chi.

Nadler reports, it is his involvement in Greek life, that taught him about pride, and his struggle and success in the College of Civil Engineering (yes, it was a college in '56) that taught him candor, communication skills, and honed his analytic ability. With these skills and strengths, Nadler has moved through and mastered several careers, and since retiring, is sharing his talents through a busy schedule of volunteer work.

One of Nadler's passions is Cornell University, in particular the School of Civil and Environmental Engineering, and the Athletics and Theatre Departments. Through his leadership and commitment, Nadler helped the Class of '56 raise over two million dollars for the 25th Reunion Campaign in 1981. That achievement has served as a model for all succeeding class reunions. Equally as important as the financial contributions he has garnered is the time and effort Mike Nadler has spent on alumni affairs, including his years on the University Council. Currently, he is heavily involved in reviving the Cornell Chapter of Delta Chi.

In 1996 Delta Chi was in jeopardy due to legal judgements. Fellow alumni interested in salvaging the waning organization gathered in December 1996 and developed a plan to improve finances and programming. The Delta Chi Housing Corporation was created and a Board of Directors, all alumni, was named. Among those names was Nadler's who was also voted President. Through a series of meetings, the Housing Corp. developed a plan to improve finances and physical plant issues. An Advisory Board of Trustees was established to focus on student support. As Nadler states, "There's a 'sticks and bricks' group and a 'touchy-feely' group". Together, both Boards are helping to revitalize and improve the quality of life and provide leadership training at Delta Chi.

*Nadler outside Delta Chi in 1954.*

Nadler's contributions to Cornell have been recognized through the highest honors that the university bestows on its alumni. In 1997 he and his wife Lorraine received the "Foremost Benefactor Award". In October, he will be honored with the "1998 Frank T. Rhodes Exemplary Alumni Service Award".


***Nadler***

After serving in the Air Force as a construction engineer, Nadler worked as a sales engineer at the dawn of the semiconductor age followed by a five year stint working for Douglas Aircraft on the auxiliary propulsion system for the Saturn rocket. After the moon landing, he continued with Douglas in aircraft manufacturing. He eventually moved into the financial services industry with Merrill Lynch Pierce Fenner & Smith where he worked for twenty-five years until retiring as Vice President in 1995.

Nadler believes his Cornell education was fundamental to his success. "I keep coming back to some very basic themes: education, risk taking, learning from mistakes, and serendipity. If you put them in a pyramid shape, the foundation would most certainly be education, and for that I have Cornell University and the School of Civil and Environmental Engineering to thank", Nadler states. He fondly remembers summer survey camp in 1955 and the survey crew of Richard Bump, Howard Emory, Donald Graves, Roger Judd, and Doug Merkle (team captain). The golden rule at the time was, "If Mother Nature calls, answer her the best you can, but don't do it 'on the line'!" Nadler's face expresses the knowing smile of a man whose life has been, and continues to be, rich with tradition, fellowship, and service.

# Risk Reduction in Transporting Hazardous Materials

You're driving behind a glistening tanker truck. The warning signs are clear. Highly volatile, hazardous material. Ahead, remnants of an accident earlier in the day lay strewn across the road. Glass shards and twisted metal fragments await the hardened steel-belted radials of passing vehicles. What if that tanker's tires fall prey to the accident debris? What would that mean to you and other motorists sharing the road? What about the neighboring community in danger of exposure to toxic, explosive fuel?

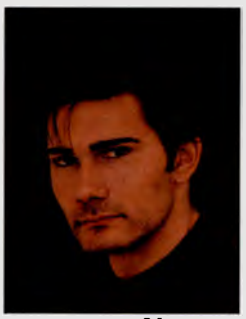
Answering these questions and devising a preventative protocol is the topic under study by Jose Alvarez, a Master of Science candidate in Civil and Environmental Engineering. One hypothesis being tested is the benefits of providing real-time routing information. This technique would direct drivers through the best route as they traveled, devising detours to avoid delays and hazardous situations such as accidents, and other dangerous driving conditions. In theory, real-time routing would help drivers avoid losing time and risking safety by being diverted from accident sites, road construction and traffic congestion. At the core of the routing system would be a central agency responsible for obtaining traffic, accident, and construction data and continuously updating a bank of information to be used by transporters of hazardous materials (hazmats).

A key part of Alvarez's work is the development of a computer simulation that would test the effect of real-time routing. One obstacle in evaluating real-time routing is developing a strategy that would provide quantifiable results. Alvarez reports working on devising "... a solid metric that allows a standard comparison of several alternatives. The specification of such a metric is complicated by the presence of multiple objectives and stakeholders, as well as inherent difficulties in estimating the nature and scope of the outcome of a hazmat incident."

In a country where eighty-four percent of hazmat incidences from 1988-1995 occurred from highway shipments, the value of Alvarez's work seems clear. Alvarez cites a 1995 CNN World News Report regarding a ruptured tank car as evidence as the growing problem and concern regarding hazmat transportation. In 1995, a cloud of toxic gas, released from the tank car, resulted in the evacuation of 1400 people from their homes in Bogalusa, Louisiana. One hospital in the region treated 350 individuals for chemical inhalation. This event, although terrible itself, could have been even more tragic if it had occurred in a more heavily populated area.

*"The specification of such a metric is complicatd by the presence of multiple objectives and stakeholders, as well as inherent difficulties in estimating the nature and scope of the outcome of a hazmat incident."*

Since the benefits of real-time routing aren't clear, one of the most meaningful methods to test the theory is to create an elaborate computer generated simulation. This would also aid in providing quantifiable data regarding the effectiveness of real-time routing. By using his skills and experience in computer science, operations research, management and transportation engineering, Alvarez is taking a multidisciplinary approach to this problem. Alvarez views the problem as a complex system requiring significant evaluation.



**Alvarez**

*photo by Jerry Hinkle*

**Jose Alvarez (CEE '95, MS '99)**, a Texas native, grew up in Cali, Columbia. He transferred to Cornell in 1993 and concentrated in structural engineering.

His interest in engineering was sparked by his grandfather's interest in design, high school teachers, and a successful structural design firm in his family. Although Alvarez focused on structures as an undergraduate, his current interests are in transportation engineering.

As an undergraduate, Alvarez worked on research with Professors Nozick and Turnquist, both with ties to transportation systems engineering. Alvarez reports that his experience was extremely positive and made the prospect of returning for graduate study in transportation systems engineering even more appealing.

Alvarez would like to continue research in engineering and eventually learn to simulate biological systems. He is dedicated to serving his community and in his free time, collects used computers for donation to Alpha House, a local substance abuse rehabilitation facility.

# New Faculty Members Join CEE

*photos by Tony DeCamillo and Adriana Rovers*

***Bennett***

**Dr. F. Lawrence Bennett** returns to Cornell after serving the University of Alaska at Fairbanks for twenty-nine years. While at U. of Alaska Bennett held an eclectic assortment of positions from Department Head to Vice Chancellor for Academic Affairs. Bennett received a B.C.E. from Rensselaer Polytechnic Institute and his M.S. and Ph.D. from Cornell University.

Bennett's work is focused on engineering management and he maintains an active engineering and management consulting practice. His research interests include management of construction in cold regions, project management, and information technology applications in engineering management. In 1996, Bennett published his third book, The Management of Engineering: Human, Quality, Organizational, Legal and Ethical Aspects of Professional Practice *(John Wiley & Sons, 1996)*.

An experienced academic, Bennett has received many teaching awards at the University of Alaska. Bennett is an active member of the American Society of Civil Engineers and the National Society of Professional Engineers.

***Billington***

**Dr. Sarah L. Billington** joined the CEE faculty from the University of Texas at Austin where she completed her graduate studies. Billington received a B.S. in Engineering and a Certificate in Architecture and Engineering from Princeton University in 1990. In 1991 she was awarded a Fulbright Fellowship and attended the Swiss Federal Institute of Technology in Zurich. Shortly afterwards, Billington returned to the United States and entered the M.S./Ph.D. program at the University of Texas at Austin. Billington was awarded a Master of Science in fall of 1994 and completed her doctoral studies in December of 1997.

Billington's specialty is the design and behavior of concrete structures. Her current research program includes seismic behavior of pre-cast post-tensioned bridge piers, numerical modeling of pre-cast post-tensioned beam-column joints under seismic loading, and experimental/numerical methods for investigating aging and deterioration in concrete structures including damage assessment and prediction.

Currently, Billington is serving as a Visiting Scholar at Delft University of Technology and is involved with the computational mechanics group headed by Professor Rene deBorst investigating computational methods in non-linear solid mechanics.

***Cowen***

**Dr. Edwin A. Cowen** joins the Cornell CEE faculty from Stanford University where he served as a post-doctoral scholar. Cowen is a 1987 graduate of Brown University where he received a B.S. in Civil Engineering with an emphasis in structures. After working in industry for three years Cowen returned to school and received his M.S. in Civil Engineering with an emphasis in water resources from Stanford University. Cowen remained at Stanford and in 1997 earned a Doctor of Philosophy in Civil Engineering with a minor in Mechanical Engineering.

Cowen's current work is focused on experimental fluid mechanics, specifically, experimental flows. His approach includes developing laboratory-based experiments that capture the important physical processes and allow highly accurate spatial and temporal measurements to be taken. Cowen is currently developing research programs in momentum transfer at an air-water interface, wave induced mixing at bottom boundaries and in surf zones, the effects of bubbles on near free-surface turbulence structure, wave induced mass transport, and breaking wave processes.

Send articles, alumni information, or photographs for the newsletter to:

CEE Update
Civil and Environmental Engineering
Cornell University
220 Hollister Hall
Ithaca, NY 14853-3501

Please include contact address, phone number or e-mail address. We will archive all photos unless otherwise directed. We reserve the right to edit submissions.

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Dawn Zeligman, Editor-In-Chief
Mary Sansalone, Contributor

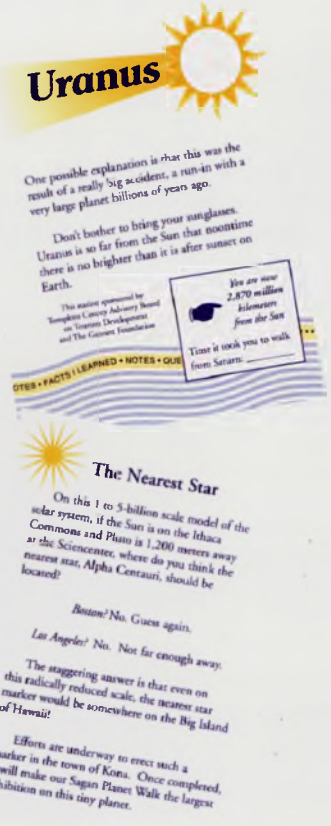
# CEE Continues Commitment to the Community

Located in what is comically called 'centrally isolated', Cornell faculty, students, and staff recognize and respond to the needs of Ithaca and surrounding rural communities. Be it through projects completed by our student chapter of ASCE, or faculty working outside of the campus arena, Cornell's civil and environmental engineers support science education for local families and youth.

Charles Trautmann, Adjunct Associate Professor in Civil and Environmental Engineering, is a generative individual who teaches a course in Professional Practice and Ethics in Engineering Management and also serves as Executive Director of the Sciencenter located in downtown Ithaca, New York. The Sciencenter is one of only 200 centers worldwide devoted to promoting science exploration, education, community involvement, and understanding of scientific issues and technology. Involved with the Sciencenter since 1990, Trautmann is devoted to the center's mission to, "...serve the educational needs of a dynamic community, excite the indifferent, and inspire the curious."

The School of Civil and Environmental Engineering has been involved with the Sciencenter since the Cornell Chapter of A.S.C.E. performed a detailed structural design for the current building in fall 1991. Students and faculty were so invested in the project that a Special Topics course in timber design and construction was developed, by Professor Richard N. White, to provide students with pertinent information. Other Sciencenter projects have included laying the floor and building trusses, design and construction of a pedestrian bridge linking the center and Cornell's Cooperative Extension, and construction of a wave pool exhibit.

Trautmann remarks that one challenge he faces as the Executive Director of the Sciencenter is maintaining a balance between developing the internal systems of the organization while nurturing external relationships that feed that growth. As an active member of his community, and a person committed to science education in all its forms, Trautmann stresses the need to develop science education in our schools. Trautmann believes, " we need to train teachers to teach science as a process; a rational approach to finding out about the world rather than just a body of facts. Society will benefit from all of us understanding the importance of science, as well as having an understanding of the scientific method."




## Sagan Walk Provides Perspective

In the past five years the Sciencenter has worked to increase the diversity of exhibits and reach a wider audience. Toward that end, in October 1997, the Sciencenter opened its largest interactive exhibit, the Sagan Planet Walk. Dedicated to the memory of Carl Sagan (1934-1996), Professor of Astronomy and Space Sciences and Director of the Laboratory for Planetary Studies at Cornell University, the Sagan Planet Walk is a one to five billion scale model of the solar system that extends from the Ithaca Commons, to the Sciencenter, located twevle hundred meters away.

The interactive portion of the exhibit consists of a fact-filled *PASSPORT to the Solar System* that contains information about each planet. Each virtual space explorer walks from planet to planet, examining the scaled planet models floating in crystal clear casements, and reading information at each stone icon. Member merchants stamp the passport after each planetary visit and participants can track the time it takes them to walk from planet to planet.

The Sagan Planet Walk, just one of many engaging and entertaining hands-on exhibits, continues to attract curious people of all ages. For CEE Alumni visiting Ithaca, consider visiting the Sciencenter knowing that it is part of CEE history as well as the greater Ithaca community.

*PASSPORT to the Solar System*
©1997 Ann Druyan and the Estate of Carl Sagan

## Mental Muscle Prevails!

*photo by Tim Bond*

The sun glistened on the lake, rippled from the wind and the wakes of racing canoes. It was a beautiful day for a canoe regatta, a common event in New York where lakes dot the landscape, except that these canoes were made of concrete. The Cornell Concrete Canoe Team participated in the Upstate New York Regional Competition held on April 11-12, 1998. The thirty-two-person team captured first place for oral presentation and second place overall.


*Holly McNamara '99 and Dirk Kestner '99 take the canoe out for a test run.*

Students also garnered second place awards in the women's sprint, co-ed sprint and men's long distance and fourth place in the women's long distance. Tim Bond, ASCE Advisor, remarked that the, "...students gave the most professional presentation. They were concise, succinct, factual and complete." The five-minute presentation, a required part of the competition, covered canoe design, concrete mix design, construction of the canoe and management of the project.

The team invested 1190 hours designing and building the concrete canoe christened Red Storm Rising. Following guidelines dictated by the ASCE Canoe Competition, students designed an 18-foot long vessel that weighed 125 pounds. The concrete used had a compressive strength of 4200 psi. This year, the canoe differed from the 1991 canoe in that it had an increased slope and rocker at the bow to improve turning ability. The team also decreased the rocker at the stern to increase turning stability.

The canoe is on display in the Hollister Hall Lobby.

## CEE Initiates Engineering Minors and Architecture Concentration

After considerable debate and planning, a CEE sponsored initiative won approval of the College faculty, and undergraduates in engineering are now able to declare a minor in another field of engineering. Each field can choose whether to participate in the program and CEE is playing a leading role by creating four minors in engineering. Students from other fields will be able to choose to minor in civil infrastructure, the environment, systems engineering, or engineering management. Each minor will consist of a flexible framework of approximately six courses. Faculty foresee tremendous interest in this new program as undergraduates frequently have interests outside of their major field. Students in CEE may now, for example, explore their interest in Mechanical and Aerospace Engineering (M&AE), Computer Science, or Material Science. In a second curricular initiative, CEE will be participating in a pilot-program developed with M&AE and the School of Architecture, Art, and Planning.

With support from Provost Don Randel's office, CEE, M&AE and the School of Architecture, Art, and Planning are forging a new alliance by the development of a Concentration in Architecture. Similar to a minor, the concentration will offer students the opportunity to study architectural history, theory, and design, and choose from a long list of electives depending on their career goals and interests. Although many students in the concentration will choose to study at Cornell, a number may elect to spend a semester abroad in Cornell's Rome Program. CEE expects approximately ten undergraduate students to participate in the architecture program each year.

### Survey says....

Out of the sixty CEE bachelor of science graduates in 1998, fifty-three percent took courses in architecture. Most frequently taken were courses in architectural history and theory.

# Decision Support Systems Aid in Environmental Managment

**Loucks**

A multi-disciplinary team, consisting of a regional economist, an ecologist, and four agricultural-environmental engineers, and headed by CEE's Professor Pete Loucks, has as its goal, improving the ability to predict the interdependent socioeconomic, terrestrial, hydrological, and ecological processes that define the dynamics of land use changes and their effects on water and associated biota. The team plans to develop and then provide community planning and environmental boards with an interactive computer-based technology designed to assist them in evaluating proposed changes in land and water use. This technology will include models for predicting the economic and ecological impacts of decisions on water and land use practices and policies.

To develop this technology, the research team must identify and quantify how various land use policies impact surface and groundwater quantity and quality, and how flows and pollutant concentrations affect aquatic and adjacent terrestrial systems. The next step will be to build predictive computer models describing how changes in land and water use policies influence socioeconomic activities, local economic development, and tax revenues.

The decision support systems will be tested on local watersheds and the systems being developed will be applicable to a variety of watersheds similar to those found in the Northeastern US.

This interdisciplinary project is just one of a number of projects on which Professor Pete Loucks is working. The Great Man-made River Project in Libya (GMRP) is a project Loucks continues to work on with a group of Master of Engineering Civil (ME(C)) students from Cornell, and Ph.D. students at TU-Delft. This project, which was developed through UNESCO in Paris, is being completed in cooperation with Libyan engineers.

The GMRP is one of the largest civil works projects in the world. When completed the 4-meter diameter pipeline will stretch from the Kufrah well field in the Sahara Desert to Tripoli. That is roughly equal to a pipeline running from southern Switzerland to northern Scotland. For the past two years, ME(C) students have worked on economic analyses including cost comparisons of alternative methods Libya can use to meet their water demands either through desalination or via the groundwater pumping system known as the Great Man-made River Project.

Last year, ME(C) students also evaluated capacity expansion scheduling alternatives for the portion of the pipeline that has yet to be built. Next year, Loucks plans to have the group work on a real-time optimization model for operating the GMRP.

Other projects Loucks is engaged in include environmental restoration and sustainability criteria for water resources development, conflict negotiation in large international river basins, and probabilistic optimization and simulation modeling for water resources problems. Loucks, who is a member of the National Academy of Engineering, works with over a dozen different organizations including the World Bank, WHO, UNESCO, and NATO.

Loucks teaches Water Resource Systems, for which he coauthored the text, and Engineering Economics and Management, a course required of all CEE undergraduates. Loucks is the coordinator for the Environmental area and is responsible for guiding research and educational initiatives.

### *Environment*

**Research Initiatives:**

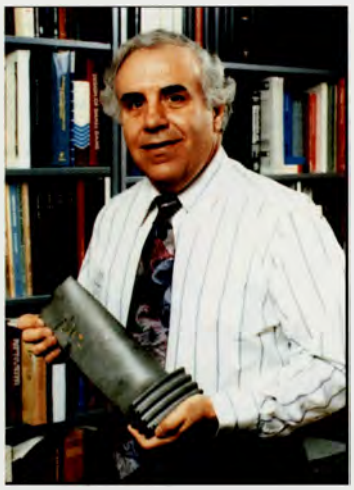
√ Integrate biotechnology and molecular biology into research program

**Educational Initiatives:**

√ Create interdisciplinary Master of Engineering Program
√ Renovate hydraulics teaching laboratory
√ Develop, in conjunction with other departments, an accredited undergraduate curriculum and a new, broad, graduate field

For more information on faculty research projects, visit the CEE Homepage at http://www.cee.cornell.edu

# Aging Aircraft: A National-Scale Infrastructure Dilemma



**Ingraffea**

In a 1997 speech, Federal Aviation Administrator David R. Hinson reported that although the United States carries fifty percent of the world's air traffic, it has only eight percent of the fatalities. Over the past five decades, aviation accidents have declined; a trend Mr. Hinson reported is due to consolidated efforts of government and industry to improve pilot training and aircraft maintenance.

The Cornell Fracture Group (CFG), lead by Professor Tony Ingraffea, has been involved in government-sponsored research and development in aircraft safety, specifically, crack growth, fatigue, corrosion fatigue and fracture. Ingraffea hopes that by studying these local phenomena and increasing predictability, a predictive maintenance protocol may be developed. By combining crack theory with applied systems engineering, millions of dollars may be saved by repairing airplanes in danger of major structural degradation. The alternative to repair would be the costly replacement of aging aircraft. Ingraffea's group has been working on crack growth phenomenon for over a decade and their contributions were recognized by NASA in 1996 when CFG received a NASA Group Achievement Award for their work on NASA's Fuselage Structural Integrity Team. CFG's work focuses on the creation, validation and transfer of state-of-the-art computer simulation of crack growth in aerospace structures using the FRANC-family of simulators. By using these simulators, scientists at NASA and the FAA have developed a better understanding of material and structural behavior in aging aircraft. CFG has also provided interactive support of industrial use of their simulators.

The research completed by CFG has led to several other projects that are cross-disciplinary in nature. In February 1998, Professors Ingraffea and Mircea Grigoriu (CEE) along with Professors Mathew Miller and Paul Dawson (M&AE) were awarded a research grant from the Air Force Office of Scientific Research for probabilistic simulation of the initiation of fatigue cracks in environments in which corrosion fatigue can occur. Another joint project involves CFG, Professors Keshav Pingali and Steve Vavasis (CS) and professors from Notre Dame and Delaware. This group

*This interdisciplinary approach...can also foster a link between advanced theory and simulation, and larger issues of economy and safety.*

*(continued on page 13)*

*photo by Charles Harrington*

## *Civil Infrastructure*

**Research Initiatives:**

- √ Infrastructure Systems, including predictive maintenance
- √ Renovate structures, geotechnical, and and materials laboratories into state-of-the-art facilities for coupling simulation and experimental mechanics
- √ Develop research collaborations with those in materials processing and behavior

**Educational Initiatives:**

- √ Create a graduate curriculum and field in mechanics in conjuction with other mechanics based disciplines
- √ Bring the study of advanced materials into the curriculum
- √ Develop an undergraduate minor in Architecture and an accredited undergraduate degree program, 'Engineering & Architecture'

# Systems Engineers Linked with Industry

*photo by Tony DeCamillo*

***Nozick***

Systems engineering is a discipline that focuses on the identification, synthesis and analysis of systems. Specifically, how can systems be designed, implemented and operated effectively? Management of information is critical to successful system design and operation and requires attention to how information must flow through a system to maximize benefits and minimize costly, unproductive system defects. Comprehensive system solutions must also include evaluation of human behavioral and social issues as well as to more traditional technical concerns. Successful systems engineering requires understanding how people will function within systems, and how people interact with systems to meet their needs.

The discipline of systems engineering is of fundamental importance to the operation of many systems that are critical to society. Our health care system, the routing of hazardous materials along highway networks, the development of decision support tools for military logistics and planning, and the design of an automobiles are all problems tackled by system engineers.

During her sabbatical, Prof. Linda Nozick is working with a team at General Motors to develop planning tools to improve the vehicle design process. Under ever increasing pressure to develop new products more rapidly, the mantra in corporate America today is better, faster, cheaper. The auto industry is certainly no exception to this ideology. The design of a new automobile literately requires hundreds of engineers, from different engineering disciplines, to make thousands of interrelated decisions over several years. The demands of the marketplace require sound decisions be made more quickly, and with fewer resources. And if the management of a single automobile design program is not complicated enough, car manufacturers must manage the development process for many new vehicles simultaneously.

Nozick's work requires explicit attention to an array of financial, social, and technological issues. The tools her team is developing are mathematical models, which will be embedded in computer-based decision support systems that will be used by engineers to optimize the organization of work and to improve the assignment of individuals to tasks. Through a complex series of evaluations and formulations Nozick's team will improve productivity which, in turn, will translate into financial savings for General Motors.

### *Systems Engineering & Information Technology (SE&IT)*

**Research Initiatives:**

- √ Stochastic Systems
- √ Networks
- √ Decision Support Systems

**Educational Initiatives:**

- √ Create a new graduate field for MS/PhD students
- √ Create a new Master of Engineering Program
- √ Create a new interdisciplinary undergraduate program in cooperation with other departments

## New Concentration Area Identified, Core Competencies Defined*

Systems are complex because they involve many separate components, the behavior of those components and/or their relationships to one another may be nonlinear, there may be uncertainty about parameters of the system, and the system may be expected to meet multiple objectives. SE&IT includes the development and use of analytical tools designed to identify and evaluate alternative system designs and operating policies, and to predict the technical, economic, environmental and social impacts of those alternatives. It explicitly incorporates the social, behavioral and organizational issues which are relevant.

SE&IT relies on the innovative and creative use of information and techniques to synthesize information from data. Core competencies include:

- the ability to conceive, formulate and use mathematical models of complex systems;
- the ability to apply tools from mathematics, statistics, and computer science to problems of substantial societal importance; and
- the ability to integrate social, behavioral and organizational elements into the models we develop.

*Excerpted from the CEE 1998 Strategic Plan

# Sansalone to Spend Year at Harvard

Harvard University recently named Professor Mary Sansalone a J.F. Kennedy Fellow. She will spend the upcoming year studying at Harvard, earning a Masters in Public Administration in an intense mid-career program at the Kennedy School of Government and the Graduate School of Education that focuses on leadership of organizations, negotiation and policy issues related to higher education. Derek Bok, former president of Harvard, will advise her research in the area of leadership of academic institutions.

Sansalone states, "The Kennedy Fellowship offers me an opportunity to form a broader vision and prepare for a strong leadership role in academia. I am looking forward to new challenges."

Tireless in her efforts in working for change and for her devotion to Cornell's students and to CEE, this year Sansalone has been responsible for leading the successful strategic planning effort, organizing the Provost's pumpkin competition, and initiating the concept of minors in engineering. Sansalone also worked to bring the Concentration in Architecture to fruition. These efforts typify her belief that many interesting educational and research opportunities lie in interdisciplinary efforts.

> *"The Kennedy Fellowship offers me an opportunity to form a broader vision and prepare for a strong leadership role in academia. I am looking forward to new challenges."*

After receiving her Ph.D. from Cornell in 1986, Sansalone spent a year as a research engineer with the Structures Division of the National Institute of Standards and Technology before returning to Cornell in 1987 as a visiting lecturer. The next year she was appointed to a faculty position and she moved quickly through the ranks on the basis of her outstanding research, teaching, and service and in 1997 she was named a full professor. She served as Associate Director of the School of Civil and Environmental Engineering from July 1993 through December 1994 and again from July 1996 to June 1997.

She has received numerous research awards, including a 1989 Presidential Young Investigator Award from the National Science Foundation and the 1991 Wason Medal for Materials Research by the American Concrete Institute. In addition, her graduate students have won eight national awards for their thesis work in the areas of numerical simulation of transient stress wave propagation in bounded solids, nondestructive evaluation of heterogeneous materials and structures,and signal processing. Sansalone is co-holder of a patent (1992) for an impact-echo field-test system. Since 1994 she has been involved in a joint effort with William B. Streett, Dean of Engineering Emeritus, to transfer the nondestructive testing technology developed through her research program to the public sector. Two successful start-up companies have spun off from this work. Impact-echo test instruments are now manufactured by a number of companies in the U.S. and Europe, and are used all over the world in evaluating the safety and stability of concrete and masonry structures. Their use has resulted in savings of hundreds of millions of dollars in the repair and rehabilitation of bridges, tunnels, seawalls, buildings, and other structures.

Sansalone's teaching and courses are legendary, and recognition of her accomplishments in teaching and mentoring students include: the 1992 National Professor of the Year Award from the Council for the Advancement and Support of Education and the Carnegie Foundation, a five-year Weiss Presidential Fellowship from Cornell University for effective and inspiring teaching of undergraduates, and the 1989 Tau Beta Pi Award for Excellence in Teaching from the College of Engineering. She has used the $40,000 from these various awards for support of undergraduate students and development of projects to attract young women and minorities to the sciences.

She served for three years as faculty advisor to the Student Chapter of the American Society of Civil Engineers, during which time the Chapter was selected as the most outstanding Student Chapter in the U.S. Sansalone has also been named as "the faculty member who had the greatest influence" by Cornell Presidential Merrill Scholars Claudia Johnson '89, Ellen Rathje '93, and Kristen DiNorscia '97.

She served for nine years as faculty advisor and fundraiser for the Cornell outreach program, Expanding Your Horizons in Math, Science, and Engineering for 6th-8th grade girls. In 1993, she was Co-Principal Investigator on a successful proposal for $300,000 to the Sloan Foundation to fund programs related to the recruitment and retention of women students. In 1997, she pushed for and helped formulate a comprehensive year-long climate assessment in the College of Engineering which is now laying the basis for an improved climate for junior faculty, women faculty and graduate students. This past spring she was awarded Cornell University's Cook Award for "her work on behalf of women at Cornell and beyond".

# Enriching the Undergraduate Experience

*photo by Tony DeCamillo*

***Kim Chan '98***

Each year approximately twenty-five Civil and Environmental Engineering undergraduate students choose to enter the College of Engineering Cooperative Education Program (Co-op) and join the working world for seven months. The program, which arranges internships in companies throughout the country, provides students with the opportunity to be an engineer, or at least get a taste of what it will be like after graduation.

In the same year, one or two students take advantage of the Cornell Abroad Program. These students travel to other Universities to study in a different setting and experience other cultures in the best way possible, up close and in person. Both programs supplement the undergraduate experience, enrich students' lives, and augment their marketability in an increasingly competitive job market. Because each program demands a student be away from campus for five to seven months, participating in both programs is rarely considered. In essence, a student would be choosing to stay in school longer in order to meet the rigorous course of study required in the College of Engineering.

> *"Studying abroad helped me come to terms with who I am, where I was from, and where I am now."*

In 1996, Kim Chan made that choice, to spend an additional summer at Cornell to facilitate participation in the Co-op program and spend a semester abroad in Taiwan through a program sponsored by Scripps College. Chan spent her semester abroad at National Cheng-chi (Political) University in Taipei, Taiwan. Curious about her ethnic heritage, she studied the Chinese language, art and calligraphy, literature and history, and anthropology. As a young adult, Chan reported being conscious of straddling the line between two cultures, a sort of cultural multiplicity. "Studying abroad helped me come to terms with who I am, where I was from, and where I am now." Chan commented that the chance to explore her interests, both engineering and her ethnic roots, has always been an important and valuable part of the educational process for her. Chan engaged in further exploration while she spent seven months working for two engineering firms through the Co-op program. Chan's Co-op assignment provided her with a variety of experiences, only a portion of which directly related to her engineering studies. Chan started her Co-op with COMSIS Corporation which, during her tenure, was acquired by Michael Baker, Jr., Inc. Chan experienced the turmoil and tribulation that occurs during a corporate takeover and learned the importance of company loyalty and good management.

Chan's Co-op program included a diverse range of work related to transportation engineering. Two of three projects required Chan to learn new computer applications, VisualBasic, Netcomp, and MinUTP. Her other responsibilities included writing user manuals and safety guidelines, researching and tabulating data related to regulation compliance, and participating as a team member on the different projects. Chan explained that her work with COMSIS Corp. and Michael Baker, Jr., Inc. helped her explore and affirm her interest in transportation engineering.

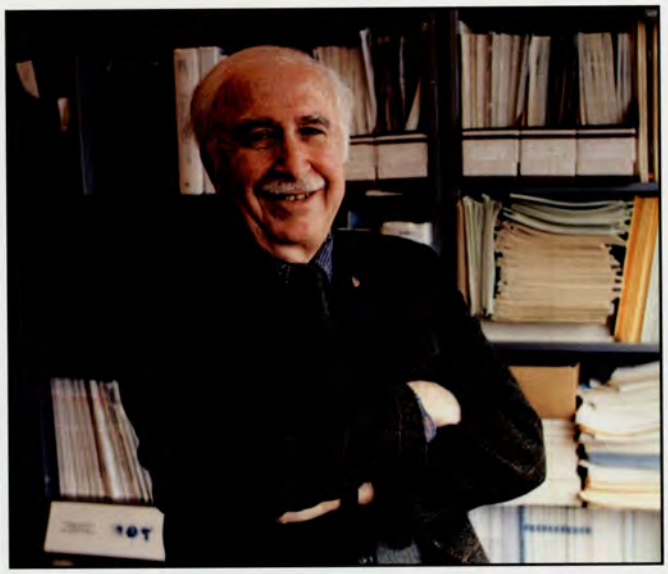
Chan states that she had two goals when she entered college, "...to learn more about myself as a Chinese person and to study engineering." Through a self-designed journey of discovery, Chan's experience as an undergraduate has helped her reach these goals.

## Survey says...

- In the past five years, the number of CEE students participating in Co-op has increased from 18% to 55%.
- Cornell University students can choose to study abroad at 113 colleges and universities in 33 countries.
- Not all study abroad programs require a student know the native language.

# Lynn Honored for Years of Service

*photo by Doug Hicks*



Following thirty-eight years of service to Cornell University, Dr. Walter R. Lynn retired in January 1998. The School of Civil and Environmental Engineering honored him at a retirement banquet on May 8, 1998.

Lynn is most noted for the application of system analysis methods to environmental engineering. His research in the application of optimization methods to wastewater treatment plant design, and to the capacity expansion scheduling and financing of such infrastructure is also known worldwide.

While at Cornell he served as Director of the Center for Environmental Quality Management (1966-76); Director of the School of Civil and Environmental Engineering (1970-1978); Director of the Science and Technology Program (1980-1988); Faculty Trustee (1980-1985); Dean of the Faculty (1988-93); and Director of the Center for the Environment (1997-1998).

Former student and CEE faculty member Dr. Pete Loucks recalled a humorous story about Lynn and his, well, other side. After playing a fast-paced game of noontime squash, Lynn and Loucks went to the pool, in Teagle Hall, to cool down. At the time, some years ago, noontime swim was regularly reserved for men and they frequently went swimming au naturel. Not thinking to check, the two red cheeked laureates dashed across the deck and dove into the pool. It wasn't until they were in flight that they spied the co-eds in the water. Loucks reported that Lynn, who was Director of something at the time, feared the next issue of the Cornell Sun would have an exposé in the most literal sense.

Lynn, not content to be idle in his retirement, is the Cornell University Ombudsman.

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*(Aging Aircraft, continued from page 9)*

garnered a National Science Foundation Challenge Grant to develop capabilities to perform crack growth simulations on teraflop computers.

Ingraffea believes interdisciplinary teamwork leads to deeper understanding of problems related to cracking. This interdisciplinary approach, Ingraffea states, can also foster a link between advanced theory and simulation, and larger issues of economy and safety.

Ingraffea is the coordinator for Civil Infrastructure and is responsible for guiding research and educational initiatives.

## Faculty Listing by Primary Mission Area

### Civil Infrastructure

John F. Abel
Sarah L. Billington
Mircea D. Grigoriu
Kenneth C. Hover
Anthony R. Ingraffea
Fred H. Kulhawy
Thomas D. O'Rourke
Teoman Pekoz
Mary J. Sansalone
Harry E. Stewart
Richard N. White

### Systems Engineering & Information Technology

F. Lawrence Bennett
Arnim H. Meyburg
Linda K. Nozick
William D. Philpot
Richard E. Schuler
Mark A. Turnquist

### Environment

James J. Bisogni
Wilfried H. Brutsaert
Edwin A. Cowen
Richard I. Dick
James M. Gossett
Leonard W. Lion
Philip L.-F. Liu
D. Peter Loucks
Christine A. Shoemaker
Jery R. Stedinger

# CEE Organizes Great Pumpkin Competition

*photos by Nicola Kountoupes*

An alleged giant pumpkin's mysterious appearance atop Cornell's landmark McGraw Tower had been making national news since early October. Five months later the so-called pumpkin was still atop the tower, long after botanists said it should have disintegrated. Intrigued, Provost Don Randel issued a challenge; if Cornell ingenuity could place a 'pumpkin' on top of a 173-foot tall tower, could Cornell ingenuity determine what the object on McGraw Tower was?

Sponsored by Provost Randel, CEE faculty members Mary Sansalone, Linda Nozick and Benjamin Schafer organized a competition for all Cornell undergraduates to determine the composition of the McGraw Tower Pumpkin. In doing so, they provided the Cornell campus with a unique educational opportunity, one in which learning, creativity, and fun came together to provide a host of unforgettable moments.

*Provost Don Randel, and Mr. James Bucko atop McGraw Tower.*

Randel set one simple rule for the competition: each student's feet were not permitted to leave the ground. Thus no climbing or flying was permitted. Students were challenged to use their abilities as rational thinkers to observe, analyze, and draw conclusions. Students employed weather balloons equipped with video cameras, remote controlled drills, and other coring devices to obtain pieces of the pumpkin. Spectroscopes, DNA analysis, philosophical thinking, and a host of other approaches were also used in trying to solve the mystery. Faculty encouraged the students, and soon departments across campus were vying to be the first to find a solution.

A panel of distinguished faculty, including several Nobel Laureates, judged the student entries to the competition for the accuracy, ingenuity, and elegance of the solutions. To verify the students' solutions, organizers arranged to have Randel hoisted to the top of the tower to retrieve the alleged pumpkin. Unfortunately, as the crane basket was lifted during a trial run, it knocked the purported pumpkin off the spire and onto the scaffolding that surrounded McGraw Tower. Maintaining the spirit of the event, Randel and Mr. James Bucko rode the crane to the top of the scaffolding to complete their mission of mercy to recover and eventually identify the object on the platform hundreds of feet above the ground. Neck-bent spectators watched the slow journey eager to get a closer look at the battered sphere. Later that day, plant scientists determined that the mass of softened orange tissue was indeed a member of the cucurbit family. It was a pumpkin!

For a few days after the competition, unbeknownst to most of the School's faculty, CEE's freezer was home to the "Great Pumpkin." Mary Sansalone, charged by Randel with the task of "preserving the pumpkin for future generations of Cornellians", located a freeze-dryer at Cornell that could hold the pumpkin. Following this process, on advice from the Smithsonian Museum, Sansalone then coated it inside and out with polyurethane to prevent further decay. On April 1st, the "Great Pumpkin" was sealed in an air-tight case and put on display in Day Hall – a fitting tribute to The Cornell Great Pumpkin and the mystery surrounding its appearance – a mystery that has come to be known as perhaps Cornell's greatest prank! Surely, no one at Cornell has any doubts about whether there really is a Great Pumpkin or what route it travels through the night sky.

*Professor Dominick Paolillo, plant scientist, examines the pumpkin.*

*And the winner is....*

*On April 2nd, students were recognized for their submissions. A team of physics and astronomy students claimed first prize and received signed lithographs of the Charles Shulz cartoon, "The Great Pumpkin" and books for a semester.*

# Alumni Abstracts:
## The who, what, when, and where of CEE Alumni

**Gran Godley (CE '36, MCE '37)** and wife **Ginny (CU '36)** recently celebrated their sixty-second wedding anniversary. Godley worked for fifty-one years, primarily in construction, and currently serves as a Director of the Indiana Area Foundation of the United Methodist Church, Inc., a post he has held for thirty years. Both he and his wife look forward to their sixty-five year Cornell Reunion.

**Jack Rogers (CE '45)** is currently involved with the Quill and Dagger Association. He remains active in Cornell University development efforts. Rogers worked as the Engineer for the Village of Cayuga Heights for 30 years.

**Bud Shumaker (CE '48)** is currently managing some properties after retiring from an active civil engineering career. Shumaker was involved in designing highways, bridges, sewers, and airports.

**Vernon Wetzel (CE '48)** concluded a successful 40 year career with Sun Oil/Suncor where he worked in offshore drilling and research across the globe. Wetzel is enjoying retirement by traveling, golfing, and staying up-to-date with computer technology.

**Jim Watson (CEE '68)** is site manager at Edwards Air Force Base. His team is constructing the launch complex for the X33 space plane that will be replacing the shuttle next year. The launch is scheduled for July 1999.

**Jeffrey Coffin (CEE '73)** is employed at Kleinschmidt Associates in Pittsfield, Maine. Coffin performs hydroelectric dam licensing and water resources/hydraulic engineering.

**Robert (Bob) Persons (CEE '73)** manages a mechanical engineering consulting business, Person's Engineering, in Newton, MA.

**Wendy Coffin (CEE '76)** returned for Reunion '98 and is currently working for the state of Maine Drinking Water Program.

**Jeff Budrow (CEE '83)** is currently Vice President-Engineering at J. Kenneth Fraser and Associates, PE, LS, LA, P.C. He is a municipal engineer and reports that his work multidisciplinary in nature, requiring him to use all the skills he acquired while at Cornell.

**Michelle Stottler-Budrow (CEE '83)** is owner of MES Consulting. MES provides hydrology and hydraulic engineering services, water quality, and site engineering.

**Greg Gilda (CEE '88)** is working in Seattle, WA for EQE, a structural engineering firm. Gilda is working on the design of new structures, seismic retrofit and risk assessment.

**Neville Rhone (CEE '91)**, Associate Vice-President of Tishman Realty Corporation, is headed to Columbia University in September to begin an MBA.

**Ellen Rathje (CEE '93)** joined the faculty at the University of Texas at Austin (see back cover). She married Tompkins County native, Andrew Baxter, on July 4, 1998.

**Katie Pilot (CEE '94)** completed a Master of Science in Environmental Engineering at the University of California, Berkeley. She recently returned from the Ivory Coast where she was stationed for three years as a Peace Corps volunteer.

**Barbara Minsker (Ph.D. '95)** recently won the prestigious National Science Foundation Career Award in Environmental Engineering. Minsker completed her Ph.D. in Environmental Engineering under the supervision of Professor Christine Shoemaker. Minsker is Assistant Professor of Civil and Environmental Engineering at the University of Illinois.

**John Ochsendorf (CEE '96)** recently completed his MS degree in structural engineering at Princeton University. His thesis was on self-anchored suspension bridges. Recipient of a three-year National Science Foundation Fellowship, John heads for England in September to begin a Ph.D. at Cambridge.

Tell us what you are doing!

Submit your own ***Alumni Abstract*** to:
CEE Update Alumni Abstract
c/o Dawn Zeligman
Cornell University
220 Hollister Hall
Ithaca, NY 14850

# Alumna Praises CEE Education

**Ellen Rathje (CEE '93)** graduated as a Cornell Merrill Presidential Scholar, won a National Science Foundation Fellowship, and took off for the west coast to attend the University of California at Berkeley and earn her Ph.D. This past year she joined the civil engineering faculty at the University of Texas at Austin.

Rathje has fond memories of her time at Cornell. Since leaving Ithaca she has experienced two large Civil Engineering departments (Berkeley and Texas) and she says she has yet to find a better place to get an undergraduate degree in Civil Engineering. "Because of the relatively small size of the Cornell CEE department I got to know my professors very well and have had the pleasure of keeping in touch with them after leaving Cornell. I value their interest in my career and future, and appreciate all of their encouragement and for inspiring me to pursue an academic career." Rathje noted that Cornell prepared her fully for graduate school and a career in engineering. She said, "all of those late nights in Hollister Hall working on problem sets paid off!"

At Berkeley, Rathje studied geotechnical engineering under the direction of Dr. Jonathan Bray, who she credits with knowing how to provide his graduate students with the right balance of supervision and freedom. She made great friends and found the academic environment extremely stimulating.

At Texas she will be teaching an undergraduate course in Geotechnical Engineering and a graduate course in Geotechnical Earthquake Engineering and she hopes to use a case method approach in her teaching. She plans to pursue research in the development of an in situ liquefaction evaluation technique and advance the state of knowledge regarding liquefaction.

*...all those late nights in Hollister Hall working on problem sets paid off!*

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