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USC Viterbi Engineer

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kiuεl is Viterbi for "Cool"

kiuεl

pronunciation: cool

adj. **1** [Slang] hip, excellent, first-rate

n. **2** Klein Institute for Undergraduate Engineering Life

n. **3** the place to be

Volume 4 Issue 2

Centennial Lectures

An Academic Celebration

In celebration of 100 Years of Engineering at USC, the Viterbi School partnered with distinguished professors, accomplished engineers and even the presidents of renowned technical institutes and a university, to produce the successful Centennial Lecture Series. We thank these individuals for their time, knowledge, spirit and generosity. Visit the link below if you missed any of these memorable presentations.

1100100
CELEBRATING 100 YEARS
1100100

USC **Viterbi**
School of Engineering
Celebrating 10^2 Years

THE FUTURE OF INDUSTRIAL ENGINEERING: SHOP FLOORS TO FACTORIES TO SUPPLY CHAINS TO ENTERPRISES

WILLIAM ROUSE, director of the Tennenbaum Institute at the Georgia Institute of Technology
Hosted by the Daniel J. Epstein Department of Industrial and Systems Engineering

FUELING THE FUTURE: OPPORTUNITIES AND CHALLENGES IN ENERGY AND THE ENVIRONMENT

LYNN ORR, Keleen and Carlton Beal Professor of Petroleum Engineering and director of the Global Climate and Energy Project at Stanford University
Hosted by the Mork Family Department of Chemical Engineering and Materials Science

MOLECULAR MECHANICS OF BONE FRACTURE

PAUL HANSMA, professor of physics at UC Santa Barbara
Hosted by the Mork Family Department of Chemical Engineering and Materials Science

THE NEWTONIAN REVOLUTION: INTERACTION OF MATHEMATICS WITH HIGH TECHNOLOGY

RUDOLPH E. KALMAN, professor emeritus at the Swiss Federal Institute of Technology
Hosted by the Department of Aerospace and Mechanical Engineering

THE FUTURE OF MICROPROCESSOR ARCHITECTURE

JOHN HENNESSY, president of Stanford University
Hosted by the Department of Computer Science

THE TURNING POINT FOR ENGINEERING: CAN WE ADAPT?

G. WAYNE CLOUGH, president of the Georgia Institute of Technology
Hosted by the Department of Civil and Environmental Engineering

INFORMATION EXCHANGE AMONG NEURONS IN SENSORY CORTEX

TOBY BERGER, professor of electrical and computer engineering, University of Virginia
Hosted by the Department of Electrical Engineering

TO THE MOON AND BEYOND

EDWIN "BUZZ" ALDRIN, astronaut
Hosted by the Astronautics and Space Technology Division

THE PROMISE OF EMERGING TECHNOLOGIES IN 21ST CENTURY MEDICINE

RODERIC I. PETTIGREW, director of the National Institute of Biomedical Imaging and Bioengineering
Hosted by the Department of Biomedical Engineering

THE IMPACT OF U.S. HIGH TECHNOLOGY NATIONAL DEFENSE STRATEGY ON ENGINEERING EDUCATION

JAMES ROCHE, former Secretary of the U.S. Air Force
Hosted by the Systems Architecture and Engineering Program

For information about all of the lectures please visit:
http://viterbi.usc.edu/links/?103

features

departments

Cover photos by Max S. Gerber and Brian Morri

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http://viterbi.usc.edu/

Viterbi Springs Centennial

Spring at Viterbi… It is a wonderful time. It is the culmination of a year of relentless efforts in teaching and research. Students graduate and carry with them all the rich experiences they have accumulated from their interaction with Viterbi faculty and staff. New students will join us in the fall and the cycle will recommence… It is this renewal process — the farewell to the graduates and the welcome to the new ones next fall — that we are celebrating.

As this academic year comes to a close, I can only say that it has been my privilege the past year — our 100th Year — to steer the magnificent ship that is the USC Viterbi School of Engineering. And it is with even greater pride that I accept my new position as permanent dean of the School at a moment when we are charting the exciting waters of a new and even more promising century.

During the past century, a tiny regional technical program at USC has blossomed into an international engineering and technology powerhouse. One with outstanding faculty, students and staff, that is winning tough competitions with top universities for national research centers.

To celebrate our 1100100 (think binary) years we held a high-profile series of academic lectures and a gala event at the California Science Center. These events were nothing short of magnificent. If you walk through the Engineering Quad, and pass by Ronald Tutor Hall you cannot miss the colorful banners that display our pride in the School's history.

And I am very fortunate and proud to share more good news about the School.

Since last June, four of our junior faculty won highly competitive National Science Foundation Career awards. Another, Elaine Chew, received the PECASE or Presidential Early Career Award given annually to only 50 young academics in science and engineering. Our faculty, the lifeblood of all institutions of higher education, continues to thrive and grow in stature.

And by (mathematical?) harmony, we have some very recent wonderful news to end the academic year: On April 24, Len Adleman, the Henry Salvatori Chair in Computer Science and winner of the 2003 Turing Prize, and Bob Hellwarth, the George T. Pfleger Chair in Electrical Engineering, were elected to the American Academy of Arts and Sciences (AAAS). One day later, we learned that Len Adleman was also elected to the National Academy of Sciences (NAS).

With these elections, Len and Bob have now joined a very elite group, one that holds simultaneous memberships in the three academies AAAS, NAE (National Academy of Engineering) and NAS. And I am very proud that the Viterbi community now counts four members (along with University Professor Sol Golomb and Presidential Chair Andy Viterbi) with this remarkable distinction.

During the past year, we have also seen two loyal and visionary alumni step forward to boost the Viterbi School even higher. John Mork and his family named the Mork Family Department of Chemical Engineering and Materials Science. And in this issue you will read in detail about Ken Klein's passionate plan to nurture undergraduate engineering students.

With the Klein Institute for Undergraduate Engineering Life, or KIUEL (pronounced "cool"), a new paradigm in engineering education is emerging at USC. This institute, which we believe is unique in the country, recognizes that each engineering undergraduate is a precious commodity. Ken Klein explained the purpose of his new institute this way:

"It's an institute with the sole purpose of making the life of the undergraduate engineering student better. That means easier, balanced, fulfilling, comfortable..."

On their journey to become engineers, Viterbi students not only learn from a demanding curriculum, they also receive the benefits that come from an overall collegial experience outside the classroom, whether it's by building community, service learning or in USC's initiative on the Arts and the Humanities.

This year, the Viterbi spring is centennial — and "cool"…

— Yannis C. Yortsos
Dean
USC Viterbi School of Engineering

Yannis Yortsos Named Permanent Dean of the USC Viterbi School

For complete announcement, see page 4.

Yortsos photo by Brian Morri

BREAKING NEWS

Yannis Yortsos Named Dean of the Viterbi School

Yannis C. Yortsos, who had been serving as dean on an interim basis since June 2005, has been named permanent dean of the USC Andrew and Erna Viterbi School of Engineering. The announcement was made by President Steven B. Sample and Provost C. L. Max Nikias, as this issue of *USC Viterbi Engineer* went to press.

His appointment comes at a symbolic time with the School celebrating its centennial year. Effective June 1, it is the culmination of an eight-month international search during which the search committee identified and reviewed more than 200 candidates for the position.

"Yannis Yortsos has shown tremendous leadership skills since arriving at USC," Sample said. "He is a world-class scholar who understands the Viterbi School's limitless potential, and he also understands how to mobilize the school's faculty, students, alumni and staff to fulfill that potential."

Dean Yortsos, President Sample and Provost Nikias enjoying the Viterbi School's centennial celebration gala event.

Nikias said: "Professor Yortsos has won acclaim for describing what the 'new engineer' of the 21st century must look like. He has argued that the future of engineering — as well as that of other disciplines that seek to impact our world — will require a 'seamless blending of left-brain and right brain skills,' which necessitates creative alliances between engineers and counterparts in other sciences, the social sciences, the humanities and the arts."

Nikias, who co-chaired the international search, said that Yortsos has laid out ambitious strategies to enhance the School's profile as an elite institution, by building additional strength and diversity within the School's faculty and student body, continuing aggressive fundraising efforts and furthering ongoing efforts to build global partnerships that offer new possibilities for education and research.

Yortsos is a distinguished and internationally known chemical engineer who has held the Chester F. Dolley Professor of Petroleum Engineering since 1975. He is highly regarded for innovative work in chemical engineering relating to the mechanics of fluids in porous media, and in petroleum engineering relating to oil recovery. He earned a diploma in chemical engineering from the National Technical University in Athens, Greece. After coming to the United States for graduate work, he earned an M.S. and a Ph.D. in chemical engineering from Caltech.

From 1991 to 1997, Yortsos chaired the Viterbi School's department of chemical engineering. He served as the School's associate dean and then senior associate dean for academic affairs during the four years that Nikias served as dean. When Nikias was named to the post of USC Provost, he immediately tapped Yortsos to serve as dean for an interim period.

During his time overseeing the Viterbi School's academic affairs, Yortsos facilitated an impressive overhaul of the undergraduate curriculum, and the School enjoyed significant gains in student strength and in the quality of academic programs for freshmen.

He also presided over the merging of two departments — chemical engineering, including its petroleum engineering program, and materials science — that now form the Mork Family Department of Chemical Engineering and Materials Science, named when alumnus John Mork (BSPE '70) endowed it with a $15 million gift. In addition, alumnus Ken Klein (BS BMEE '82) established the Klein Institute for Undergraduate Engineering Life (KIUEL), described in detail in this issue, during the period that Yortsos served as dean for an interim period.

"I am humbled and honored to be named dean of the USC Viterbi School of Engineering," Yortsos said in accepting the position. "The School has become a global leader in innovations in engineering, and I am thrilled to be part of its future enhancement and growth. In this century, engineering will flourish in exciting new areas that require interdisciplinary research and teaching, and alliances across disciplines and across the globe. I am convinced that with the continuing, unparalleled help of our friends, the Viterbi School will reach new heights of excellence in creating new paradigms of engineering education and research."

› STRAIGHT & to the POINT ‹

To Boldly Go Where No Computer Science Class Has Ever Gone

Milind Tambe

Tambe photo by Brian Morri

Students in a new engineering class will be writing computer code for Isaac Asimov's disobedient robot Speedy, and for the sinister many-bodied Star Trek menace, the Borg.

Milind Tambe, associate professor of computer science, plans to use classic stories by Asimov and other science fiction sources as problem sets in a class on artificial intelligence for undergraduate programmers beginning in the fall, 2006 semester.

"Computer science is catching up with the ideas in these stories," says Tambe. "We are using science fiction as the spice for the main dish of teaching an important new area of our discipline."

While a number of universities use science fiction as a way to introduce concepts in physics and other fields, Tambe believes his course is the first of its kind in the field of computer science. Tambe and third-year doctoral student, Emma Bowring, collaborated to design CS 499, "Intelligent Agents and Science Fiction." Bowring will be the teaching assistant for a class that "she made very significant contributions in creating," says Tambe.

The class will focus not on robots per se, but on their "minds," what are known in computer science as artificial intelligence "agents." These are virtual robots, which are complex software systems capable of creating strategies, negotiating with each other and cooperating, all to achieve ends.

"Science fiction provides three key benefits in this course," says Tambe. "First, it is a great motivator and it provides context, generating excitement about artificial intelligence topics in general, and agents and multiagent systems in particular.

"Second, science fiction also helps provide a perspective on how far we have come in our research, as well as current limitations, and future research challenges.

"Third, science fiction literature is a great vehicle for understanding the impact on society if agent-based computing truly succeeds."

Most of the texts will be standard scholarly references in the field of AI. But the assignments will also include science fiction films and television shows, along with such famous stories as Asimov's "Runaround" — the 1942 tale that introduced his famous "Three Laws of Robotics."

In this story, set in 2015, astronauts on the planet Mercury send a robot named Speedy on a vital, but dangerous mission to bring back the element selenium. Instead of obeying, Speedy starts running in a circle around his destination. The reason, the humans discover, is the robot's calculation of required behavior conforming to the second law of robotics: "A robot must obey orders given by a human," is in delicate equilibrium with its necessity to conform to the third law: "A robot must protect its own existence."

The humans manage to break the cycle by convincing Speedy that they are in mortal danger, which brings into play the top-priority first law: "A robot may not injure a human being or, through inaction, allow a human being to come to harm."

The syllabus asks students to analyze Speedy's thinking with what is called "belief-desire-intention" or "BDI" logic, which formularizes persistent agent goals, with questions like "(a) Explain in BDI logic the commitment formed to save humans. (b) Is this commitment only invoked when a human is in danger or is it present under all circumstances?"

In more traditional academic course syllabus language, the course will cover "introduction to agents, elementary decision theory and reasoning under uncertainty, elementary game theory (includes Nash equilibria and prisoner's dilemma), teamwork and belief-desire-intention logics, emotions in agents."

Other science fiction source materials that

continued on page 6

Smart Tools, and Not Just for Smart Kids **Faculty OpEd**

by Carole Beal

Leo Tolstoy famously began *Anna Karenina* with the observation that "All happy families are alike; each unhappy family is unhappy in its own way." While it is an overstatement, this also applies to K-12 education where "all good students are alike; each failing student fails in her or his own way."

We more commonly call this phenomenon the "rich get richer" effect. Seemingly exciting new educational tools and products characteristically work well for students who are already superior but do little or nothing for students whose work is below grade level or who are failing outright.

What if we could quickly and accurately diagnose how each failing student fails and provide them with specific tools to address their specific pattern of failure?

Inspired teachers know how to do this — that is why they excel. But teachers are under multiple constraints and heavy pressure to deal with large classes in the 180 days per year they have available for teaching. Even great teachers need all the help that they can get and many of them are asking for technology-based tools to help their most needy students.

Information technology can provide this support with appropriately designed teaching materials — the kind we are now building. What is critical in these systems is not so much that they teach certain educational material, but the way they engage with individual students to see where their learning problems are.

One example we have developed is "Wayang Outpost," a multimedia learning system meant to teach geometry to high school students. It works, bringing a 20% improvement in post-test scores. But it improves scores only on the skills taught in the system, not on other material, so we know that the benefits are not due to a transient novelty effect. The weakest students post the biggest improvement, which is a reversal of the usual "rich get richer" effect that is so often found in the education community.

Wayang does not just give vivid multimedia explanations of geometry. It lets a failing student try a problem, fail, get immediate feedback and learn from failure. Only the computer knows about the failure. It helps discouraged students while shielding them from embarrassment in front of classmates or the teacher. Our research indicates that many of these "failing" students are eager for such opportunities.

The key is that Wayang studies and learns from its users. With data gathered from the student, the software creates a model of where each student is — spatial ability, math proficiency and prior knowledge. The system surveys their motivation from a variety of angles — their learning style, test anxiety, self concept in math and even their mood on that particular day — and produces a detailed picture of each learner, classifying them into various learning categories.

It tailors an educational program for each student using information about how earlier students with similar profiles had done in the system. It can recognize bad "trajectories," such as the student forming an anti-successful strategy to get by or coast through, and it intervenes before the student is set on the track. For example, Wayang can diagnose that the student is guessing and remind the student of his or her goal to go to college, making the link between today's class work and where the student wants to be in a year.

Information about the student comes not just from what he or she types. New technologies allow us to monitor the student and do so with a "light footprint." Simple, inexpensive web cameras can track eye gaze to see when attention lags. We're starting to experiment with lightweight wireless EEG headsets to directly measure cognitive effort and distractibility.

It is not just students who can profit from these technological individualized tutoring tools. We believe the tools will also help teachers learn to be more effective in the same way. The systems provide teachers with real-time assessment about each student's strengths and weaknesses, feedback they can use to adapt the next day's lesson plan instead of waiting for the results of annual achievement tests.

Unfortunately, technology has often been oversold in education so I do not want to

exaggerate where we are. We still have a long way to go, but I believe we are on the right track in focusing on technology that listens to and diagnoses students. Our goal is to provide each student with individualized tutoring. Information technology can do this.

Carole Beal is a project leader and educational psychologist specializing in K-12 education at the USC Viterbi School's Information Sciences Institute.

To Boldly Go

continued from page 5

will be discussed — and coded — by the class include Star Trek episodes on the alien distributed intelligence (one mind in many bodies) called the Borg; and on the emergence of emotions in Lt. Commander Data.

The Viterbi School and its Information Sciences Institute are leading centers of research in agents and artificial intelligence, and many of the non-science fiction texts the class will read are original papers by USC researchers including Stacy Marsella, David Pynadath, Jonathan Gratch, Gal Kaminka and Tambe himself.

Tambe also hopes that some authors of science fiction sources to be analyzed and coded will visit the class.

"This will be a rigorous class in state of the art computer science," says Tambe, "but it will be one that I think will challenge students in an interesting way, one that they'll enjoy taking. I know I will enjoy teaching it."

—EM

USC Notables Honor Sol Golomb at Hillel L'Chaim Award Dinner

University Professor Solomon Golomb received an evening of praise and reminiscence and USC Hillel came away with $100,000 in funding.

President Steven B. Sample, Viterbi School naming donor and trustee Andrew J. Viterbi (Ph.D. EE '62) and Leventhal School naming donor Kenneth Leventhal spoke, while Provost C. L. Max Nikias, Viterbi School Dean Yannis Yortsos and Nobel Prize winner George Olah joined more than 220 well-wishers filling the Skirball Center.

The occasion was USC Hillel's annual L'Chaim Award Dinner, a fundraising event for the benefit of the Jewish student group, which, per its mission statement, "provides the foundation for Jewish student life at USC, offering a secure, inclusive and nurturing environment for all Jews who are part of the USC community."

Golomb has been a steadfast supporter of the group for decades, and wryly pronounced his association as the reason he had "offered himself as a sacrifice" for the fundraiser. The warmth and specificity of the tributes to Golomb, a polymath linguist/mathematician/philosopher/game-designer and beloved father broke through the award dinner format in the presentations of speaker after speaker. Sample, himself multitalented as engineer, administrator and musician, pointed out the dimensions of Golomb's distinctions as an introduction.

"The title of university professor is the highest recognition USC can bestow on a faculty member," said Sample, noting that out of more than 3000 faculty, only 17 held the distinction. And, the president continued, "With his ceaseless curiosity, his thirst for learning across the academic landscape and his extraordinary accomplishments, Sol Golomb is the very embodiment of the concept of university professor. … I often turn to Sol for advice and assistance, and I know I can always count on him."

Sample also noted Golomb as a "triple threat" — a member of the National Academy of Science, the National Academy of Engineering as well as the American Academy of Arts and Sciences; and a winner of the Shannon Prize, the highest award in signal processing.

Golomb has served as a mentor to numerous students over the course of his career, and perhaps the most distinguished of all these former students delivered a long and eloquent tribute to his teacher. Andrew J. Viterbi recollected how he had met Golomb years before at JPL, and how generously Golomb had helped him not just in academic matters, but for such things as helping find a place for his parents to live.

It was in Golomb's car, Viterbi said, on a long-ago drive north to the Bay Area that he had made his decision to propose to his wife Erna. And when the marriage took place, in a now-vanished synagogue on Santa Barbara Boulevard (long since renamed after Martin Luther King), Golomb was by his side.

Viterbi took at least some of the credit for bringing Golomb to USC in 1963, where, as Viterbi noted, he is widely credited with laying the foundations of USC's emergence as an engineering superpower. Golomb now holds the engineering chair that bears Viterbi's name.

Golomb's daughter Beatrice could not be at the dinner: she had booked tickets more than a year before for a cruise of Patagonia. But through video, she presented a slide show of her father's life, beginning with tales of his astonishing precocity, of his courtship of his Scandinavian wife, of his linguistic prowess, of his invention of the game of polyminoes, the precursor of Tetris, all this while her mother, Bo, looked on proudly.

No tributes to Golomb would be complete without a review of the classic photographs of the white-bearded professor sitting in USC's Hoose library in a full USC football uniform. The image was used for the cover of a USC recruiting brochure that got the largest response in the history of the publication, so striking that it was reprised a second year.

A surprise award closed out the evening. Golomb already held the Kapitsa medal from the Russian academy of sciences (Russian is one of the languages he speaks). Fellow Russian "akademik" Professor George Chilingar (BSPE '49, MSPE '50, Ph.D. GEOL '56) presented him with two new awards, plaques from the Russian academy and the Russian Academy of Natural Sciences honoring Golomb for lifetime achievement.

Hillel itself offered its own tribute: "Sol Golomb has been a significant part of USC Hillel and the Jewish community for thirty years. We are so proud to honor him for his work on the board and executive committee and for being such a strong supporter of Jewish life at USC," said Robert Gach, board chair of the USC Hillel Foundation.

—EM

Top (left to right) USC Hillel Executive Director Dr. Steven Mercer; USC Hillel Board Chair Robert Gach; Solomon W. Golomb; LA Hillel Council President Jaime Gesundheit; USC Trustee Andrew J. Viterbi.

Left: Golomb suited up for student recruiting with Donald "Don" McInnes, professor of music.

On the Threshold of Miniature Flight

Inspired by the recent upsurge of interest in small-scale aerodynamics, some aerospace engineers at USC are raising simple questions with surprisingly elusive answers. 'If we were to build a small flying machine,' they ask, 'what would it look like? A dragonfly? A moth? A bat? A bird?'

With the steadiness of a surgeon, John McArthur, a graduate student in aerospace and mechanical engineering, positions a slightly curved plate about the length of a 12-inch ruler on a rod that protrudes from the force balance in USC's Dryden wind tunnel. The flow properties and the force balance calibrations in this tunnel, housed in the basement of the Rapp Research Building, have been carefully tested over three or four months.

Today the airflow in the tunnel will be seeded by a fog of one-micron-diameter smoke particles and illuminated by consecutive double pulses from a dual-head laser. Each light pulse will be five nanoseconds in length and consecutive flashes will be separated by about 150 microseconds. The laser will flash at a rate of 10 Hertz, so each pulse pair will be regenerated every 1/10th of a second. Images of the airflow will be captured on a charge-coupled device (CCD) array camera and saved in real time.

Over the past ten years, McArthur's faculty adviser, Geoff Spedding, professor of aerospace and mechanical engineering, and his colleagues, have developed custom software to perform an analysis of this flow field with extreme accuracy. After making the measurements, they will be able to describe not only the lift and drag forces of this small curved wing, but also the spatial gradients of the airflow in which it is flying, which are difficult quantities to estimate.

No one has paid much attention to small-scale airfoil geometry — how the shapes of small flying things impact their flight capabilities — or to understanding the aerodynamics of winged flight on small scales, until quite recently, Spedding explains, as he adjusts the cambered plate and aims the laser.

"The geometry and kinematics of bird flapping are complicated," he says. "The question then arises, must this complexity be mimicked or are there more simple fundamental designs of small-scale aerodynamics that can be applied to build the next generation of small, remotely piloted flying machines?"

Geoff Spedding

Winged Flight

Spedding and a research group in the Viterbi School's Aerospace and Mechanical Engineering (AME) Department are busy pursuing those questions with data from their wind tunnel experiments. AME graduate students machine the simplest possible wings — flat plates, curved plates and classical airfoils — and then plot the wind tunnel measurements on graphs that are scotch-taped to the laboratory door.

Winged flight has always fascinated Spedding, who is a zoologist by training. After earning a Ph.D. in zoology from the University of Bristol, England, he specialized in animal aerodynamics and hydrodynamics. With the recent upsurge of interest in small-scale aerodynamics, he has begun to investigate what affects the aerodynamic performance of these very simple objects, which fly at very low speeds.

"Imagine a flying ruler, which is a simple flat plate," he says, holding up a ruler he has retrieved from the top drawer of a desk. "How well could this fly when attached to a suitable airframe? How would we improve this design?"

It is remarkable that such questions qualify as topics of research, but Spedding says there are two reasons for it. "First, all of our textbooks on aerodynamics and on aircraft and helicopter flight have been developed for devices that are much larger and fly much faster. These aerodynamic models and analytical methods are, arguably, among some of the crowning intellectual and practical achievements of the past century.

"Modern aircraft are efficient and powerful, and routinely carry people and armaments over long distances," he continues. "But few have paused to reflect on how a very small plane might work. In fact, most of the serious work has stopped at the scale of competition sailplanes."

Of Bats and Thrushes

Spedding wends his way out of the wind tunnel and back through the maze of instrumentation filling the basement of the Rapp laboratory, then climbs a flight of stairs leading to his office. Stepping inside, he reaches for a small plastic bat with a wingspan of about 20 centimeters dangling on a string from the ceiling.

When he is not collaborating with a group of biologists at Lund University in Sweden, using live birds and bats, Spedding relies on wind-up or battery-powered toys, such as this red-eyed Halloween bat, to inspire him. He winds it up and gives it a gentle shove. The bat begins to flap its wings and flash its red eyes as it circles high above his desk. Gaining momentum, it lifts into a higher orbit.

"Newton's laws of motion in action," Spedding grins.

How do Newton's laws of motion work on much smaller scales? Just the same, Spedding notes. But because the viscosity of the air can no longer be ignored, the flows are very complex. That is what gives aerodynamicists a second reason to pause. Even simple textbook problems become complicated. Standard aerodynamic models do not give researchers the answers.

"Paradoxically, it is far easier to predict, analyze and model the flow around a Boeing 747 than it is to predict the flow around our simple ruler flying at some reasonable speed,"

Spedding photo by Brian Morri

Graduate student John MacArthur, left, and Professor Geoff Spedding are probing the aerodynamics of small objects.

Assistant Professor Eva Kanso works on biological locomotion with Professor Tony Maxworthy.

Spedding says. "And much of the existing data in the literature is controversial and inconsistent, with little apparent incentive to force the issues to resolution."

Then what sort of small-scale flying machine should he build?

"We could build just about anything," says Spedding. "Suppose we built a small flying machine that can flit through crowded spaces, hover silently in a precise position, making observations of a moving target, abruptly reverse direction in times of danger, and do all of this for more than an hour. Then it would report back to base as directed with images and other sensory information, such as chemical and pressure readings, visibility, heat and radioactivity measurements."

It is not the technology that is holding engineers back from building that plane, he says. It is possible to build all kinds of small-scale electromechanical devices these days. It is the design — what it would look like.

"It could look like a dragonfly. A moth. A bat. A bird. Or none of the above," he says.

Biological Locomotion

Assistant Professor Eva Kanso and Professor Tony Maxworthy, who holds the Smith International Professorial Chair in Mechanical Engineering, collaborate with Spedding's AME research team addressing problems in biological locomotion.

In 1979, Maxworthy, a member of the National Academy of Engineering, was the first scientist to realize and demonstrate that many simple wings in oscillatory flapping motion will generate strong swirling currents, or vortices, of fluid at the front edge of the wing, and that the forces associated with this strong rotational motion will be both beneficial and controllable. In many cases, the presence of these complex, time-varying fluid motions can make the difference between flying and being grounded.

Since then, the leading edge vortex (or LEV) has become a staple of those seeking to understand the aerodynamics of both insect and bird flight. Maxworthy predicts that it is "very likely that any successfully engineered device will have to have some similar means of generating and then controlling such fluid motions."

Similar principles apply to swimming fish, he says. Researchers are currently working on experimental modeling of the forces and flow fields generated by fin and tail motions.

Kanso, a mechanical engineer who earned her Ph.D. from the University of California, Berkeley, is the third member of the team. Interested in the interaction of shape changes with wake dynamics, she is attempting to unlock the mathematical keys to underwater locomotion.

"If we were to build a swimming robot, should it resemble a jellyfish? Or an eel?" she asks. "How many degrees of freedom does it need to have to be able to achieve a desirable forward or steering motion?"

Dynamical Systems Theory

Kanso answers questions like that with simple yet powerful tools drawn from dynamical systems theory, geometric mechanics and computation. The reduced modeling approach has already been able to demonstrate some amazing things — for starters, for a simple cyclic shape, changes will occur in an articulated three-segmented swimming machine placed in water.

Voilá! It swims.

This line of research enables novel engineering applications, such as the design of biologically inspired vehicles, both micro and macro, that can propel themselves by undulating their shapes.

"Investigating simple systems like this helps to unravel the basic principles of aquatic locomotion," Kanso says. "I am interested in quantifying these principles and building on them…learning to improve on what we've already built."

The research has a ways to go, but it is a first of its kind. The data is providing new insights into biological locomotion and the future of small-scale flying and swimming machines. But like all good mysteries, the future is full of unanswered questions.

"There's still a lot to learn from bird flight before a reasonable airfoil design can be proposed," Spedding says, "or before we start pasting bird feathers on our small flying machines."

However, the day will come when this planet is populated by both animals and small autonomous vehicles whose forms and behaviors may or may not mimic the natural world. That day is not too far away.

—DA

student works

An Engineering Senior's Journey Into Africa

Chemical engineering student Fima Macheret wanted to do "something meaningful" during his summers, and at the same time acquire some hands-on experience in medicine. So before the start of the Fall '05 semester, he embarked on a journey of hope and goodwill to the small fishing village of Prampram, Ghana, on the west coast of Africa.

"I'm going to medical school in a few years, so I wanted to work in a part of the world that really needs help," says the USC senior, who is specializing in biochemical engineering.

He could not have landed in a more remote corner of the world. Prampram is a poor village located an hour from Accra, Ghana's capital. The town has a population of about 6,000 people. Macheret says it is also known as "Gbugbla," which means to "keep on trying."

For three weeks, Macheret kept on trying. As part of a team of volunteers from Global Volunteers, he helped nurses in the village clinic administer shots and medicine to local residents. Global Volunteers sends teams of volunteers to sites worldwide, including the United States, to work on projects ranging from teaching English, to assisting with health care, to constructing community buildings. "The clinic staff quickly became both my teachers and my colleagues in that they were excited to teach me their techniques, but also eager to know my opinion on various issues," says Macheret, who graduated in May 2006. "International health care has a long way to go, but through hard work, responsibility and international effort, it will improve."

High Incidence of Malaria

The young engineering student saw a variety of patients, 75 percent of whom had malaria and were suffering from high fevers and body aches. Other villagers came to the clinic with work injuries — cuts, scrapes and sprains — while a few came in with injuries caused by domestic violence. "I started giving injections the first day I was there," he says. "I learned that their babies had very leathery skin; it was hard to puncture the skin with a hypodermic needle."

Fifteen nurses staffed the clinic, but they did not have much more than basic first aid supplies, vaccinations and generic medicine to work with, Macheret says. The nearest hospital was a half hour away, so most of the ailing residents sought out the clinic for medical attention. Macheret explains how six or seven volunteer teams from Global Volunteers work three-week stints in the village each year. Quite often, they bring some of the basic medical supplies with them. Those volunteering in the clinic learned how to dress wounds, take blood pressure and apply tourniquets before administering an IV of saline solution to dehydrated patients.

While Macheret helped out in the village clinic, other volunteers taught conversational English and other subjects in village classrooms.

The volunteers were given "rock star treatment" everywhere they went in Prampram, he says, with throngs of children running up to greet them and villagers waving hello every time they arrived. The volunteers were honored at one point with an invitation to a meeting of the traditional council of the Prampram area, during which they presented the council with 20 boxes of donated books. "I was very happy about that, because they had a very good library in town," Macheret says. "I was really surprised to find a chemical engineering textbook there."

New Best Friend

Macheret also assisted on school painting projects. Over the course of a few weeks, he had struck up friendships that transcended geopolitical boundaries. But it was Emmanuel, a young soccer player on the city team who had bigger ambitions of playing in the nationals, who made the biggest impression.

"Emmanuel ran on the beach for two hours each morning," Macheret says. "He was so inquisitive and had so many questions about everything. I think one of the best things I did while I was there was to help him set up an email address. And now that he knows how to do that, he'll be able to teach others in the village how to get online."

During their free time, the volunteers watched the fishing boats come home in the afternoon and joined in other community rituals. They also visited the homes of community members and learned to cook local dishes. They learned that everyday life in Prampram is difficult. Too many residents struggle to achieve even a minimal standard of living, Macheret explains. The fishing industry is unpredictable, unemployment is high and education is still inconvenient and inaccessible for many.

Once part of the powerful

Ashanti Empire, Ghana figured prominently in one of the most tragic chapters of Western history— the African slave trade. In colonial forts perched along the Ghanaian coastline, countless Africans were imprisoned until their departure on slave ships bound for the New World. The volunteers had the opportunity to visit these sobering sites.

Macheret, who started a student volunteer group at USC called "Cry for Freedom," spent spring semester "actively recruiting USC students to undertake a similar trip next summer." He says the volunteer group, co-founded by his friend and fellow USC student, Jon Turco, is dedicated to freedom from inequality in healthcare and education.

"I hope we can organize a fundraiser to raise some money for those who want to go," he says. "It's a great way to apply your education and to learn what it's like in other parts of the world. It really does transcend any learning experience I've had so far."

—DA

Right; Macheret treating a baby at the clinic.

Top; L-R: Fellow USC student Jon Turco, Macheret, nurse Evelyn Narty, soccer player and new friend Emmanuel Narty, and Lindsay, a volunteer from Barnard College in New York City.

Shahabi photo by Max S. Gerber

IMSC Awarded Microsoft Grant to Advance Digital Geographics

Stay tuned for the next generation of online maps. Led by Cyrus Shahabi, a team of computer scientists at USC's Integrated Media Systems Center (IMSC) is conducting basic research in advanced geographical visualization and data management systems for "Virtual Earth." The technology is being developed in a project called GeoDec.

Shahabi is an associate professor of computer science and specializes in databases and information management. He received one of eight highly competitive Microsoft research grants to conduct his research, which is also supported by a recent grant from Google. GeoDec is designed to rapidly and accurately enable an information-rich and realistic 3-D visualization or simulation of geographical locations, such as cities or states.

Shahabi says, as high-powered interactive mapping tools like "Virtual Earth," "Google Earth," and "MapPoint" come online, GeoDec programming applications are needed for data mining and management. These mapping tools are hints of what is to come in commercial mapping and local search platforms that will enable users to harness state-of-the-art capabilities.

"This award from an industry leader in online mapping provides us with an incredible opportunity to work with high-caliber scientists at Microsoft Research and to help advance the state-of-the-art in online mapping," says Shahabi. "We would like to extend the query and data analysis utilities of 'Virtual Earth' so it can be used in more application scenarios, such as in emergency-response, urban planning and intelligence applications."

USC's GeoDec research includes a family of interactive, highly accurate, 3D visualization tools ranging from rapid modeling to the depiction of live dynamic data, including live video. Led by Shahabi, the project is part of IMSC's Decision Support Research Area, which is devoted to research that presents massive amounts of data in real-time via forms and displays that can be quickly understood.

These interactive mapping capabilities have already been sought out, Shahabi adds. For example, GeoDec has also received funding from USC's Annenberg Center for Communication to support an urban renewal project that is under way in downtown Los Angeles. IMSC researchers are developing programming interfaces that will allow urban planners to redesign the city and create digital blueprints for a proposed $1.8 billion redevelopment project.

Cyrus Shahabi

"In our proposal, we demonstrated that we can build more accurate 3-D models in a relatively short time," says Shahabi. "We have also shown that we can map images and live video textures to the models to make them even more realistic."

In addition, GeoDec can automatically and accurately integrate a variety of spatial and temporal data, such as road networks and GPS data, into a model to make it ready for sophisticated spatio-temporal data analysis.

"The ability to create high fidelity, information-rich models of cities, states or countries is critical for a wide variety of decision makers," Shahabi explains. For example, in the United States, city managers, urban planners, emergency response planners and first responders can use GeoDec. In military operations, these capabilities will be useful to urban operations planners, psychological operation planners and training systems for soldiers in the field.

Co-principal investigators on the GeoDec project include USC Information Sciences Institute (ISI) researcher Craig Knoblock, who specializes in databases and artificial intelligence, and IMSC researchers and Viterbi School faculty Ram Nevatia, an expert in computer vision, and Ulrich Neumann and Suya You, who will focus on graphics.

More information about IMSC's GeoDec project is available at http://viterbi.usc.edu/links/?105

Four Viterbi School Faculty Win NSF CAREER Awards

Assistant professors at the USC Viterbi School have recently won four highly competitive National Science Foundation Faculty Early Career Development awards. The awards, which include five-year grants of approximately $400,000, are one of the highest honors for young faculty members and support early career development for teacher-scholars who are most likely to become future academic leaders.

The four Viterbi award winners are Igor Devetak of the department of electrical engineering, David Kempe of the department of computer science, Ellis Meng of the department of biomedical engineering, and Maria Yang of the Daniel J. Epstein Department of Industrial and Systems Engineering.

"This is extraordinary news and confirmation that the Viterbi School's faculty is continuing to grow in stature," said Dean Yannis Yortsos. "I offer my warmest congratulations to all four of these very distinguished young academics."

Igor Devetak

Devetak works in the area of quantum information theory and is especially interested in classic information theory as systematized by Claude Shannon. His goal is to expand classical information theory to include quantum information systems. His project is entitled "A High-Level Framework for a Unified Treatment of Quantum and Classical Information Theory and Thermodynamics," and he hopes to accelerate the creation of quantum cryptography systems and eventually quantum computers.

In a groundbreaking paper published in 2003, Devetak set forth a novel rigorous proof for determining information capacity of quantum information channels. Shannon did this for now-standard digital electronic channels.

Devetak received his Ph.D. in electrical engineering from Cornell University in 2002. Before coming to USC in January 2005, he completed a postdoctoral research appointment at IBM's T.J. Watson Research Center.

More information can be found at: http://viterbi.usc.edu/links/?106

David Kempe

Kempe is an algorithm researcher and programming team coach. His award will underwrite five years of research on modeling epidemics in networks. The abstract of his project reads as follows:

"Epidemic phenomena in networks occur when an infectious disease, computer virus, behavior, piece of information or innovation is disseminated in a highly decentralized and parallel way along the links of a social or computer network. Epidemic phenomena often have a strong effect on society."

Kempe is one of the organizers of the USC Programming Contest for Viterbi students. Prior to coming to USC in 2004, he was a postdoctoral fellow at the University of Washington. He received his Ph.D. in 2003 from Cornell University.

More information about Kempe's award can be found on the web at: http://viterbi.usc.edu/links/?107

Ellis Meng

Meng is an expert in bioMEMS (microelectromechanical systems) fabrication. Her research involves developing biocompatible polymer microsystems that can seamlessly communicate and interact with the body's natural chemical and electrical pathways. Her award will support her effort to develop novel microfabricated neural interfaces that may one day help to repair damage and restore lost functions in people who have suffered central nervous system injuries.

"These MEMS devices integrate both microelectrodes and microfluidics on a single platform and facilitate multi-channel, multi-modality flows in both directions. This has never been accomplished before," she says.

Meng, who received her Ph.D. in electrical engineering from the California Institute of Technology, is also associate director of education and diversity programs in the Viterbi School's Biomimetic Microelectronic Systems (BMES) Engineering Research Center.

More information about Meng and her project can be found at: http://viterbi.usc.edu/links/?108

Maria Yang

Yang's project, "A Design Data Analysis Approach to Early Stage Design Process Modeling," will determine models and measures for the conceptual or formulation phase of the engineering design process.

"Decisions that are made at the very early stages, when a product is still just an idea, will have a strong impact on the later phases of design," Yang said. "The challenge will be to come up with measures and a model of that process across industries and product types."

Yang will document a wide variety of design processes in such industries as aerospace, automotive and consumer electronics. Gathering text, sketches and prototypes drawn from design artifacts and documentation, she will determine models and process measures that will eventually serve as indicators of potential design outcome.

She received both her master's degree and Ph.D. in mechanical engineering from Stanford University under an NSF Graduate Fellowship. Her mechanical engineering bachelor's degree is from MIT, where she is also currently a member of the Mechanical Engineering Visiting Committee.

In addition to her research, Yang teaches several courses in process design in the Daniel J. Epstein Department of Industrial and Systems Engineering, including a graduate-level course on the management of engineering design teams.

More information about her award can be found at: http://viterbi.usc.edu/links/?110

Viterbi Students Win Water Grants

Three teams of USC's Viterbi School civil engineering students met with Assemblywoman Carol Liu (D-La Cañada Flintridge) and Metropolitan Water District officials recently to discuss novel technologies for water conservation in Southern California.

The students were among a dozen Southland college and university teams to receive World Water Forum grants totaling $120,000 to research local water supply solutions that may result in global benefits. Assemblywoman Liu is honorary chair of the Southern California World Water Forum, which is currently celebrating the United Nations' "International Decade of Fresh Water."

Liu met with USC Viterbi School civil engineering faculty, including Carter Wellford, chair of the department of civil and environmental engineering; Professor J. J. Lee; and Research Professor Dennis Williams, as well as water officials including Timothy J. Brick, a Metropolitan Water District (MWD) board member representing the city of Pasadena, and Nancy Sutley, a MWD board member and City of Los Angeles deputy mayor. Liu called the projects "wonderful," offering people "some very practical solutions to a very difficult issue about how to handle our water efficiently and economically."

"We have a lot of work to do," Liu added, "but I thought the projects were very stimulating and very practical."

The water conservation grant program is part of a year-long competition sponsored by the United Nations to mobilize students at dozens of universities and community colleges to address global water issues.

Suraj Kumar Shankar, a civil engineering graduate student, is working with fellow graduate student Zhiqing Kou to study catch basin insert devices, which are found in drainage systems, and propose the most economically viable products for use in residential, commercial and industrial areas.

"Catch basin insert devices are designed to prevent trash and pollutants from flowing into the ocean, but they don't stop all of the pollution from entering the storm drains," Shankar said. "There are about 90,000 catch basins in Los Angeles County alone and 30,000 in the City of Los Angeles. We could achieve a 20 percent reduction in the cost of treating storm water runoff if we had more efficient insert devices."

Shankar's project, supervised by J. J. Lee, will compare the costs of insert devices with hydraulic performance and pollution removal efficiency. His team will deliver a cost-benefit analysis to help decision-makers reduce the costs of implementing and managing new catch basin systems.

Hyoung-Jin Kim, a graduate student and team leader of a project to design a touch-activated on/off showerhead switch, was another of the USC grant winners. He said water use through showering accounts for about 17 percent of all indoor water use.

"Many older showerheads and even the low-flow showerheads do not prevent waste while showering," Kim said. "My idea was simple. Let's turn off the water while soaping or shampooing. That way, we will save considerable amounts of water."

The project will investigate switches that adjust for height and maximize water-use efficiency. Kim's faculty adviser is Carter Wellford.

Civil engineering graduate student and team leader Christopher Harich won a grant for his project to test water well clean-up techniques and propose the best and most efficient methods for increasing well efficiency.

"In national expenditures, 56 percent of the large public utilities obtain their water from the ground," Harich said. "If we could just go in there and clean our wells, and gain 10 percent efficiency, we would be saving about $350 million a year."

Under the supervision of Dennis Williams, Harich and his team will use USC's full-scale well/aquifer model to determine those well clean-up methods that are most efficient.

"All of these projects demonstrate the tremendous benefits that are coming out of this grant program," concluded Timothy J. Brick, MWD board member for the city of Pasadena.

"USC is the only school that got three grants," he said. "You've done a tremendous job and I'm very excited about taking this information back to Metropolitan and telling everyone how successful it has been.

—*DA*

Top: (left to right) Christopher Harich, USC civil engineering graduate student and grant winner, meets with Timothy Brick, Metropolitan Water District board member representing Pasadena, and Assemblywoman Carol Liu (D-La Cañada Flintridge).

Left: A camera crew captures Assemblywoman Liu chatting with Metropolitan Water District representative Benita Horn.

KIUEL is Viterbi for "cool"

by Diane Ainsworth

" My hope is that KIUEL will send a strong message to students that the Viterbi School cares, the university cares, and that I care about undergraduate student engineers."

—Ken Klein

Ken Klein (BS BMEE '82) knows the rigors of USC's undergraduate engineering major better than most of the echo-boomers filling today's classrooms and lecture halls.

He has been in the trenches, where he learned to work hard, set goals and stay focused.

"The engineering major is tough, any way you slice it," says the president and chief executive officer of Wind River Systems, Inc., a global leader in device software optimization (DSO). "Our undergraduates have an extremely heavy burden to shoulder during their USC years, so it's important to support them as best we can."

Klein sees his $8 million gift to establish the new Klein Institute for Undergraduate Engineering Life (KIUEL) as the way to support student engineers at a critically important time in the history of the profession. The rest of the world is producing more engineering graduates than the U.S. each year and the competition is gaining ground.

"We are really on the precipice of a serious shortage of engineers," says Klein, who earned a dual degree from USC in biomedical engineering and electrical engineering. "I wanted to send a message of encouragement to student engineers by establishing an institute that will enrich their lives outside of the classroom and, hopefully, make things easier for them."

Klein, who is tall and slender, with ocean-blue eyes, jogs four miles every day and surfs when he is in the vicinity of an acceptable surfing beach. Professionally, he is riding the crest of a burgeoning new market in device software optimization, but that has not prevented him from devoting some time to the formation of his new institute.

He announced the gift in the fall of 2005 and worked closely with Viterbi School Associate Dean Louise Yates to design an overarching program to expand current student services and create an aura of community within the School. When it opens later this year,

Student photos by Max S. Gerber and Brian Morri

Ken Klein

Klein photo by Brian Morri

the Klein Institute, housed next to the admission and student affairs office, will provide students with a full array of academic and social support services beyond the traditional classroom environment.

Institute's Building Blocks

KIUEL is designed to create a more cohesive and positive experience for Viterbi School undergraduate engineering students. It is founded on the building blocks of leadership development, building community, service learning opportunities and cross-disciplinary activities. Some of its programs are already in place, but they will be enhanced and expanded. Other new programs and activities are in the planning stages now and will be implemented, customized and modified in the years ahead.

Klein's institute is heart-felt. He hopes to help connect students with little time outside of the classroom with the student community at large.

"I felt cut off from university life, like there was a school within a school, and that in engineering, things were a lot more difficult for us than for students in other majors," says Klein.

"I took some time to engage in a number of personal pursuits, like becoming captain of the USC surfing team, but the majority of my life was spent studying and working. Of course, I managed to squeeze in a USC football game from time to time."

Klein is no stranger to university life. He is the son of a peripatetic professor, a wandering engineer who moved his family frequently to take new teaching assignments at some of the top engineering schools in the nation — the Massachusetts Institute of Technology, Purdue, UC Berkeley and Stanford University.

continued on page 16

The Klein Institute Q&A with Louise Yates

Louise Yates is associate dean of admission and student affairs in the Viterbi School of Engineering. As overseer of undergraduate student affairs, her office will administer most of the new programs that are established by the Klein Institute for Undergraduate Engineering Life (KIUEL). *USC Viterbi Engineer* asked Yates to discuss the institute's role in student affairs and give readers a sneak preview into some of the new programs in store for undergraduate students.

Q Why is the Viterbi School establishing an institute for undergraduate engineering student life at USC?

The engineering major is a difficult major. It's probably more difficult than 90 percent of all the majors available to undergraduate students. Engineering students work hard at academics and don't often see the need for getting involved in other activities. We think that if we can provide a variety of personal and professional activities to support our students and offer more opportunities for a more rewarding college experience, they will begin to balance their lives a bit more and ultimately gain all the skills that will help them develop as engineers and leaders.

continued on page 17

"I moved every single year from the time I was born until the time I was in junior high school," he laughs. The family finally settled in Monarch Beach, Calif., near Laguna Beach, where Klein learned to surf. But while he was still in high school, the family made one final move, this time to New Canaan, Connecticut, outside of New York City.

"That final experience made me realize that I really wanted to get back to Southern California and that was a big factor in my decision to attend USC," says Klein, who makes his home today in Atherton, California. "I knew I wanted to get back home and USC provided me with the home I was looking for."

Honors at Entrance

He began as a freshman honors student in the fall of 1977 and worked part-time through a fellowship program at Hughes Aircraft Company. Midway into his biomedical engineering major, Klein got interested in very large-scale integrated circuit design and decided to begin a second major in electrical engineering. Working and studying day and night, he completed the requirements for both majors in the same amount of time it took most students to complete one major.

"That was a formative experience," he says modestly. "At one point, I was taking 18 units and working 30 hours a week. I've never worked harder before — or since — so it was both a very valuable and a very painful experience."

"I knew I wanted to get back home and USC provided me with the home I was looking for."

For fun, with his limited free time, he surfed his favorite beaches along the Southern California coast, from Trestles in San Onofre to Salt Creek in Dana Point to Rincon in Ventura County.

Klein took a fulltime job at Hughes Aircraft Company after graduation, but was careful not to stay too long. "If you stay in a technical job too long, you get pigeon-holed," he says. "I wanted to transition into the business side of engineering and took on a field application engineering position in marketing."

Silicon Valley startups were just beginning to spring up in the mid-1980s, so Klein leap-frogged from Hughes to Daisy Systems in Mountain View, Calif., a pioneer in the electronic design automation industry.

"I was able to really experience a Silicon Valley company and it was a very exciting time," he remembers. "I grew my career at Daisy, going from a field application engineer to a sales engineer and then, finally, to a regional sales manager, so that's when I really completed my transition from being purely technical to being more business-oriented."

From Daisy Systems, he tried his hand at another startup company based in San Francisco called Interactive Development Environments. After a couple of years, Klein joined an even smaller startup, Mercury Interactive. He saw opportunity in the business of software testing and application management. As part of Mercury's founding team, he worked as a regional sales manager and helped to grow the fledgling company into a half-billion-dollar a year enterprise.

Climb to the Top

In 12 years at Mercury, Klein rose to chief operating officer and became a member of the company's board of directors. He remembers the climb to the top fondly, calling it "a real home run" to be part of a business that had such an impact on industry.

The experience was a stepping-stone to Wind River System, Inc. In January of 2004, Klein was recruited to jump-start Wind River, a 20-plus-year-old software applications company in need of a major overhaul. Founded in 1981, Wind River enabled companies to develop, run and manage device software better, faster, at lower cost and more reliably.

In less than two years at the helm, Klein and his management team turned Wind River into a $270 million business with approximately 40 percent of the market share in the device software optimization (DSO) industry. That made it four times larger than the nearest competitor.

"We are really at the forefront of a seminal shift in the marketplace, where software is increasingly becoming the battleground of differentiation for devices," Klein says. "In the next five years, there will be over 14 billion intelligent devices connected to each other in ways we can't even imagine right now. Software will be playing a greater role than it ever has in the past in these devices. In a few years, DSO is projected to become a $3 billion industry."

Wind River Systems designs embedded software platforms — soup-to-nuts applications solutions — for devices as prosaic as digital video recorders, digital television sets and set-top boxes to very exotic systems for scanners, medical equipment, satellite systems and avionics systems. Its longer-term aspirations are to become a one-stop shopping site for everything from operating systems to networking, management and security.

The "Wind River Dry Heavers"

The four-building facility sits on 275,000 square feet of prime real estate in Alameda, Calif. adjacent to the Oakland Estuary and a deep-water port. Klein jogs four-to-six miles a day along luscious grass picnic areas lining the perimeter of the property and up the streets of Alameda with his "Wind River Dry Heavers," a team of pretty serious runners who

continued on page 19

Student photo by Brian Morri

Q Describe the Klein Institute's main goals and objectives.

Really, its main goal is to create a more cohesive and positive experience for undergraduate engineering students. We are interested in developing an undergraduate community so that our students feel connected both in and outside of the classroom. After all, we are attracting some of the most academically gifted, talented young people in the country to our campus. Naturally, we'd like to make sure they enjoy their time at USC and that they ultimately become great engineers. So many of them often get frustrated with the amount of time they have to spend on academics and this is one way to help them balance their lives while encouraging them to stay in the field.

We've spent a lot of time carefully mapping out the foundations of KIUEL. Its building blocks emphasize leadership development, building community, service learning opportunities and cross-disciplinary activities. In developing these programs, our hope is that students will socialize and interact beyond the classroom, creating a positive community and overall student life experience for themselves, while at the same time developing and enhancing skills ranging from communication to volunteerism. In addition, we want to encourage and facilitate the interaction between students and faculty outside of the classroom.

Q What kinds of programs will the institute support?

We have a range of ideas for new activities and events we'd like to introduce in the next few years. These programs are diverse and learner- centered to encourage proactive behavior. Hopefully, the variety will give every Viterbi School student an avenue for involvement within the School.

The very first set of programs that we will be offering next year will be leadership development programs, including a leadership retreat for all of our current student organization officers. In addition, we are developing a leadership seminar series as well as a peer leadership consultant program to help all students understand some of the basic concepts about leadership that are so important today.

We have lots of ideas. They include programs such as an alumni mentoring program, career related workshops and seminars, an emerging leader program, cross-disciplinary activities and workshops, including undergraduate research symposiums, and much more.

Some of the service learning and globalization ideas include programs that would link students with community agencies in need of short-term technical assistance, interdisciplinary design competitions, an international experiential program providing opportunities for students to assist in solving technical problems in Third World countries, more opportunities for overseas experiences and establishment of a KIUEL Student Arts Council. This is so that engineering students can get more involved with the recent Arts and Humanities initiative of the USC Provost taking place on campus.

Q When will this institute be launched?

Our first KIUEL programs will begin in the fall of 2006. The staff managing these programs will be housed in Tutor Hall within our student affairs office, with support being provided by our retention coordinator as well as both our career services office and our center for engineering diversity.

Q How and in what ways will students benefit from KIUEL services and activities?

The primary goal is to get engineering students to participate in more out-of-classroom experiences that are actually related to their majors as well as help them build community within Viterbi.

Louise Yates

Our hope is that they will benefit, and hopefully thrive, with a community-building process as they begin to develop deeper friendships and relationships with other students while learning some things that will carry them through their careers.

Although we already offer a variety of support services to help students make it through what is ultimately one of the toughest programs at the university, KIUEL will go beyond those services and take them to the next level. We want to graduate well-rounded leaders who are great engineers.

continued on page 19

Yates photo by Brian Morri

Viterbi School Celebrates New Klein Institute for Undergraduate Engineering Life

Holding up a very "cool" black T-shirt, with the definition of KIUEL in white lettering — that's Viterbi School nomenclature for the Klein Institute for Undergraduate Engineering Life (KIUEL) — alumnus Ken Klein rejoiced with a crowd of engineering students, faculty and administrators in a jubilant courtyard celebration on March 30 that inaugurated his new $8-million institute.

"Thanks to Ken's support, we have created new and much needed resources, a facility so special that it will set us apart from all other engineering schools," said Viterbi School Dean Yannis Yortsos, who was the master of ceremonies.

Joining the celebration were some of KIUEL's key supporters: USC Provost and former Viterbi School Dean C. L. "Max" Nikias; USC's Vice President for Student Affairs Michael Jackson; Viterbi School Associate Dean of Admission and Student Affairs Louise Yates; members of the Viterbi School Board of Councilors, including chairman Jim Baum; and the Klein family.

"Today USC salutes a couple who truly epitomize the concept of KIUEL, Ken and Natalie Klein," said Nikias. "The Klein Institute is more than an act of generosity; it is an act of vision.

Groundbreaking Program

Jackson praised the school for having the vision and perseverance to design such a groundbreaking program for undergraduate life.

"Great ideas sometimes take a collective effort to mature and develop and be realized, so I want to congratulate you all on the vision that you have for developing this center," he said.

Before the celebration got under way, Klein, his wife, Natalie, and son, Sean, were escorted to Louise Yates's office on the first floor of Tutor Hall, where Dean Yortsos unveiled an elegant glass sign bearing the Klein Institute name.

Dean Yannis Yortsos, left, presents Ken Klein and his wife, Natalie, with original KIUEL artwork.

The Trojan Marching Band shadowed the events, stepping out onto the second floor balcony of Tutor Hall at the appropriate moment to salute Klein and the crowd of students.

Speakers underscored the importance of the institute to help facilitate greater community building between students and faculty within the School and throughout campus.

"There is a difference between information and education," Nikias said. "There is a difference between data and wisdom. Technology can help us educate a student in many ways, but here at USC, President Sample has challenged us to create the best human environment within this technological revolution."

Defining Experiences

Kellyanne McLachlan, a senior in the Mork Family Department of Chemical Engineering and Materials Science, said her many extracurricular activities, including serving as a trustee scholar and chairwoman of the Viterbi School Student Council, defined her undergraduate experience at USC.

"I've gained leadership experience through my participation in student organizations, and I've also had the opportunity to give back to our community through servicing these projects with my friends and classmates," she said. "This gift from Ken Klein will have an incredible impact on our lives as USC engineers.

"As I reflect on nearly two decades and a half since I left this place, I assert to you that I would not be the person that I am today without a USC engineering degree, nor without the experience I garnered here at the school," Klein said.

"They say that a mark of a good life is to leave the world a little better off than when we arrived," Klein said. "If KIUEL enables one student to stay in school and graduate as a Trojan engineer, then I will take great pride in knowing that we were successful, that I did a good deed, that I made a difference."

Amid cheers and a standing ovation, the Trojan Band emerged to play USC's victory song while the speakers raised their hands in the victory sign to the beat. Engineering students rushed to the stage to shake Klein's hand and ask him more about the institute.

Klein photo by Brian Morri

Q Will industry play a part in this institute and its programs? What about other participants outside of Viterbi School staff and faculty?

We encourage Viterbi School alumni to volunteer their time and resources to some of these programs. If they work in some of the companies we partner with, they can certainly help us design programs and activities for students that will help connect them to current engineers. The students benefit a lot from exposure to engineers from industry. They can help in a variety of other ways, too. Our industry partners are key to providing the information we need about what is expected of students after graduation. We will be seeking a lot of input from them as we move forward in designing these new programs.

Q Do you think the establishment of KIUEL will help in attracting more freshmen and transfer applicants in the future?

I have no doubt. KIUEL is really one of a kind. I don't know of another comprehensive institute specifically for engineering quite like it that has been established anywhere in the country. I think that as our programs are developed and gain momentum, their uniqueness will be attractive to prospective students when they compare various institutions as they decide where to attend college.

So yes, one of the things we hope to build on is our reputation for offering students a very broad, well-rounded undergraduate education with plenty of opportunities to develop important leadership, social and networking skills. We want to provide them with a place where they can transition from the university to real life and have all the important skills they need in real life to be successful. We want them to call up their friends who are applying to colleges a couple of years after them and say, "Oh yeah, you have to do engineering at Viterbi."

Student Affairs photo by Max S. Gerber

Klein story continued

competed and won second place in last year's 199-mile California Relay.

Among some of its recent accomplishments, Wind River Systems provided Boeing with the applications platform, or brains, of the main computer system onboard its new 787 Dreamliner aircraft. Wind River also built the VxWorks embedded operating system that controls the main computers onboard NASA's twin Martian rovers, Spirit and Opportunity, 60 million miles from Earth.

The company's robust DSO systems are used by everybody who is anybody in the computer industry — Cisco, Apple, Siemens, Hewlett-Packard, Nortel, Mitsubishi, Motorola, Sony, Samsung, Bang & Olufsen, ZTE Corp. in China, NASA, Nissan and Tektronix, to name just a few.

With offices in Europe, the Middle East and Africa, Wind River employs about 500 engineers around the world, "all of whom report to somebody who reports to me," Klein says. In addition to his daily responsibilities, Klein also serves as a member of the USC Viterbi School Board of Councilors, where he adds a unique perspective to matters involving undergraduate education.

In occasional guest lectures on the nearby Cal and Stanford campuses, Klein tells young engineers that the life they expect to have when they graduate — especially in the embedded software industry — will be nothing like the reality they face once they get there. Things change too quickly in the global economy. He encourages them to broaden their horizons as undergraduates and partake of the many extracurricular activities that will give them a more well-rounded view of the business of engineering.

Minors and Cross-Disciplinary Electives

"I strongly recommend that student engineers take as many electives as they can or that they minor in a cross-disciplinary field, like economics, biology, psychology or business," he says.

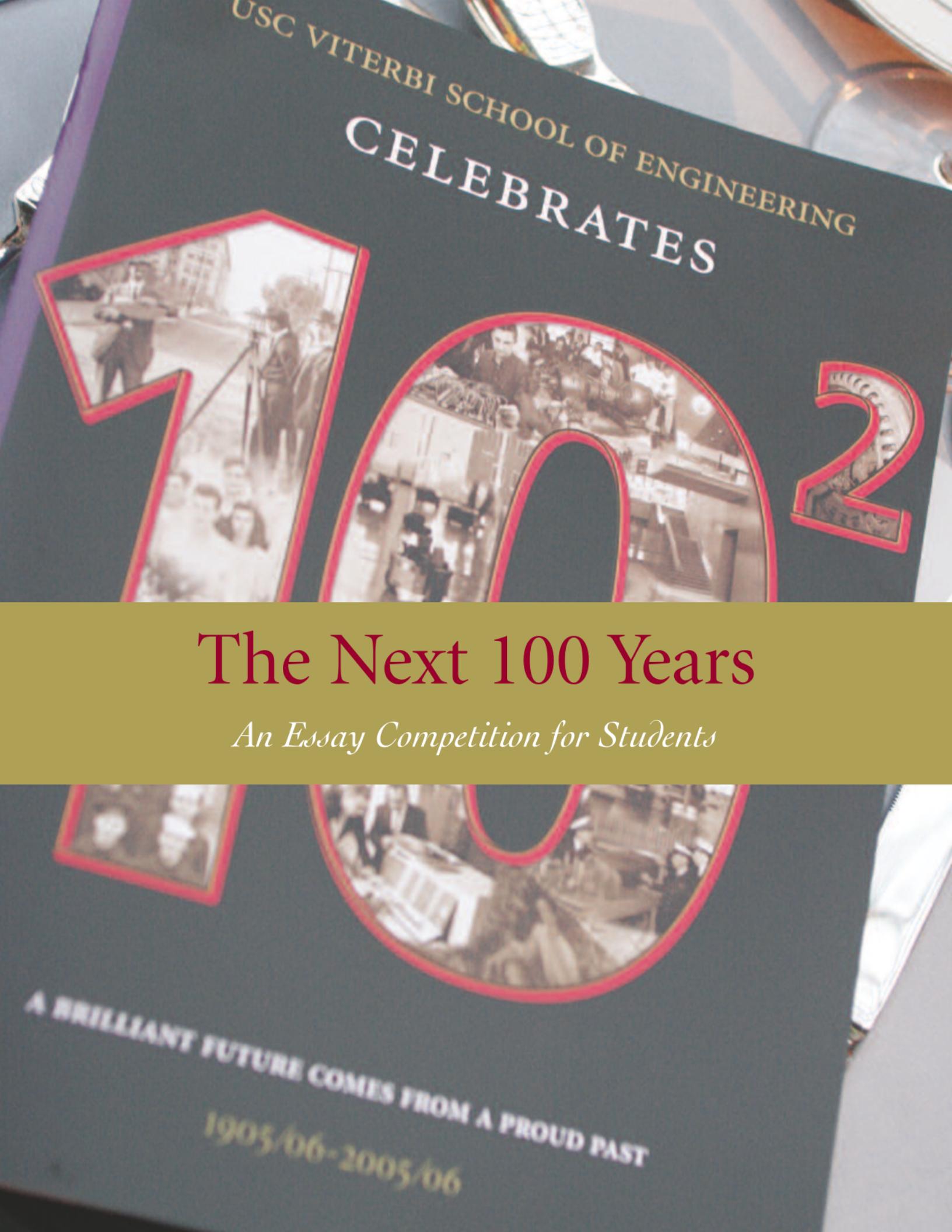
"Engineers who haven't gained that broader experience, either through education or work, will wind up on a very narrow path for a very large portion of their careers."

From a functional perspective, it's important that engineers develop skills in sales, marketing, accounting, finance, business law and leadership.

"These are really important skills to master," Klein says. "I look at a number of these things when I hire engineers at Wind River. For example, I'm always on the lookout for engineers who are very customer-oriented or who are focused on business and have some expertise in that area."

Klein's institute, the first of its kind, promises to help Viterbi School undergraduates gain that experience with a number of programs, including mentoring, guidance counseling, tutoring, networking, study abroad, community outreach and internship/fellowship opportunities. That is because Klein feels strongly that homegrown talent is a commodity to be treasured.

"My hope is that KIUEL will send a strong message to students that the Viterbi School cares, the university cares, and that I care about undergraduate student engineers," he says. "I want engineering students to know that there will be people in the Viterbi School who can make their undergraduate experience vibrant and enjoyable."



The Next 100 Years

An Essay Competition for Students

FIRST PLACE

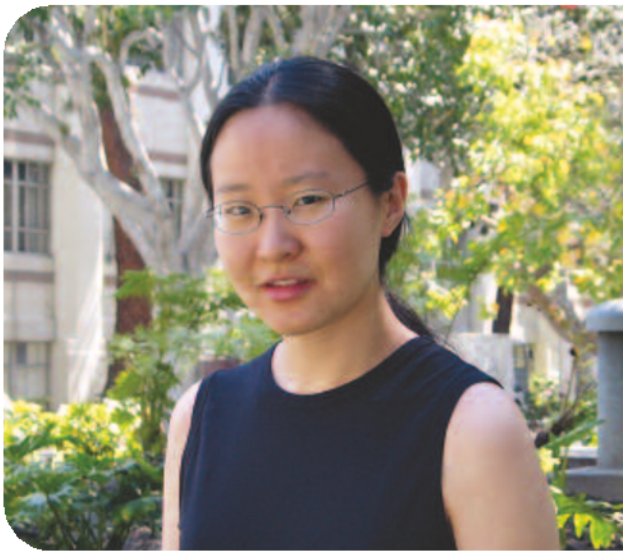
The Next 100 Years: A Love Story

by Linda Deng

Engineering is no longer the solitary bachelor it once was. Instead, it has finally found a mate — or many mates, for that matter — and the world has born witness to DNA computing, the hybrid child of computer science and biology; to laser micrometers, the offspring of electrical engineering and physics; and to the study of human factors, resulting from an illicit affair between mechanical engineering and psychology. Indeed, engineering has come out of its shell and will be constantly looking for love in the next 100 years.

It's just as well too, since engineering has started to get a tad creaky in the knees, but its children will divvy up engineering's many fortunes among themselves and they will someday have children of their own, and by 2105, engineering's blood will be surviving in many of the world's disciplines. No longer will engineering's human followers be restricted to constructing steel bridges or developing word processing software, but they will build roads between cultures and perform calculations in alternate dimensions — not through gushy Miss America promises or out-of-this-world science fiction stories, but through cognitive science and quantum computing.

For sure, engineering's offspring will be faster, stronger and friendlier, as we employ interdisciplinary principles to create more efficient forms of computation, more structurally sound materials and more of an understanding of human psychology. But of course we must first nurture the children, for they are mere kids now. USC — and universities around the world — must show their students the photo albums of engineering's children, make their students aware of just how adorable these children are now and how handsome they will surely turn out to be if we raise them right. Students will no longer be engineers; they will be engineers and linguists, engineers and chemists, engineers and musicians. The Viterbi School of Engineering will be the Viterbi School of Engineering and Mathematics and Science and Psychology and Law and Philosophy…



Of course, that is not to say that "pure" engineering wasn't just as handsome. But what good is beauty when you lack a significant other with whom to share it? Indeed, engineers may still be able to produce smaller silicon chips and faster microprocessors year after year, but perhaps all computer engineering requires is the gentle encouragement of a physics wife to whisper that she wants a son named a Qubit — and the world will become proud godparents of a quantum computer able to calculate any equation faster than its pure engineering father, even after decades of training, ever could.

Granted, the see-how-fast-and-small-you-can-go race is not the only competition we want to win either. Humans have always been curious about themselves, so monikers like Freud have become household names. But cognitive science, a mixture of computer science and psychology and linguistics and neuroscience and philosophy and anthropology (oh, there's probably more), has cropped up lately to answer those burning questions about ourselves. No, engineers won't just be building things anymore, even if what they build will be smaller and faster and better. We'll be learning about ourselves as well, winning the human race, attempting to answer virtually any question thrown at us, mechanical, electrical, psychological, philosophical, or otherwise.

Early this year as part of the Viterbi School's 100 Years of Engineering celebration, we announced an essay contest. We asked students to tell us in 700 words or less what the next 100 years of engineering would look like. We received 50-plus essays on subjects that ran the gamut of engineering thought, perspective, prediction and illusion.

Essays were judged by Steve Bucher, director of the engineering writing program; Bob Calverley, executive director, communications and public relations; Martin Gundersen, professor of electrical engineering; Eric Mankin, communications manager (who suggested the contest); Louise Yates, associate dean for admissions and student affairs; and Yannis Yortsos, dean of the Viterbi School.

First place went to Linda Deng with Yi Luo receiving second place honors. You may read those two essays on the following pages. Rachel Morford and Justin Perez won the two third place prizes. The other three finalists were Danielle Elkins, Andrew Jacobs and Valerie Giambanco. These seven essays and more can be found on the web at: http://viterbi.usc.edu/link/?104.

There were many interesting observations about engineering and predictions for the next 100 years. The following pages include some excerpts from several of the many insightful essays.

SECOND PLACE

The Next Century for Engineering

by Yi Luo

The industrial revolution of the late 1800's heralded the beginning of the rapid acceleration of human technological progress. For thousands of years before, agriculture, transportation and materials had changed relatively little, yet the decades and centuries afterwards would include scores of revolutionary advances. Technology is self-perpetuating; as it grows more sophisticated and more prevalent within society, it is pushed to become more advanced even faster than before. This trend will continue in the next century, giving engineering and its advances increasing importance in society. Ultimately, technology and engineering will allow human beings to become the only known animals to truly transcend the traditional constraints of environment and scarcity.

Future engineers will perfect machines of molecular size, allowing them to cheaply and directly manipulate the basic structure of matter. This, along with other innovations, will result in light new materials with astounding strength and durability, allowing USC engineers to design buildings immune to earthquake damage. Advances in materials science will facilitate a variety of inventions throughout the engineering world, from cars that travel safely at ludicrous speeds to flexible, controllable prosthetics that look and feel true to life. As robotic technology becomes progressively more advanced, engineers will be able to automate an increasing number of tasks. In some places, human physical labor could be replaced completely, granting the population the freedom to focus purely on intellectual pursuits or simply lead a life of ease and joy.

Engineers of the future will face problems largely identical to those that have plagued humankind throughout its existence: starvation, disease, natural disaster and other problems of environment. However, future individuals will have the unique opportunity to actually handle these complex issues. Molecular sized machines will revolutionize medical technology, especially in terms of anti-viral capability. Nanotechnology will lead to a cure for the dreaded HIV virus. Derivatives of these innovations will be constructed to seek out and destroy harmful pollutants in the environment. Additionally, engineers will improve electric fuel cell, solar and hydroelectric power and other clean sources of energy. Collectively, engineering advances will largely eliminate the harmful byproducts of human society.

During the next century the ballooning human population will necessitate increases in food production. Engineers will address this need by constructing advanced, sealed hydroponics farm facilities. Crops would be managed remotely and tended by robotic machines with perfect efficiency. Such facilities would allow for farming irrespective of local soil or weather conditions and essentially turn the entire Earth into arable land. Increasingly effective networks of transportation will ensure that the ample supplies of food can be distributed cheaply to any location on Earth.

Engineers will further tackle problems of overpopulation by using advanced materials to build cities that stretch high into the sky. Massive skyscrapers that are taller and wider yet still safer than those of today will characterize the expanding urban areas of the world. Building upwards instead of outwards is simply immensely more efficient in terms of space, helping to make room for the masses of the future. The catastrophic effects of natural disasters like tsunamis and hurricanes will be minimized in the communities of the future and cheap, safe housing will be provided throughout the world. Ultimately, technology will provide the means to finally eliminate scarcity, the issue that has defined the direction of human progress for thousands of years.

"Flying cars. Vacations on lunar settlements. A robot housekeeper in every home. Regenerative human limbs. A cure for all modern diseases. Clothes that can maintain the wearer's temperature in any weather. New energy sources. A longer human lifespan. An end to world-hunger. These predictions may seem remarkably similar to those made in the 20th century as we entered the 21st."

—Rachel Morford

Engineering and technology have grown tremendously more important in human society as it has progressed, a trend which will only continue during the next century. Humanity will become more connected to global communication and information networks. These networks will allow for the emergence of a global culture unified by a desire to consume the next exciting new technology.

An engineering education at USC after the next century will likely cover many of the same topics as today, but merely as background knowledge to begin understanding the innovations of the era. The focus will be much more theoretical as opposed to "hands on" since physical engineering duties will be carried out by robotic assistants. The students of tomorrow will have an unprecedented privilege to never be the victims of human physical fallibility. Instead, they will be limited only by the magnitude of their intellect.

"A few things we know for certain: Nations will go to war over conflicting foreign policies. The USC football team should win 10 or 11 national championships while UCLA wins 10 or 11 games. And if you start soon, during the next 100 years, you could probably get through the Lord of the Rings Trilogy three, maybe four times."

—Justin Perez

"…sooner than 100 years from now, students may one day be embedded with microchips that directly download and store lecture lessons into their brains."

—Elizabeth K. So

"Actually, it seems that everything needed to improve and sustain human life has already been created…I cannot think of any completely novel item that can be feasibly engineered, even though I am still holding out for teleportation and mind-reading devices."

—Valerie Giambanco

"There will be a USC Viterbi campus on every continent by 2015."

—Lanita Williams

"Our society should reevaluate our final goal as human beings. Do we exist merely to eat what and whenever we want, live in constant comfort and be entertained? Is this how we find true 'happiness?' Current trends in society seem to suggest otherwise."

—Kirsten McKay

"The engineering students of this school must work to unite all students. They must wholeheartedly pursue the interdisciplinary, depth-with-breadth education that is growing increasingly vital to the survival of our world."

—Zenzile Z. Brooks

"In the next 100 years, the hybrid system will not only become affordable and reduce the world's dependence on oil, but it will become a large part in reducing the amount of carbon dioxide being released into the atmosphere."

—Danielle Elkins

by Diane Ainsworth

The Big Three-O

THE CENTER FOR ENGINEERING DIVERSITY CELEBRATES 30 YEARS OF VALUE-ADDED PROGRAMMING

The Center for Engineering Diversity (CED) turns 30 years old this year. In that time, it has grown from a small program of support services for underrepresented engineering students into a multifaceted center offering all of the academic, social and professional opportunities students may need to succeed in a very rigorous field.

CED's mission is to provide scholastic, personal and professional growth to students who are traditionally underrepresented in engineering. Those students include African Americans, Latinos and Native Americans. Many of those who declare engineering majors will be introduced to CED long before they enter USC. If they take advantage of CED's services, they will make important connections that could help them academically and/or professionally.

That is the beauty of CED. Its programs span the pre- and- post-USC years and its recipients usually form lifelong friendships and business connections in the process.

"There's no getting around it, engineering is a very rigorous major," says Louise Yates, associate dean for admission and student affairs. "We are always looking for ways to attract students with diverse backgrounds to this field, but at the same time, we are also trying to retain them and give them the tools they need to succeed and graduate."

According to the students, a few "signature" programs — Summer Bridge, reFROSHer, the Corporate Dinner and Shadow Days — are among the most popular. Most of these programs are works in progress. They have evolved over the years, built on content, sometimes shifted emphasis to match industry's changing needs, as well as the interests and talents of each incoming class. But they all have lasting power and universal appeal, because they get results.

SUMMER BRIDGE

Summer Bridge is one of those signature programs and among the oldest the Center offers. Founded in 1980 as a non-residential program, it turned into a two-week residential experience years later to immerse the incoming class in the day-to-day realities of pursuing an

Navarro photo by Brian Morri

engineering major at USC.

"It's designed to help students ease through the transition from highschool to college and help them adjust to college life," says Traci Thomas-Navarro, CED director. "We are also interested in preparing them as much as we can for the academic challenges of engineering."

During the two-week program, students are given a general introduction to USC and enroll in two or more academic courses, usually in math and physics. They are also given many opportunities to meet with upper classmen, young alumni, industry representatives, faculty and CED staff to gather information about the school, the major and the industry.

"It's the best," says Carlos Arredondo, a freshman majoring in mechanical engineering. His Summer Bridge roommate, Daniel Lind, agrees. "Without it, I wouldn't know anyone," says the first-year mechanical engineering student from Florida.

The opportunity to make new friends is a big part of the community-building process. Students also participate in important team-building exercises, industry tours, social outings and orientation. By the end of the second week, Thomas-Navarro says, many of these students have found their new roommates for the first year at USC and learned more about the field of engineering.

reFROSHer

ReFROSHer is a relatively new event, created by CED's Assistant Director David Martinez. The Saturday workshop reunites Summer Bridge students and first-year engineering students who did not attend Summer Bridge.

The focus is to give students an overview of the engineering major, what they can expect later in graduate school, as well as information about all of the academic and co-curricular opportunities available to them at CED. "This is really to tell them about the academic experience and what lies ahead in terms of job prospects," Martinez says. "In addition, we talk about graduate school and what they should be prepared to do to get in. We want to plant the seed in their minds early."

Martinez invites upper classmen to the event, as well as young alumni, and puts together industry or alumni panels for the day-long workshop. He asks sophomores to speak to the freshmen about summer internships because it's more difficult to find one after the first year of school. "I want them to give the students some insight into how they got their internships; whether they did an intern program or were just good at networking," he says.

CORPORATE DINNER

Students also enjoy CED's Corporate Dinner. Ask Dawn Carter, senior manager of university programs at Amazon.com and a transfer student herself. Carter served eight years on CED's industry advisory board, helping to develop and orchestrate aerospace industry-university events like this.

"These industry events are an opportunity for students to interact with companies in an inclusive environment" she says. "This interaction starts in their freshman year and can be continued all the way through the undergraduate years. Not many companies give kids access for four or five years while they're working on their degrees."

CED students can also participate in a mid-year corporate luncheon, which provides them an opportunity to interact with industry partners over lunch. During the meal, they learn what opportunities are available at specific companies such as Boeing, Raytheon, Northrop Grumman, Hewlett-Packard, Intel, Lockheed Martin and Qualcomm.

SHADOW DAYS

Just about every undergraduate engineering student knows about Shadow Days. "It's one of the first questions I get from new students," Martinez is quick to point out.

Held during spring break, the program allows students to spend a day "shadowing" a working engineer. The event usually includes about 10 companies and draws about 35 engineering undergraduates, all going off to different companies in the Los Angeles area to learn what professional engineers do every day.

The students love it.

"One student went to Raytheon last year and now he works there," Martinez says with a smile.

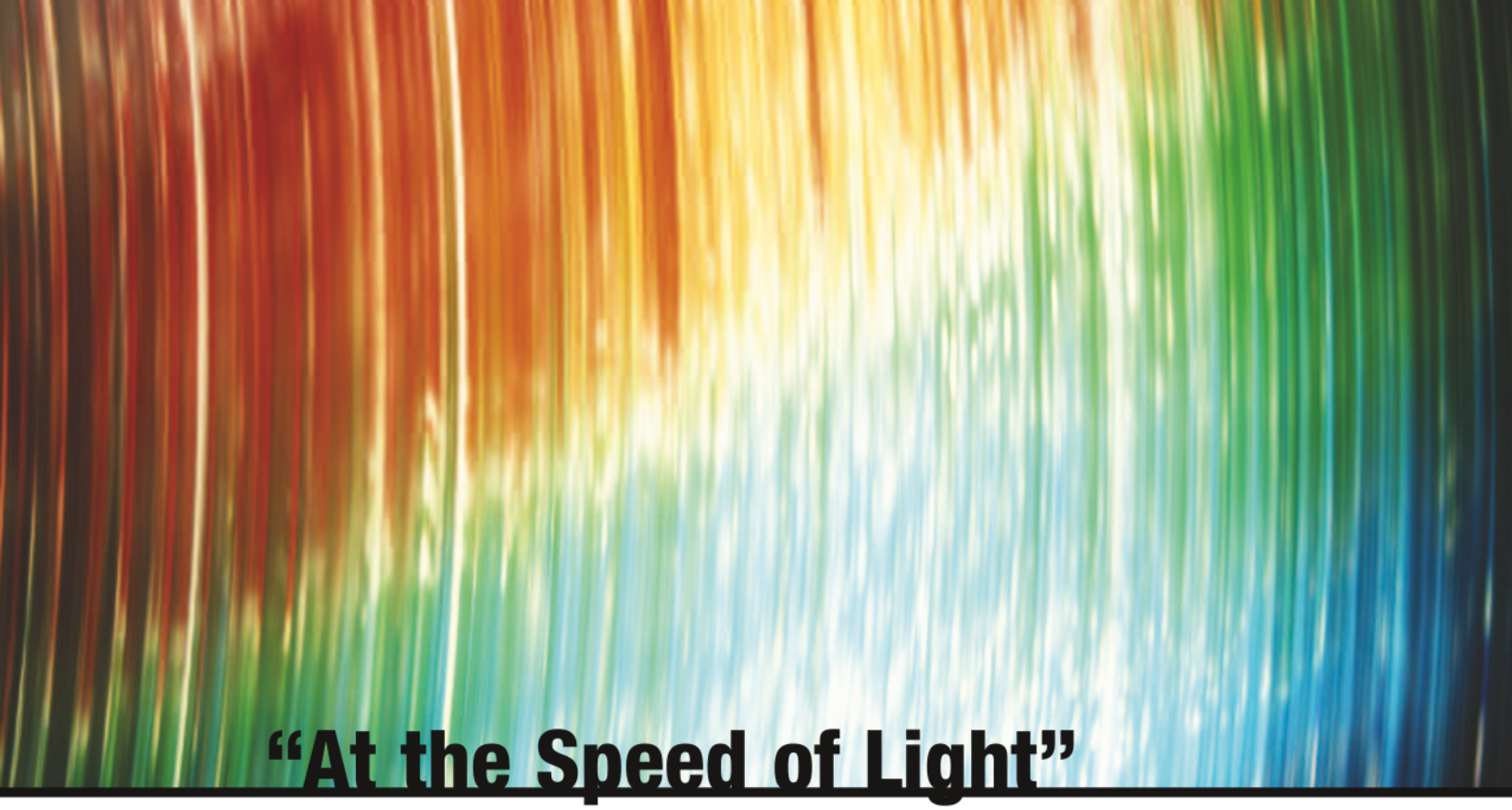
Sunita Deb, a senior biomedical engineering major, fell in love with Amgen, a biotechnology company headquartered in Thousand Oaks, California, after shadowing a biomedical engineer last year.

"I got a summer internship in global medical writing that summer (2005) and kept the cards of all the people I worked with so I could contact them again," says the identical twin, whose sister is a USC chemical engineering major. "The internship helped me to define the kind of a job I wanted, which is something you don't really get until you're in the workplace," she said. "So now I know where I want to work and what kind of work I want to do."

Left to right: Traci Thomas-Navarro, David Martinez and student Robyn Jackson chat about an upcoming event.

Established in 1975, CED has a long tradition of outstanding commitment to diverse students in engineering. CED designs, implements, and collaborates on various student-centered activities to increase student persistence within the Viterbi School of Engineering. CED offers its services to the entire USC community and maintains a focus on the retention and graduation of African American, Hispanic and Native American students in engineering. CED alumni who take a special interest in the center's mission and many programs are encouraged to become actively involved. They serve as role models and coaches for engineering students who are carefully choosing their career paths within the discipline. Alumni support comes in the form of time, energy and resources to help deliver professional and academic workshops for the students.

Interested alumni may fill out an information form online at http://viterbi.usc.edu/ links/?111.



"At the Speed of Light"

An Academic and Corporate Collaboration

by Teresa Hagen

With a little help from his industry friends, Alan Willner is leading his students on a search for the end of the rainbow. He might not find a pot of gold, but he could very well uncover the technological riches to be mined from the use of light and its hundreds of refracted colors. "You can have 100 (wavelength multiplexed) colors all being modulated with their own data stream at, say, 10 or 40 gigabits per second, and they're all going down a single optical fiber," explains Willner, who is a professor of electrical engineering at the Viterbi School. "Since data bits become distorted due to all kinds of physical-layer problems, there has been a lot of research to figure out how to make all this happen in the most efficient method possible.

"I was hired at AT&T Bell Laboratories in the late '80s in their research department, which was performing pioneering work on wavelength division multiplexing (WDM) for optical fiber systems," Willner recalled. "The first undersea transatlantic cable was (sending data) at about 280 megabits per second, whereas now, even commercial systems are sending a terabit (per second) over a single strand of optical fiber."

Since the eighties, the Internet has exploded as both an economic and communication powerhouse, creating challenges for companies to provide ever-faster and more reliable connections at minimal cost. Enter Willner and a group of Ph.D. students that work in his fiber optics lab, add three corporations with different approaches to this problem, and let the brainstorming begin.

Willner, who joined USC in 1992 and received the National Science Foundation Presidential Faculty Fellows Award from the White House, specializes in high speed optical fiber communications research. Over the past few years, he and his students have established close partnerships with leading researchers in industry. In particular, Willner's lab receives funding from Cisco Systems, HP and Intel, with incredibly valuable and active technical collaborations resulting from the funding dollars. "This close interaction creates a unique educational experience, producing a Ph.D. graduate that is uniquely suited for future engineering challenges," Willner says.

Willner first engaged in collaboration with Cisco Systems, Inc., working closely with Dr. Loukas Paraschis, technical leader for the Advanced Technology and Network Planning Group. "My students and I are working with Cisco to achieve longer reach, reduce complexity/cost, and provide higher performance," says Willner. "These systems can be fairly complex, so my students perform both experimentation and simulation to find design guidelines for future networks. And who better to work with than Loukas and Cisco on communication networks!"

"Alan's research has provided multiple benefits for Cisco, most notably new innovative ideas and excellent collaborations," adds Paraschis. "He has also provided some of the most exciting seminars/tutorials. And, of course, his students are top-notch."

According to Willner, "My students simply love interacting with Loukas, have a very deep respect for him and have published several research papers with him. He is an endless source of encouragement, inspiration and technical insight, helping them identify the ultimate potential for making a future commercial impact."

Meanwhile, Willner also nurtured a relationship with Intel. He and his students work closely with Dr. Mario Paniccia, director

of the Photonics Technology Lab, who specializes in silicon photonics. By using photons instead of electrons, optics is a promising breakthrough technology for interconnections in and around future PC's and servers. Furthermore, manufacturers could someday build optical components from silicon, a more cost-effective material compared to the exotic materials used for today's optical devices. "Mario's team has the potential to revolutionize optical hardware as we know it, and my students are thrilled to interact in the process with his outstanding and innovative people," says Willner.

"We all think that Alan has put together one of the top optical networking labs in the country. He has the infrastructure to do very long distance transmission and networking measurements as well as the modeling and simulation capabilities to explain the experimental results," Paniccia responds when asked about the advantages of working with Willner and USC. "My feeling of Alan is he's a pleasure to work with, he's very focused, and his time at Bell Labs has given him a valuable industrial perspective. He understands how 'applied science' works and tries to instill that in his students. We routinely have his students intern with us here at Intel and that further enhances our working relationship."

Research that investigates the high-speed interconnections within an electronic chip has recently partnered Willner with HP and Dr. Ray Beausoleil, principal scientist for HP Labs. Beausoleil's specialty is nanophotonic crystal devices, a promising technology that can control light within tiny spaces and be applied to information processing.

"When you have many chips with a huge number of high-speed transistors packed very densely, you have a lot of power consumption and critical clock distribution challenges. These are big problems and big money issues for the microprocessor industry," explains Willner. "So you look to see if optical interconnects can connect transistors in a more efficient way, with lower power and higher speed in a more efficient architecture. That's a big win and a huge limitation buster."

There is plenty of mutual admiration and respect in the HP/USC relationship. "Alan, his students and his post docs have become well known for their system modeling capabilities," comments Beausoleil. "I like the way their models gather the non-ideal characteristics of the physical building blocks of the network, and they try to find the limitations that physics imposes. It's generally much more valuable to build an end-to-end model of an optical system when you've gotten all the physics right. One of the things that I really appreciate as someone who hires is that Alan is teaching (his students) how to learn, how to stay curious, how to not be afraid to dive into an area where they don't know anything at all."

Willner doesn't mince words in his own high regard for Beausoleil. "Ray is the consummate explorer, thinks about the big picture, and is a natural mentor to my students. He helps the student connect physical issues to a grand vision. What a great role model for young people!

"The research projects with Cisco, HP and Intel are all collaborative, which I love, and hopefully we bring value to the companies," Willner adds enthusiastically. "It is great for my students who have direct access to scientists and researchers at each company. I'm only there to help facilitate the interaction. In fact, I believe that this is a key difference between me and many other professors around the country. I encourage the students to communicate directly with the industry collaborators. The benefits to students are enormous: developing team spirit, developing trust with the collaborators, developing project management abilities and developing communication and leadership skills. Also, most of them are going to be working in industry, and this interaction gives them a perspective on their future that they would not otherwise experience. They gain keen insight as to how companies evaluate their own 'pain' when looking at future challenges."

Willner is also quick to note that "these collaborations could not flourish without the encouragement and wisdom of the Viterbi School administration. Companies always point out that USC is very easy to work with. USC has a can-do attitude in terms of making things possible, rather than making it harder. Non-disclosure agreements and intellectual property issues are so much more straight-forward at USC. Provost Nikias' and Dean Yortsos' emphasis is always on building long-term valuable relationships, not putting stumbling blocks in the way."

Clockwise from top: Professor Alan Willner, left, with Loukas Paraschis of Cisco Systems; Ray Beausoleil, principal scientist for HP Labs; Loukas Paraschis (third from left) visits Willner (second from right) in his USC lab with his students.

4 x 3 = Rarified Air

by Diane Ainsworth & Eric Mankin

At one memorable White House gathering, President John F. Kennedy once quipped, "there has never been a greater concentration of intellectual power here... since Thomas Jefferson dined alone."

But the intellectual power concentrated in the dean's boardroom of Ronald Tutor Hall on May 3 rivaled that gathering, as 50 of USC's best minds gathered to pay tribute to four of their colleagues who had achieved an exceedingly rare intellectual distinction.

The four, Leonard Adleman, Solomon Golomb, Robert Hellwarth and Andrew Viterbi (Ph.D. EE '62), all affiliated with the USC Viterbi School, now hold memberships in the three prestigious national academies: the National Academy of Sciences (NAS), the National Academy of Engineering (NAE) and the American Academy of Arts and Sciences (AAAS).

At the beginning of the event, three of the honorees also held an appointment in the USC College of Letters, Arts and Sciences and by the event's close, all four did.

Two of them, Andrew Viterbi and his longtime mentor and friend, Solomon Golomb, have been triple academy members for several years, but Adleman and Hellwarth had both achieved the same rare honor just a few days before the reception. Hellwarth, already an NAE and NAS member was elected to AAAS while Adleman added NAS and AAAS membership to his NAE honors.

"The work you have done is the kind to which we all aspire. It is profoundly rich and original in its theoretical implications," said Viterbi School Dean Yannis Yortsos, addressing the four. "And, in all cases, society has found practical, world-changing uses for it."

Joseph Aoun, dean of the USC College, where Adleman, Hellwarth and Golomb hold joint appointments, joined Yortsos in the celebration. The two deans paid tribute to each individual's specific achievements, but also emphasized the extent to which the contributions of all exemplified the interdisciplinary ethos that has become profoundly part of the USC intellectual paradigm.

Aoun noted that the ideal was not a re-creation of the old idea of a single researcher mastering multiple disciplines in the mold of Leonardo da Vinci — knowledge and research have expanded beyond this point — but rather the ability and willingness to share skills with masters of other disciplines.

On hand to hear the presentations and intellectual banter was a group that included all Viterbi School department chairs, numerous distinguished faculty members, along with representatives from the Provost's office, including Viterbi School faculty member Tom Katsouleas, president of the USC Academic Senate, Vice Provost for Academic Affairs Elizabeth Garrett, and Dean of Graduate Programs Jennifer Wolch.

Aoun and Yortsos detailed, briefly, the career contributions of the four honorees, before presenting each of them with a commemorative plaque.

Leonard Adleman has achieved worldwide recognition in two widely separated areas. In 1977, with Ronald L. Rivest and Adi Shamir, he co-developed an algorithm known as the RSA Code (for the initials of the three creators). The RSA Code opened commerce on the Internet becoming the foundation for an entire generation of technology security products. Adleman and his collaborators later received the A. M. Turing Prize, sometimes called the Nobel Prize of computing.

Photo by Brian Morri

From left to right: Dean Yannis Yortsos; Solomon Golomb; Robert Hellwarth; Leonard Adleman; Andrew Viterbi and Joseph Aoun, dean of the USC College.

In a 1994 paper, Adleman demonstrated that DNA molecules could act as a computer and he used DNA to solve a simple problem, creating the new field of molecular computing. Eight years later, he demonstrated how to use DNA computing to solve complex problems.

Adleman, who was elected to the NAE in 1996, is a USC distinguished professor and the Henry Salvatori Professor of Computer Science, and is also a professor of molecular biology.

Solomon Golomb is renowned for developing a mathematical curiosity called shift register sequence into a robust tool that now underlies digital communications, cryptography, radar, cell phones and much more. In 1961, shift register enabled the detection of extremely faint radar echoes bounced off the planet Venus.

In 1976, Golomb became the very first USC faculty member elected to the National Academy of Engineering. Golomb is also an internationally known expert on mathematical games and a longtime mentor of Viterbi, who later endowed the Viterbi Chair of Engineering that Golomb now holds. A USC university professor, Golomb is also a professor of mathematics.

Robert Hellwarth was part of the Hughes Research Laboratory team that created the first laser in 1960, and subsequently became an early and continuing contributor to the new optics spawned by this development. He currently is working to understand and create materials for nonlinear optical devices.

At USC he developed a new, and now widely employed, method for reversing the light-wave pattern of an optical image, a process called "optical beam phase conjugation." His election in 1977 to the NAE cited his "major contributions to the understanding of quantum electronics and the invention of new laser devices." Aoun paid tribute to the help Hellwarth gave to physicist Jack Feinberg when Feinberg had to master laser technology.

Hellwarth has received the L. A. Hyland Patent Award, the Charles Hard Townes Award, given by the Optical Society of America, and IEEE's Quantum Electronics Award.

Hellwarth is a USC university professor with joint appointments in the Viterbi School's department of electrical engineering, where he holds the George T. Pfleger Chair, and in the USC College Department of Physics.

Andrew Viterbi, who holds the USC Presidential Chair in Engineering, and who with his wife Erna named the Viterbi School, earned one of the first USC doctorates in electrical engineering. He went on to create the Viterbi Algorithm, a groundbreaking mathematical formula for eliminating signal interference now used in all four international standards for digital cellular telephones, as well as in data terminals, digital satellite broadcast receivers and deep space telemetry.

The co-founder of Qualcomm, he was elected to the NAE in 1978, to the NAS in 1996, and to the AAAS in 2001. His long list of professional honors includes the IEEE's Shannon Lecture Award and its Alexander Graham Bell Medal.

Near the end of the Tutor Hall ceremony, Aoun noted that Viterbi had wanted to become a professor of Latin in the College, but his qualifications were, the dean said puckishly, somewhat thin in that department. As an alternative, he announced that Viterbi would receive an appointment in the department of mathematics.

About a week before the reception, word spread through USC that both Adleman and Hellwarth had been elected to AAAS. And then, the next day, news arrived that Adleman had also been elected to NAS.

"Len Adleman's election to the National Academy represents a special achievement, because it shows how much those most familiar with his scientific contributions — his peers — value his work," said Aoun, "Robert Hellwarth remains one of the best examples of scholars committed to both advancing fundamental research and the development of those discoveries into useful applications."

"Professors Adleman and Hellwarth's contributions to science and technology, and to society, have been nothing short of remarkable," said Dean Yortsos. "It is very gratifying that these two prestigious academies have recognized their outstanding interdisciplinary work, which straddles electrical engineering, computer science, physics and molecular biology."

Election to the NAS and/or the NAE is considered one of the highest honors in American science and engineering. Membership in the American Academy of Arts and Sciences is broad-based, consisting of scholars and practitioners from mathematics, physics, biological sciences, humanities and the arts, public affairs and business, which gives the Academy a unique capacity to conduct a wide range of interdisciplinary studies and public policy research.

"Throughout its history, the American Academy of Arts and Sciences has convened the leading thinkers of the day, from diverse perspectives, to participate in projects and studies that advance the public good," said Academy CEO Leslie Berlowitz. "I am confident that this distinguished class of new Fellows will continue that tradition of cherishing knowledge and shaping the future."

Adleman is among 72 new members of the NAS. He and Hellwarth join 195 scholars, scientists, artists, civic, corporate and philanthropic leaders elected to the AAAS this year. AAAS recipients come from 24 states and 13 countries, and represent more than 60 universities, a dozen corporations, museums, research institutes, media outlets and foundations. The 2006 AAAS Fellows also include former presidents George H. W. Bush and Bill Clinton.

Arthur Lin, PHD EE '90 *Imagining the Future of Mobile Digital Life*

As Corporate Vice President and Chief Technology Officer of Core Networks at Nokia, Arthur Lin has a lot of responsibilities…and a lot of fun.

"There is plenty of excitement working with a small company, but you can have a lot of fun working for a large company, too," Lin says in reference to his employer, a European-based company headquartered in Helsinki, Finland. "Since leaving school, I've always been either one of the engineers working on the products or a general manager responsible for the business or company. Now, I don't have the direct P and L (profit and loss) responsibilities, and that gives me the freedom to look at the business we are in (or not in yet) more generally and into the future. My job is to look at what the products and solutions are that Nokia should offer to our customers."

Lin, who received both his master's and Ph.D. degrees in electrical engineering and computer science from USC, is highly qualified to be in that position. Prior to Nokia, Lin served as the co-founder, president and CEO of Tahoe Networks, which was acquired by Nokia in 2003. He also was the co-founder, CTO and vice president of engineering and operations at Shasta Networks and later, the executive vice president and general manager for Nortel's IP services and routers business unit. (Shasta Networks was acquired by Nortel Networks in early 1999.) For many years, Lin worked as the director of engineering and held various senior-level engineering and management positions at Cisco Systems.

He has developed an extensive list of breakthrough products for the networking industry, including the Tahoe Mobile Internet eXchange TMIX-5000, Shasta 5000 BSN (broadband service node/router), Cisco's 120x0 and 7x00 series routers, the Cisco Catalyst 5x00/6x00 series multi-layer LAN switches and the Cisco LS-1010 multi-service ATM/IP (asynchronous transfer mode) switch. Lin has also received 16 patent awards and has published more than 100 technical papers. He is a leading authority on technologies such as very high speed packet switching systems, gigabit router architectures, high performance multicast algorithms, VoIP (voice over Internet protocols), traffic management, QoS (quality of service) control schemes, captive portals, network-based firewalls, NAT/PAT, (network address translation/port address translation) VPNs (virtual private networks) and high-performance, high-touch packet processing.

On a daily basis, Lin's responsibilities focus on assuring Nokia's highly competitive standing as a technological leader in mobile communication. "Our customers include both the service providers as well as the end subscribers, like you and I," Lin explains. "I keep thinking about how we can actually enable people to be more connected, and not just professionally, but also in their social lives as well. I'm working on the services, the applications and also the next big thing for Nokia. We're looking at products, software and hardware components, platforms, technology and solutions. What will be the future of the digital home, the digital life and the mobile digital life?"

So, what does the future look like? According to Lin, mobile phones have already become an essential part of our lives and will continue to dominate as a means of communication, but that is just the beginning. "In the next couple of years or so, we will all be 3G and WLAN connected so we'll have a much higher bandwidth," Lin adds. "Mobile phones today already include a high-quality digital camera with integrated flash, PDA, mobile messaging and e-mail functions. The mobile devices that we're coming up can also play MP3 music and video; you can watch TV and play network games, so they are also mobile entertainment devices.

"I think the mobile device we know today will be almost everywhere, covering everything we do on a day-to-day basis, including serving as a remote control for our home security and appliances," Lin continues. "I think also in the not so very distant future that device will also be our credit card, charge card, pre-paid card and ID card. That's already happening in Europe and parts of Asia." Lin admits that security and battery life still offer challenges, but he believes that technology will eventually resolve those concerns.

Born in Taipei, Taiwan, Lin came to the United States specifically to study at USC. He remains in touch with his thesis advisor, John Silvester, professor of electrical engineering and vice provost for scholarly technology, as well as former engineering faculty member Deborah Estrin, who is now a professor of computer science at UCLA. Lin stays connected to his alma mater by serving on the Industry Advisory Board for electrical engineering-systems.

"When I was (at USC), I really enjoyed every single bit of it," he remembers enthusiastically. "It was a nice campus, nice environment, with great professors and great classmates. Any success I've had I definitely attribute to my education at USC."

—Teresa Hagen

"Any success I've had I definitely attribute to my education at USC."

Orna Berry, PHD CSCI '86 *The Most Important Thing*

These days, the most important thing in the world to Orna Berry, high-tech entrepreneur, venture capitalist and former chief scientist of Israel, is a six-month old bundle of joy, her first grandchild Neta David. But the road to grandmotherly bliss has been sprinkled with many important accomplishments, and the journey is by no means over.

Berry was a pioneering female engineer in the field of computer science when she enrolled at USC in September 1980.

"There were few women, but it was actually easier than it was in industry. I avoided paying attention to the issue and saved myself a lot of emotional pain," she says. "I was really happy at USC. The friends I made at USC are still my friends today. Most of us were foreign and we were like a virtual family."

It was one of the many branches of the famous Trojan Family. One of her peers, Victor Vianu, is now a professor of computer science at UC-San Diego. Another, Serge Abiteboul, is a senior researcher at INRIA, the French National Institute for Research in Computer Science and Control. Still another is Gérard Medioni, now chair of the USC Viterbi Department of Computer Science.

"We used to go hiking together and we went to the beach — all the usual Southern California things," remembers Medioni. "Orna and I lived in the same part of town and we carpooled together."

Berry was born in Jerusalem about the time Israel became a nation. She and Israel grew up together. At 18, she was inducted into the military and served as an Air Force officer in the period immediately following the June 1967 Six Day War. This was a time known to Israelis as the War of Attrition. She was responsible for scheduling ground training in the Air Force's flying school and prepared the technical documents for the first American fighter aircraft — the F-4 Phantom and the A-4 Skyhawk — received by Israel's Air Force.

"The world has learned how difficult it is to come to political agreements between different systems in the Middle East but also elsewhere. In Israel we are pretty much at the center of this tension."

After the military, Berry went to Haifa University and earned a bachelor's degree in mathematics and statistics. She then went on to study at Tel Aviv University where she earned a master's degree in operations research. When Berry came to the United States, she was interested in medical mathematics. When it came to computers, her main concern was keeping all of the punch cards in order rather than algorithms. But the advent of terminals and keyboards changed that and lured her to computer science.

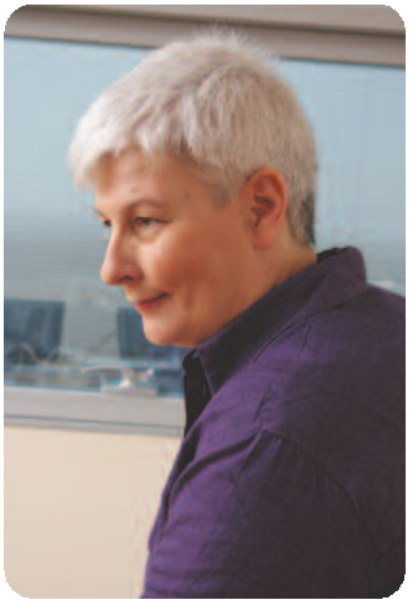
"I had a fellowship and worked at Rand and then later at SDC," she says describing her studies as a USC computer science doctoral student in the early 1980s. This was the period when the Internet, then known as Arpanet, was emerging. "My Ph.D. relied on the Arpanet heavily. I was doing experimental work that involved a few hundred CPU hours — that's hours, not seconds — across the Arpanet on 11 CPUs spread in the U.S. and Canada."

When she left USC, Berry's career began to take off. She spent 18 months at SDC, a company that later became Unisys. Next she returned to Israel where she was a researcher for IBM. Then she became the chief scientist — a position known today as chief technical officer — for Fibronics. There her design and implementation work became international standards (IEEE 802.1 and 802.5).

"I had the good fortune to move from distributed computing into networking at a time when it was moving into the commercial market," she explains. "In 1993, I co-founded my own company, ORNET Data Communication Technologies. We developed a very high performance local area network switch. It increased traffic in a local area network fifty fold."

ORNET was eventually acquired by Siemens and after Berry fulfilled her commitment to stay for a year, she became chief scientist for Israel in the Ministry of Industry and Trade. She was the first and is still the only woman to have held that post. The job, which was to encourage industrial research and development, was a professional rather than a political position, and she controlled an annual budget of half a billion dollars.

"Israel has no natural resources," she notes. "Turning our educational infrastructure, our problem-solving skills, into economic



leverage is a major mission. It puts value on our education and boosts the economy."

As Israel's chief scientist, Berry chaired a half dozen large bi-lateral and multi-lateral industrial research and development funds. One of these is BIRDF (the Bi-national Industrial Research and Development Fund), which was established to stimulate collaborations between Israel and the U.S.

"It puts small Israeli companies together with large U.S. companies that have market access in the U.S.," she says. BIRDF has an endowment of $110 million. Its interest and royalties from successful projects have generated revenues of $7.5 billion to collaborating companies from the US and Israel, with three-quarters of that going to the U.S. and one-quarter to Israel. "That's good. The Israeli economy has benefited a great deal and U.S. financial markets are now looking at Israel."

Berry was a member of a task force organized by the Association for Computing Machinery (ACM) that issued a recent study, *Globalization and Offshoring of Software.* The study found that despite intensifying competition, offshoring between developed and developing countries can benefit both parties. "Technology collaborations and investments among different nations produce a climate of innovation leading to new jobs, particularly

continued on page 33

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Benjamin Kuo, BSEE '94 *Broadening the Focus*

Seven years ago, whizzing along the 101 corridor for two hours a day between his Thousand Oaks home and his Pasadena office, Benjamin Kuo began pondering the rich and largely unknown Southern California technology industry.

"I was looking to cut my commute because my wife was expecting our first child, so I started coming up with a list of tech companies in the local area and put it up on my personal website," says Kuo. "It was just a hobby. It sort of happened by itself."

Others soon noticed Kuo's website. People began emailing him with corrections and additions to his list, and he emailed them back asking for more information. Before long there was so much traffic that his Internet Service Provider booted him and Kuo had to go out and get his own domain name.

He began emailing updates, beginning with a grand total of 25 recipients. And so was born socalTECH, now a newsletter sent daily to 4,700 subscribers and a website packed with news and information on Southern California's high tech industry, pulling in 50,000 visitors a month. It grew so much, and has done so well, it is no longer a hobby. It is Kuo's fulltime job.

"I used to read articles about companies 'based in the Silicon Valley' when I knew they were in Pasadena," he says. "Five or six years ago, no one talked about Southern California tech firms and people said there's no high tech down here. They were wrong."

SocalTECH.com provides high-tech news about the Southland. It tracks venture-capital-backed companies and venture funding, and Kuo conducts interviews with executives, entrepreneurs and venture capitalists.

SocalTECH.com has become an important virtual place for tech networking in the industry, and is widely followed by the movers and shakers in Southern California's high tech world.

Midway through USC, Kuo remembers taking an early morning interdisciplinary class taught jointly by the engineering and USC Marshall schools. It focused on entrepreneurs, venture capitalists and the whole business of starting a high tech company.

"It was a 7 a.m. class and you really had to be motivated," he says. "But Mike Markkula, the guy who financed Apple was there."

Kuo believes engineers tend to be narrowly focused. They learn to focus on the problem at hand, analyze it and solve it. A very good skill to have, he says, but there should be more.

"Sometimes engineers need to step back and take a look at what is going on around them," he says. "Too often engineers are working long hours solving problems and aren't talking to people. You need to understand the market and the world beyond your own little piece."

After graduation, and after he had been working purely as an engineer for a period, Kuo deliberately switched to product management and marketing. He simply wanted to get a broader view of the world. He found time to write a book *Building SANs with Brocade Fabric Switches,* and became a regular contributor to storage industry publications like Storage magazine.

Today, Kuo is enjoying talking to people and networking with others as he continues to grow socalTECH.

"I love what I'm doing," he says. Kuo still lives in Thousand Oaks. He is married to Jennifer Miyasaka (BSEE '96) whom he met at USC, and the couple has two children, a boy and a girl.

—Bob Calverley

Orna Berry *continued from page 31*

high value jobs that benefit all parties." Berry led the industrial track in the ACM task force.

Sequoia Capital, one of the Silicon Valley's most well-known venture capital firms, in which USC Trustee and Viterbi School Board of Councilor member Mark Stevens (BSEE '81, MS CENG '84) is a senior partner, has an office in Israel. Berry, in fact, has communicated with both Stevens and Andrew Viterbi (Ph.D. EE '62), who named the Viterbi School. She counts Benny Hanigal and Shmil Levy, two of the three Sequoia partners in Israel, as close allies.

She continues to work to develop new areas in high-tech research and development in Israel's science and technology industries. She sits on the Israel National Research Advisory Board, the European Union Research Advisory Board and in 2000, she joined Gemini Israel Funds as its first venture partner.

"When I was an entrepreneur, Gemini was my main investor," she recalls. "Today I'm chairing two young companies that I'm really excited about."

One of those companies is Adamind, with which Gérard Medioni has also had contact. Adamind is working on a system for transcoding images and content between handheld devices. The other company is Prime Sense, which is working on a device to replace mouse, keyboard and joystick inputs into a computer or other systems.

"Actually, it is quite similar to some work being done at the GamePipe Laboratory at USC," she says. "USC has evolved a great deal and there are a lot of interesting things being done there."

Berry has three children. Her son studies at INSEAD in France and her older daughter is a patent translator, whose husband builds atom chips at Ben Gurion University. Her older daughter is the mother of her first grandchild. Her youngest daughter, who is 16, is a budding photographer who has won prizes and is studying in a special science program.

"We like to go biking, or go to the desert and watch meteorite showers, or to see the flowers in Galilee," she explains. And would she consider sending her daughter to study at USC.

"Oh yes, absolutely!"

—Bob Calverley

snapshots

USC Viterbi School of Engineering Events
Late Fall 2005 & Spring 2006

Jeremiah Allen (MSCE '68), Carlos and Erin Canedo (BSEE '98), and Tayo Oviosu (BSEE '98) enjoy a night of friends and video games at Viterbi Gamefest.

BAY AREA WEEKENDER

On Friday, November 11 alumni joined together for the first ever Viterbi Gamefest at Le Colonial Restaurant in San Francisco. Led by Viterbi gaming experts Anthony Borquez and Victor Lacour, alumni previewed the next generation gaming technology designed by USC Viterbi School engineers and played in an NCAA 2006 Videogame tournament between the virtual USC Trojans and the Cal Golden Bears.

Gamepipe Lab Director, Mike Zyda meets with Microsoft representatives to discuss updates in the Viterbi School's new gaming courses.

MICROSOFT EVENT

In early February, Microsoft hosted representatives from the USC Viterbi School including Gérard Medioni, chair of computer science; Mike Zyda, director of the Viterbi School's GamePipe Laboratory; and Louis Johnson, associate professor of research for USC's Information Sciences Institute. Together, they presented cutting-edge research, curriculum enhancements and gaming information to more than 40 Microsoft employees, among which were several Viterbi School alumni. To conclude the event, USC memorabilia was raffled-off, including an autographed Matt Leinart jersey.

Engineering students Kevin Kellogg, Daniel Marsh, Cynthia Jeong, Donovan Schafer, and Kristine Skinner show their Trojan spirit.

E-WEEK

As its name suggests, National Engineers Week is a week celebrated across the country by both professional and student engineers. At USC, it is a week filled with annual events such as the Engineering Date Auction and the Viterbi Ball, along with other social and professional get-togethers. On February 21-24, engineers of all majors, years, and areas of concentration came together to celebrate the world of engineering.

After creating a rocket using a plastic bottle and water, aerospace engineering student Allison Anderson tests out her creation during E-Week's rocket competition.

USC ON THE ROAD

TEXAS VITERBI ALUMNI EVENT

The Viterbi School and the USC Alumni Association marked USC's 125th anniversary celebration with their "USC on the Road" program. In Dallas and Houston on February 1 and 2, Dean Yortsos; USC trustee, Major General Charles Bolden, Jr.; and Michael Zyda, director of the Viterbi School's GamePipe Laboratory, presented "Creating a Science of Games." The presentation allowed the Viterbi School to showcase this exciting technology to an enthusiastic crowd of alumni and friends.

Ming Hsieh (BSEE '83 MSEE '84) celebrates his distinguished alumni award with wife Fong Liu and daughter Tiffany at the luncheon's VIP reception.

Cal Tech President and Nobel Prize winner, Dr. David Baltimore delivers the keynote speech at this year's awards luncheon.

Dean Yortsos presents USC president, Steven Sample with the Viterbi School of Engineering Centennial Medallion.

28TH ANNUAL ENGINEERING AWARDS LUNCHEON

On Wednesday, April 5, 2006 alumni, faculty and USC trustees gathered for the 28th Annual Engineering Awards Luncheon held on campus at Town and Gown. This year, alumnus Ming Hsieh (BSEE '83, MSEE '84) was awarded the Distinguished Alumni Award; alumna Dr. Nan Marie Jokerst (MSEE '84, Ph.D. EE '89) was awarded the Distinguished Alumni in Academia award; and Chevron CEO David O'Reilly was given the Engineering Management award. A special award went to USC President, Steven B. Sample, who was honored with the Viterbi School of Engineering Centennial Medallion. Guests enjoyed a keynote speech from Nobel Prize winner and Cal Tech President, Dr. David Baltimore. The USC Viterbi School of Engineering extends its gratitude to the many corporate and individual sponsors who helped make this event a success.

Dean Yortsos celebrates with honorees Nan Marie Jokerst (MSEE '84, Ph.D. EE '89) and Chevron's Vice Chairman Peter Robertson.

Alumni in the News

Alumna named President of Lehigh University

Alice P. Gast, (BSChE '80) a member of the USC Viterbi School Board of Councilors, has been appointed president of Lehigh University in Bethlehem, Pa. She will assume leadership there on Aug. 1, 2006.

"It is a tremendous honor to be asked to serve Lehigh University as its next president," Gast said.

Gast had been vice president for research and associate provost at MIT, and was also the Robert T. Haslam Professor of Chemical Engineering. A chemical engineer specializing in complex fluids and colloids, she joined MIT in 2001 from Stanford University.

She earned an M.A. and Ph.D. from Princeton, and is a member of the American Association for the Advancement of Science, the American Chemical Society, the American Institute of Chemical Engineers and the American Physical Society.

Among her many other awards, she received the Viterbi School Distinguished Alumnus in Academia Award in 2002, the first year it was given.

She cited Robert Hellwarth, professor of electrical engineering and Victor Chang, associate professor of chemical engineering, as two USC faculty who strongly influenced her.

Gast and her husband, a computer consultant, have two children.

Gast photo by Theo Anderson

Alumni news & notes

Winter and Spring 2006

1973

Juan Jose Gonzalez (BSCE) started his career in the Peace Corps — first in Malaysia and then in Thailand. He has spent most of his professional career in Asia working for a two consultant firms before joining the Louis Berger Group, Inc., where he has worked for 20 years. He has managed rural and urban infrastructure projects in Asia, supervising international and local professionals as well as support staff. Recently, he participated in and managed several integrated urban and regional development programs in Tajikistan, Afghanistan, Indonesia, Thailand, India and the Philippines. As the team leader for a World Bank project in Indonesia, he prepared strategic plans for infrastructure development in 18 towns that included solid waste management, cost recovery, revenue generation and financial management plans. In March 2006, Gonzalez began a three-year urban infrastructure project financed by the World Bank in Afghanistan.

1980

Arturo Salazar (BSCE) was elected as the Los Angeles area representative to the Board of Directors of the Professional Engineers in California Government. Also, Salazar recently completed 25 years of employment with the California Department of Transportation (Caltrans).

1981

CAPT Donald S. Muehlbach, Jr. (MSSM) assumed his 5th Navy Commanding Officer (CO) position. He is serving as CO of the NAVSEA Engineering Duty Qual Unit 102 in San Diego.

1989

Erik Haroutounian (MSCENG) married Garine and settled in the UK. They have three children, Alexander (11), Anoushka (9), and Isabella (5). His career focuses on project and program management as well as consulting in telecoms, IT and government. Upcoming personal projects include writing a children's book in Armenia.

1995

Joel Chacon (MSEE) just started a new career with Matrikon Europe, Ltd. in Aberdeen, Scotland.

Amy Stewart-Deaker (BSENVE) and James Deaker are happy to announce the birth of their son, Tobin, on November 12, 2005. The family lives in Berkeley, CA.

Apolonio (Polo) Ramirez (BSCE) married Norma Grimaldo-Ramirez in January 2002. They live in Granada Hills and are currently in the process of adopting a child. Apolonio is currently working for Parsons Corporation managing construction projects in the transportation industry.

1999

Emre Ekmekci (BSISE) just started in the MBA program at Columbia Business School in NYC.

Yen-Shuo Peter Liao (Ph.D. BME) has recently been promoted as principal scientist of DePuy Orthopedics, Inc., a Johnson & Johnson company. He is in charge of the research on the wear of artificial hip joints and particle analysis of various implant materials. In addition, he is the chairman of the Community of Asian Associates at Johnson & Johnson (CAAJJ), DePuy Chapter. He and fellow CAAJJ members received an Impact Award from Johnson & Johnson for their Tsunami Relief Fundraising Campaign in 2005. He has made numerous presentations at major international conferences such as the Orthopedic Research Society Conference, Society for Biomaterials and Wear of Material Conference. He also has several patents in progress.

2001

Amit Shah (MSMFE) will graduate with an MBA from The Tepper School of Business at Carnegie Mellon University in May 2006.

Publish your class note on-line!!! Share your news and photos with the USC Viterbi community.
Visit http://viterbi.usc.edu/alumni/alumni/classnotes/ and fill us in!

Viterbi Storybook

Submitted by:

Ada Chan (BSCE '00, MSCE '01)

"I will be forever grateful to the Viterbi Alumni who provided not just their financial contributions but also their time in mentoring and speaking to students. A monumental Viterbi story for me was in Fall 1997 at the USC Engineering School Career Conference when I met the keynote speaker: Viterbi and Marshall alumna Mrs. Marie Knowles. Mrs. Knowles' speech inspired me to follow in her footsteps in working full time while pursuing a graduate education at night and in becoming a three-time USC Trojan. Mrs. Knowles instantly became a role model for me as a woman engineer and a woman in finance. Since then, I have obtained three USC degrees — a BS in Civil Engineering Building Science in 2000, a MS in Civil Engineering Structural Engineering in 2001, and a Master of Business Administration in 2005, (both graduate degrees were fulfilled while I was working full time). Viterbi alumni like Mrs. Knowles made a huge impact in my life. Thus, I continue to stay involved with the USC community by attending Viterbi School mentoring dinners, being part of the USC David M. Wilson Associates Civil Engineering Alumni Support Group, and speaking at the Marshall School MBA.PM program recruiting information sessions. One day, I hope to make this same impact on the younger generation."

Visit http://viterbi.usc.edu/links/?113 to add your favorite memory today!

In Memoriam

James Robert Cannon (BSCE '47, MSCE '56), passed away on April 16, 2005 in Walnut Creek, California. Born on September 14, 1925, Jim was a graduate of South Pasadena High School and USC, where he earned three degrees including a bachelor's and master's in civil engineering. He served his country during World War II in the U.S. Navy on the battleship *USS Mississippi* and later achieved the rank of Commander in the Navel Reserve Civil Engineering Corp (Seabees). For more than 40 years, he was a distinguished civil engineer specializing in water resources, and eventually retired as chief design engineer at the consulting firm Bookman Edmonston. Jim was an enthusiastic sailor and after retiring pursued world travel and volunteer work.

He leaves behind his wife of 52 years, Marian Griffith Cannon, his son and daughter-in-law Frederick L. Cannon and Jean Mitchell, daughter Linda Cannon-Reese and five beloved grandchildren: Kyle Cannon, Griffith Cannon, Claire Cannon, Tyler Cannon-Reese and Tucker Cannon-Reese. He was preceded in death by his father, mother, step-mother Ruth Cannon and his brother William (Bill) Cannon. He will be sadly missed by all, but his spirit and his commitment to his family will be long remembered. Jim was an exemplary husband, father, grandfather and friend.

Faculty

F. A. (Eddy) Kroger, an original member of the USC Viterbi School's materials science faculty and a professor emeritus, passed away on March 17, 2006 in Encinitas, California of complications from a fall and Alzheimer's Disease. He was 90.

Kroger's work contributed significantly to the basic understanding of electronic materials, was vital to semiconductor technology and led to the development of many practical devices. He was also a scientist with a keen sense of social responsibility warning that unless humans became willing to sacrifice some of the amenities of modern life, science could become like an 'uncontrollable cancerous growth'.

Born on September 11, 1915 in Amsterdam, Netherlands, he was one of the youngest candidates, at 22, to receive a Ph.D. in Physical Chemistry from the University of Amsterdam in 1937.

Kroger was a research scientist for Philips Electrical for 25 years in the Netherlands and the United Kingdom. In 1964, he moved to the U.S. to become a USC professor of electrical engineering. The following year he became a professor of materials science in the engineering school's new materials science department. In 1972, he was the first recipient of the Hewlett-Packard Chair in Electrical Engineering.

His published books include *The Chemistry of Imperfect Crystals* and *Luminescence in Solids* and he authored numerous research articles in his field. He was a member of the Royal Dutch Academy of Sciences and was awarded the Chandon Gold Medal from the French Society of Mineralogy and Crystallography in 1979. In 1980, he retired from his academic and administrative duties at USC.

Kroger was preceded in death by his second wife, Inka Pietersz. His survivors include his first wife, Elisabeth Nicholson of Carlsbad, California, son Frank Kroger of Seattle, daughter Catharine Kroger-Diamond of San Diego, grandson Matthew Kroger-Diamond, grandson Robert Pietersz of the Netherlands, and granddaughter Solange Pietersz, his 'little angel', of the Netherlands.

Services were held Monday, March 20, at Silverado Care Center in Encinitas, with ashes to be scattered in his beloved Pacific Ocean.

In Memoriam

Eberhardt Rechtin, (1926 – 2006) a USC Emeritus Professor and Honorary Degree Recipient, who had academic appointments in three departments, died April 14 following a long illness. He was 80 years old.

"All of us at the Viterbi School will miss Eb who was a giant in the aerospace industry and a creative force in the academic realm," said Dean Yortsos. "It was through his leadership that the Viterbi School established the graduate program in Systems Architecting and Engineering, which continues to be one of our most successful programs today."

At USC, Rechtin held joint appointments in the Daniel J. Epstein Department of Industrial and Systems Engineering and in the departments of electrical engineering and aerospace and mechanical engineering. He played a key role in the development of U.S. space technology and had a storied career in government and industry before coming to USC.

"I first met him in January 1955 when he visited me at Harvard while I was a graduate student," said Solomon Golomb, professor of electrical engineering. Rechtin was trying to recruit Golomb for his group at the Jet Propulsion Laboratory. "I had just received a Fullbright Fellowship, but I eventually went to work for him in August 1956."

In addition to Golomb, Rechtin's JPL group included future USC electrical engineering faculty William Lindsey and Lloyd Welch, as well as Andrew Viterbi (Ph.D. EE '62). The group made fundamental advances in developing U.S. space technology, particularly deep space communications. At the time, Nobel laureates told Rechtin that communication with spacecraft at the edge of the solar system would be impossible. He and his group accomplished that feat with technology still in use today. All five were eventually elected to the National Academy of Engineering.

Rechtin received his B.S. (with honors) and Ph.D. (cum laude) from Caltech where William Pickering, the director of JPL, which was administered by Caltech, was his advisor. Rechtin started at JPL as an engineer in 1948 and left in 1967 as an assistant director.

Rechtin moved to the Department of Defense (DoD) where he was director of the Advanced Research Projects Agency (ARPA, now DARPA), then principal deputy director of research and engineering, and finally, assistant secretary of defense for telecommunications, each for a term of two years. While at the Pentagon, he met David Packard, co-founder of Hewlett Packard who was deputy secretary of defense and who recruited Rechtin to become chief engineer for his company.

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In 1977, Rechtin became chief executive officer of Aerospace Corp. for a term of 10 years. He tripled revenue while advising the Air Force on the development of such big technology projects as the Global Positioning System and Star Wars missile defense program.

Upon retiring from Aerospace Corp. in 1987, he joined the faculty at USC where he created the Systems Architecting and Engineering Program. Rechtin said the field was known as "the front end of systems engineering" because of its emphasis on conceptualization, design management and certification for use, and dealt with problems that are ill-structured, non-replicable and non-measurable.

"In addition to writing some of the defining literature on systems architecting, he was a superb teacher who never failed to inspire students," said Stan Settles, professor of industrial and systems engineering who currently directs the Systems Architecting and Engineering Program.

In addition to being an NAE member, Rechtin was a fellow of the Institute of Electrical and Electronic Engineers (IEEE), the American Institute of Aeronautics and Astronautics (AIAA), the American Association for Advancement of Science and the Institute of Environmental Sciences. He received IEEE's Alexander Graham Bell Award, the DoD Distinguished Public Service Award, the U.S. Navy Distinguished Public Service Award, the U.S. Air Force Exceptional Service Award and the NASA Medal for Exceptional Scientific Achievement. He was honored with Caltech's Distinguished Alumni Award and the AIAA's von Karman Lectureship.

Born in 1926 in New Jersey, Rechtin served in the U.S. Naval Reserve from 1943 to 1958. He was an accomplished musician who played the piano, violin and other instruments. A resident of Rolling Hills Estates, he is survived by his wife of 55 years, the former Dorothy Denebrink (Deedee), five children, four grandchildren and a sister, Joan Lincoln.

A memorial service was held April 23 at the Neighborhood Church in Palos Verdes Estates.

President Sample and Andrew Viterbi Become Eta Kappa Nu Eminent Members

In separate ceremonies, USC President Steven B. Sample and Viterbi School alumnus and naming donor Andrew J. Viterbi (Ph.D. EE '62), were both honored with Eminent Member status by Eta Kappa Nu (HKN), the 100-year-old national honor society for electrical and computer engineering.

Eminent Member status is HKN's highest membership classification and requires "attainments and contributions to society through leadership in engineering that have resulted in significant benefits to humankind."

Sample became the 108th Eminent Member of HKN on Oct. 31, 2005 in a noontime celebration held in the Ronald Tutor Hall Dean's Boardroom. An electrical engineer who is on the faculty of the Viterbi School, Sample was honored by 40 fellow Eta Kappa Nu members, including about two dozen USC student members. Also attending were USC trustee Malcolm Currie and USC alumnus Marcus Dodson, who are also Eminent Members. Sample was cited for his extraordinary leadership skills as 10th president of the University of Southern California.

"It's wonderful to be with my fellow Eta Kappa Nu members," Sample said in accepting the award. "That Eta Kappa Nu had its roots at my alma mater — the University of Illinois — makes this award especially meaningful."

Sample became president of USC in March of 1991. He is an electrical engineer, a musician, an outdoorsman, a best-selling author and an inventor. He has been elected to the National Academy of Engineering for his contributions to consumer electronics and leadership in interdisciplinary research and education. He earned B.S., M.S., and Ph.D. degrees in electrical engineering from the University of Illinois at Urbana-Champaign.

He has received honorary doctorates from the University of Notre Dame, Northeastern University, the University of Nebraska, Purdue University, Hebrew Union College, the University of Sheffield, England and Canisius College, Buffalo. Sample has also received a number of awards from civic organizations and educational institutions, including the Chancellor Charles P. Norton Medal from SUNY Buffalo, a Distinguished Alumnus Award from the Department of Electrical Engineering at the University of Illinois and the Humanitarian of the Year Award from the National Conference for Community and Justice.

Andrew Viterbi and President Steven B. Sample at the 100th anniversary gala of the USC Viterbi School of Engineering.

Andrew Viterbi was presented with the HKN Eminent Member award on January 17 at the 2006 IEEE Radio and Wireless Symposium in San Diego. Viterbi's principal original research contribution, the Viterbi Algorithm, has changed the world. The algorithm is used in most digital cellular phones and digital satellite receivers, as well as in such diverse fields as magnetic recording, voice recognition and DNA sequence analysis. More recently, he has concentrated his efforts on establishing CDMA as the multiple access technology of choice for cellular telephony and wireless data communication.

With his wife Erna, Viterbi, who holds the USC Presidential Chair of Engineering, made a record-setting $52 million gift to name the USC Viterbi School of Engineering in 2004.

In accepting the HKN award, Viterbi said, "I am honored to be selected for inclusion among such a distinguished group of my professional peers. Interestingly, this is the fiftieth anniversary of my election to Eta Kappa Nu as a student at MIT and the three hundredth birthday of the eminent "founder" of our discipline, Benjamin Franklin."

Viterbi is a co-founder and retired vice chairman and chief technical officer of QUALCOMM Incorporated. He spent equal portions of his career in industry, having previously co-founded Linkabit Corporation, and in academia, as a professor in the Schools of Engineering and Applied Science, first at UCLA and then at UCSD. He is currently president of the Viterbi Group, a technical advisory and investment company.

Viterbi has received numerous honors both in the United States and internationally. Among these are six honorary doctorates from universities in Canada, Israel, Italy and the United States. He is a member of the National Academy of Engineering, the National Academy of Sciences and the American Academy of Arts and Sciences. He has received the Marconi International Fellowship Award, the IEEE Alexander Graham Bell and Claude Shannon Awards, the NEC C&C Award, the Eduard Rhein Foundation Award, the Christopher Columbus Medal and the Franklin Medal.

He has also received an honorary title from the President of Italy, and he has served on the U.S. President's Information Technology Advisory Committee. Viterbi serves on boards of numerous other non-profit institutions, in addition to USC. He also serves on the California Council on Science and Technology, the MIT Visiting Committee for Electrical Engineering and Computer Science, the Mathematical Sciences Research Institute, the Burnham Institute and the Scripps Research Institute.

—DA and EM

Celebrating 100 Years with Humor

On October 28, 2005, the Viterbi School launched its centennial celebration with a black-tie gala held at the California Science Center. The evening culminated with a performance by comedian and engineer, Don McMillan. Don uses PowerPoint slides packed with charts, graphs and metrics resulting in a hilarious presentation. Here is a highlight from his performance that evening.

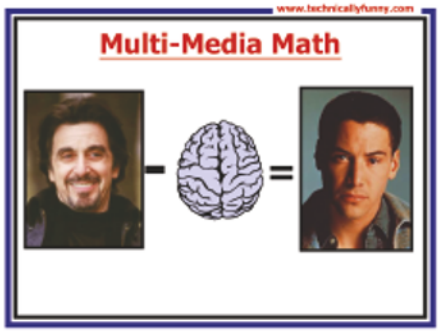
"Most stand-up comics would rather have root canal than perform for a crowd of 500 engineers. Not me. I love engineers — the more the better. Nerd herds are my life. I am Don McMillan: Engineer/Comedian. That alone makes me pretty unique. Nobody ever thinks, 'Engineer — this guy has got to be funny!' or 'We're having a party and we're only inviting engineers!' You see, a lot of people think engineers are boring, but we're not boring. We just get excited about boring things: A 512MB memory upgrade can make me jump for joy. The sale ads for Fry's Electronics make me giddy! In fact, I love Fry's so much, that when I got married, we registered at Fry's. But, that is exactly why I had the honor of being invited to speak at the Viterbi School of Engineering's Celebration of 100 years of Engineering at USC — I think engineering is funny.

100 years is very impressive. 100 years! That's '1.0 x 10^2' in scientific notation. '1100100' in binary. But, it's only '64' in hexadecimal. I am all for using alternate base systems. Just think, the USC football team could defeat Washington State by '110100' to '0'. They could defeat UCLA by Avogadro's number. (That's 6.02 x 10^{23} — that's' a blowout!)

This is the kind of comedy that most engineers can relate to. Even math can be fun. In the next 100 years of Engineering, I think we need to change the way we teach math. Nowadays, kids think in images and graphics — not symbols. We can teach what I call 'Multi-Media Math'.

For example, 'Al Pacino' minus 'Brains' equals 'Keanu Reeves'. Or 'Hermie the Dentist' from Rudolph the Red-Nosed Reindeer plus '$50 Billion' equals 'Bill Gates'. Isn't math more fun this way?

In addition, if we took the time to do math, we would not get duped by marketing people who manipulate data to send the wrong message. For example, your chances of getting Alzheimer's by age 85 are '1 in 10'. But, the average cigarette smoker lives to be age 66. So, if you were in



marketing at a cigarette company, you could say, 'Smoking lowers the chance of getting Alzheimer's.'

In conclusion, there is perhaps no field that is richer in comedy than engineering. Engineers are creating the world of tomorrow and with that come tomorrow's jokes. And for an engineer/comedian that is a good thing. Happy Anniversary, Viterbi — keep those jokes coming!"

To learn more about Don and his engineering humor, please visit www.technicallyfunny.com.

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