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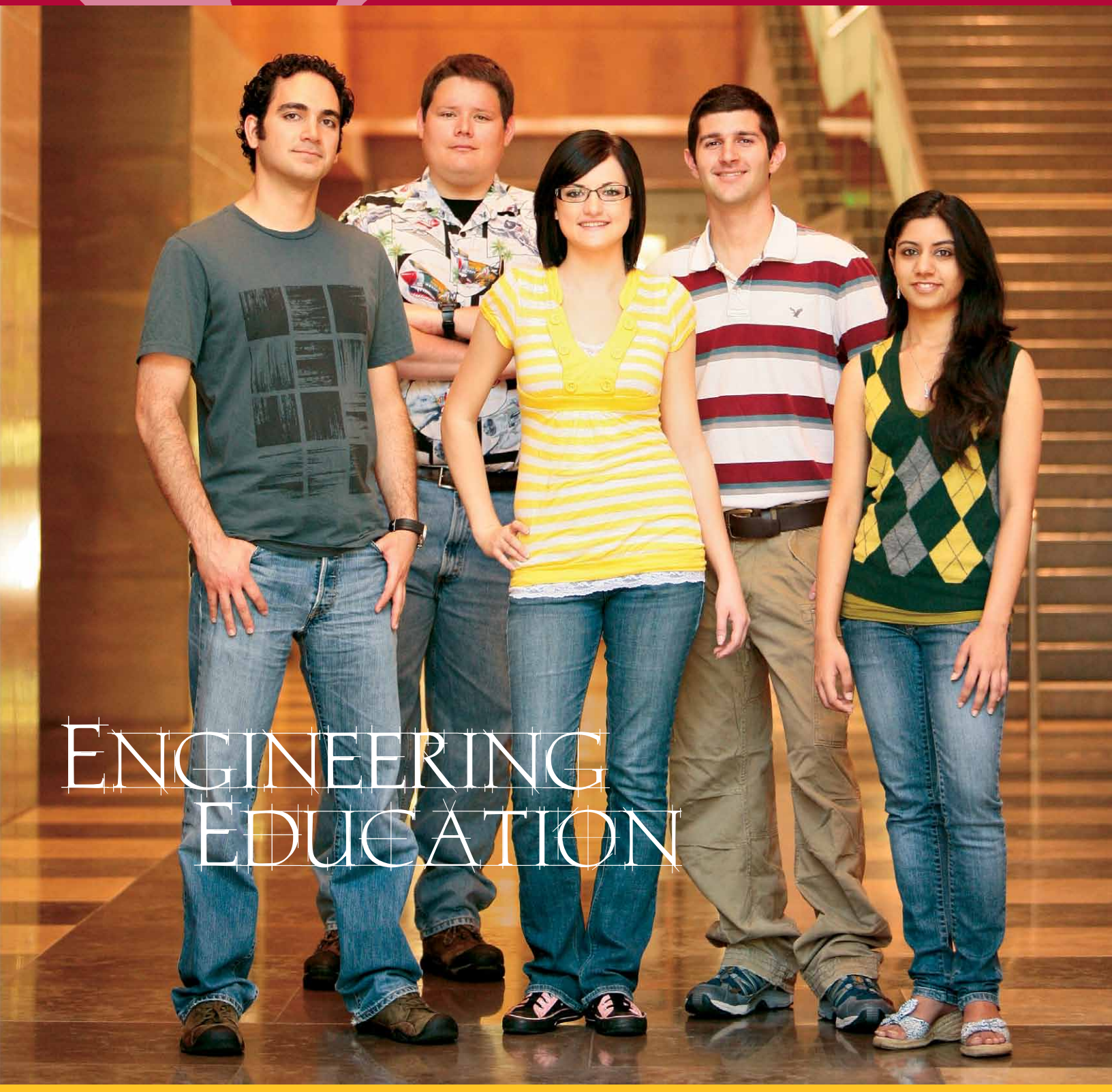
USC Viterbi // Engineer



ENGINEERING EDUCATION

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USC **Viterbi**
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USC Viterbi // Engineer

FALL 2009

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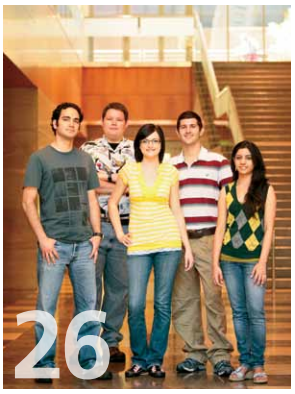

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ENGINEERING CHANGE

LIKE MOST EVERYTHING ELSE, ENGINEERING EDUCATION IS ALSO CHANGING; THE VITERBI SCHOOL HELPS SHAPE THE NEW LANDSCAPE

The ancient Greek philosopher Heraclitus captured change in fluid dynamical terms: "Τα παντα ρει και τα παντα χωρει και ουδεν μενει," loosely translated into, **"Everything flows… and nothing stays the same."** Engineering education has not escaped from this edict.

At first, it was the niggling problem of the leaky pipeline.

Anecdotally, only slightly more than half of the freshmen who embarked on the study of engineering earned an engineering degree.

> "In today's complex and interdependent world, engineers are becoming the great enablers. Engineering plus medicine innovates health care. Engineering plus art equals new entertainment. And just maybe, engineering plus policymaking can save the planet."

Then suddenly, technology flattened the world. Engineering schools were challenged to provide the added value beyond the classical, last-century curriculum.

Organizations like the American Society for Engineering Education, the National Academy of Engineering and the National Science Foundation have taken up the cause: Engineering education must change.

But technology has also brought some good news: Engineering is now evolving in new dimensions. In today's complex and interdependent world, engineers are becoming the great enablers. Engineering plus medicine innovates health care. Engineering plus art equals new entertainment. And just maybe, engineering plus policymaking can save the planet.

The unprecedented challenges brought by the financial meltdown a year ago can only be met by this new kind of evolving engineer. The same holds true for the 14 National Academy of Engineering Grand Challenges. The new engineering requires innovative technologies and a systems approach, but also the ability to shape public policy, transfer innovation to the market place, and to inform and be informed by the humanities and the social sciences.

All these ingredients are constantly injected into the Viterbi School's educational offerings. Just this year, in partnership with Duke's Pratt School of Engineering and Olin College, the Viterbi School began implementing a new program in its curriculum, the National Academy of Engineering Grand Challenges Scholars program, which we hope will be emulated beyond the three schools.

In the pages to follow you will read of this and some of the other engineering education innovative efforts under way. They help attract and retain in the school students with the right-left brain balance and the passion needed by the new breed of engineer. The results are very encouraging.

More than 93 percent of last year's freshmen are returning to Viterbi this fall and 97 percent have returned to USC overall. This fall's freshman class once again will be the brightest on record. Since 2000, the average SAT scores of freshmen entering the Viterbi School has risen 86 points. The fall 2009 enrolled engineering students' SAT's are projected to be 10 points above last year's.

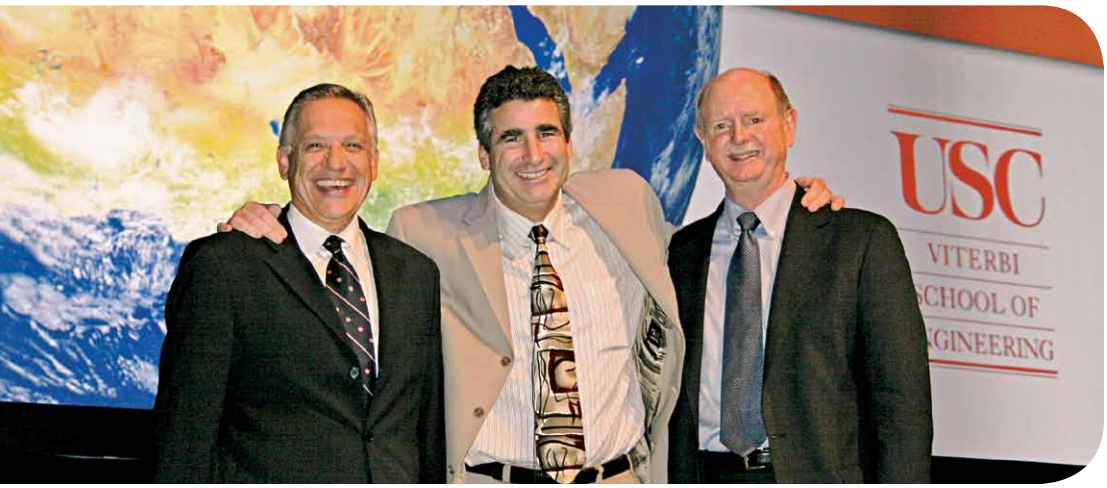
In parallel, the school is constantly enriching its graduate programs: At the Master's level we are constantly providing new specialized degree options and taking advantage of sophisticated Internet technology to transform education for on-campus students and create new opportunities for professional engineering education. And at the Ph.D. level, our strong research posture helps us provide the funding needed to secure a robust Ph.D. education. The results have been strong. During the current decade, the number of engineering Ph.D.'s graduating annually has more than doubled.

In this issue you will find detailed descriptions of the Viterbi School's unique undergraduate, master's and doctoral programs, and all the constant and dynamic changes that are taking place in them.

Yannis C. Yortsos
Dean, USC Viterbi School of Engineering

Addressing Engineering's Grand Challenges

VITERBI SCHOOL EXCELS IN ALL FOUR STUDENT CONTESTS



Left to right are the co-hosts of the first Engineering Grand Challenges Summit, deans Yannis C. Yortsos (USC Viterbi) and Tom Katsouleas (Duke-Pratt), and President Richard K. Miller (Olin).

The first Engineering Grand Challenges Summit, co-sponsored by the Pratt School of Engineering at Duke, the Olin College of Engineering and the Viterbi School, was held early in March and concluded with a rousing summary address by Viterbi's Dean Yannis C. Yortsos.

In addition to summarizing the summit, Yortsos said the new 21st century engineer, or "Engineer 2.0," is a leader, an innovator and an entrepreneur.

"I will characterize it as engineering plus," he said. "This evolution is manifested steadily, most spectacularly in health—engineering plus health, engineering plus biology—and earlier today, engineering plus law.

"It's an essential part of the NAE Grand Challenges," he continued, "and indeed, engineering plus, as in enabling other disciplines, is now the norm."

The two-day event, held on the campus of Duke University, was an early and strong response to the National Academy of Engineering's call last year to address society's most pressing environmental and societal challenges. The NAE challenges numbered 14, but the Summit consolidated those into sessions on energy, health, entrepreneurship, security, and the brain, as well as a panel focusing on "big ideas."

The summit drew more than 900 leading engineering, science, humanities and social science scholars from across the nation. More than 50 engineering deans attended. Leading federal government agencies, including the National Science Foundation, the Department of Energy, the Department of Defense, the National Institutes of Health, and the National Institute of Standards and Technology, sent policymakers. More than 300 engineering students were also present.

The summit's speakers featured an impressive array of national engineering leaders and thinkers, including NAE President Charles Vest; Robert Socolow of Princeton; Robert Langer of MIT, recipient of the 2008 Millennium Technology Prize; Tom Byers of Stanford; and Jeff Hawkins, founder of the Redwood Center for Theoretical Neuroscience.

Students from a variety of engineering schools across the country—not just the sponsoring institutions—competed in poster, trivia, design and video/essay contests. Viterbi School students won in all four categories:

- **Farzana Ansari**, biomedical engineering major, took third in the Video/Essay Competition for *Quenching the Thirst of Many, Community by Community*, an essay and video about supplying clean water to poor and undeveloped regions of the world.
- **Meredith Hankins**, a chemical engineering major, placed third in the poster competition for her entry *Experimental Investigation of Non-Wetting Phase Entrapment in Counter-Current Subsurface Flows*.
- **Dennis Krouse**, a biomedical engineering major, led a five-member team that won the design contest; contestants designed miniature wind turbines using playing cards, popsicle sticks, superglue, tape and small wooden cylinders. The Viterbi team turbine generated twice as much electricity as any of the designs by other teams.
- **Ilya Golosker**, a mechanical engineering major, won the trivia contest demonstrating broad knowledge that ranged from computer science to chemistry, mechanics, engineering, and "even a little bit of politics." //

Three Faculty Win Early Career Awards

GRANTS ARE FUNDED BY THE OFFICE OF NAVAL RESEARCH AND THE NATIONAL SCIENCE FOUNDATION

Stephen Cronin and Hossein Hashemi, both of the Viterbi School's Ming Hsieh Department of Electrical Engineering, have won Faculty Early Career Awards from the National Science Foundation, while Andrea Armani from the Mork Family Department of Chemical Engineering and Materials Science has received the Young Investigator Award from the Office of Naval Research.

The awards recognize "junior faculty who exemplify the role of teacher-scholars through outstanding research, excellent education, and the integration of education and research within the context of the mission of their organizations."

"The standards for these awards are very high," says Dean Yannis C. Yortsos. "Honoring Andrea, Hossein and Steve in this fashion is a wonderful recognition of their skills and talent. The school is justifiably proud of them."

Cronin, an assistant professor, is a specialist in nanostructures, including nanotubes, which are tiny cylinders of carbon atoms, one atom thick, and nanowires made of the element bismuth. He investigates both basic properties and a broad range of possible applications, from bio-sensors to Micro-Electro-Mechanical Systems (MEMS) devices.

Cronin is also a member of the new Energy Frontier Research Center for Emerging Materials for Solar Energy Conversion and Solid State Lighting. He received his Ph.D. in physics from M.I.T. in 2002 and joined the Viterbi School in 2005.

> "**The standards** for these awards are high. Honoring Andrea, Hossein and Steve in this fashion is a wonderful recogntion of their skills and talent. The school is justifiably proud of them."

Stephen Cronin

Andrea Armani

Hossein Hashemi

Armani, an assistant professor, received the ONR's Young Investigator Award for her proposal "Interferometric Optical Biosensor," in which she will develop an optical biosensor capable of detecting DNA and bacteria with high precision. During the course of the project, she will work to develop novel optical devices and surface functionalization methods. This innovation in sensor technology could produce small, portable devices with low power requirements.

Possible uses include monitoring a soldier's health or checking food and water supplies for bacteria. In medicine, the ability to distinguish between viral and bacterial infections could lead to more accurate diagnoses and earlier interventions against disease.

Armani received her B.A. in physics from the University of Chicago (2001) and her Ph.D. from the California Institute of Technology in applied physics with a minor in biology (2007). From 2006 to 2008, she was the Clare Boothe Luce Post-doctoral Fellow in chemical engineering and biology.

Hashemi, an associate professor, creates novel designs for circuits that can both send and receive radio signals, with a wide range of potential uses ranging from medical imaging to vehicle accident avoidance systems.

He holds the USC Gordon S. Marshall Early Career Chair, and was previously a co-recipient of the IEEE Journal of Solid-State Circuits 2004 Best Paper Award, and winner of the IEEE International Solid-State Circuits Symposium Lewis Winner Award for Outstanding Paper in 2007. He earned his Ph.D. at Caltech in 2003. //

New DOE Research Center Awarded

P. DANIEL DAPKUS WILL DIRECT THE NEW CENTER; OTHER VITERBI FACULTY ARE PART OF TWO OTHER DOE ENERGY CENTERS

Daniel Dapkus

With a five-year grant totaling $12.5 million, the U.S. Department of Energy (DOE) has designated the University of Southern California as the site of an Energy Frontier Research Center (EFRC).

P. Daniel Dapkus, who is the William M. Keck Professor of Engineering, will direct the EFRC for Emerging Materials for Solar Energy Conversion and Solid State Lighting.

Dapkus will work closely with Prof. Mark E. Thompson of the USC College of Letters, Arts and Sciences Department of Chemistry, who, like Dapkus, also has an appointment in the Viterbi School's Mork Family Department of Chemical Engineering and Materials Science.

"Mark was instrumental in obtaining this award," says Dapkus, and the project will involve a number of other faculty members from the Viterbi School, the USC College and three other universities.

"The award of this EFRC is a resounding testament to the vision and leadership of Dan Dapkus and the talent of his colleagues on the team," said Viterbi School Dean Yannis C. Yortsos. "It promises to revolutionize the way we utilize energy in our lives and work. And it reaffirms USC as a national leader in the critical area of energy."

"USC is an excellent choice for such a center, and Viterbi and College faculty will make an extraordinary collaborative team on this important energy initiative," said College Dean Howard Gillman.

The team of materials scientists, chemists, electrical engineers and physicists will explore new phenomena possible in organic materials, in thin-layer semiconductor nanostructures, and in hybrid structures utilizing both types of materials to improve the efficiency of solar cells and light sources. They'll design and synthesize new materials and new device structures in configurations that will dramatically reduce the cost of high efficiency solar cells and LEDs.

According to the DOE, the Emerging Materials EFRC is one of 46 nationwide selected from a pool of 260 applications, based on a rigorous merit-review process. It's one of 16 funded by the American Recovery and Reinvestment Act.

USC faculty will also be part of EFRCs at two other institutions. Prof. Fokion Egolfopoulos of the Mork Family Department and Prof. Hai Wang of the Department of Aerospace and Mechanical Engineering will participate in the Princeton University EFRC for Combustion Science. Wang will also work with the University of Delaware EFRC for Rational Design of Innovative Catalytic Technologies for Biomass Derivative Utilization.

"As global energy demand grows over this century, there is an urgent need to reduce our dependence on fossil fuels and imported oil and curtail greenhouse gas emissions," said Secretary of Energy Steven Chu in a news release. "Meeting this challenge will require significant scientific advances. These Centers will mobilize the enormous talents and skills of our nation's scientific workforce in pursuit of the breakthroughs that are essential to make alternative and renewable energy truly viable as large-scale replacements for fossil fuels."

Chu, a Nobel laureate, delivered the first Jack Munushian Keynote Lecture at the Viterbi School in April 2007, when he was director of the Lawrence Berkeley National Laboratory. //

Stevens Receives Alumni Award

USC Trustee Mark Stevens (BSEE & BAECON '81, MSCENG'84), managing partner at Sequoia Capital in Menlo Park who is a member of the Viterbi School's Board of Councilors, received the Alumni Merit Award at the Annual USC Alumni Awards Gala last May. From the left are Richard A. DeBeikes, president of the USC Alumni Assoc., Stevens, and Scott M. Mory, USC associate senior vice president for alumni relations.

Distinguished Innovators Honored

THE THREE EXEMPLIFY THE CONCEPT OF "ENGINEERING PLUS"

Left to right are the Viterbi Awards honorees Don Paul, Thomas Reed (MSEE'59) and Narayana Murthy, with Dean Yannis C. Yortsos.

On April 1, at the annual Viterbi Awards banquet, the USC Viterbi School honored three outstanding individuals who exemplify the concept of "Engineering Plus" according to Dean Yannis C. Yortsos.

"Since 1978, the Viterbi Awards have recognized outstanding members of the engineering community," said Yortsos, "and those of our own alumni who've made lasting contributions to engineering in all its manifestations."

Thomas Reed (MSEE'59), who served in the Ford, Carter and Reagan administrations, received the Mark A. Stevens Distinguished Alumni Award. Don Paul, Chevron's first chief technology officer, was given the Distinguished Service Award. Narayana Murthy, co-founder of Indian IT giant Infosys, who served for 21 years as the company's chief executive officer, garnered the Daniel J. Epstein Management Award.

Yortsos said that while the three honorees met challenges in widely disparate fields, each also followed the same path.

"They applied engineering plus in government, policy, business and industry," he said. "In doing so, they transformed national security and the oil industry, and helped to transform an entire nation."

In a long and distinguished career, Reed served as Secretary of the Air Force, Director of National Reconnaissance, Special Assistant to President Reagan for National Security Policy and was a consultant to the director of the Lawrence Livermore National Laboratory. He's the author of *At the Abyss: An Insider's History of the Cold War* and *Nuclear Express*, co-authored with Danny Stillman. Reed received his undergraduate degree in engineering from Cornell and an M.S. from USC.

Paul is founder and president of Energy Technology Strategies, LLC, and is a former vice president and the first chief technology officer for Chevron Corporation. Currently, he's the executive director of the USC Energy Institute and holds the William M. Keck Chair of Energy Resources. Paul is also an advisor at the Center for Strategic and International Studies. A native of Los Angeles, Paul earned his B.S., M.S. and Ph.D. degrees from MIT in mathematics, geology and geophysics.

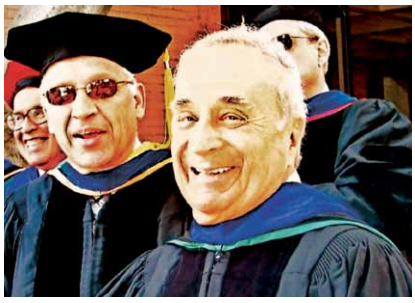
Murthy currently is chairman of the board and chief mentor of Infosys Technologies Limited, a global information technology, consulting and software provider headquartered in Bangalore, India. Murthy and six others founded Infosys in 1981, with Murthy serving as CEO for 21 years. He designed and implemented the Global Delivery Model, which has become the foundation for the successful outsourcing of IT services from India. Recipient of numerous awards and honors, Murthy received his B.E. (Electrical) from the University of Mysore and his M. Tech (Electrical) from the Indian Institute of Technology, Kanpur. He has also received several honorary degrees from well-known institutions in India and abroad.

The Viterbi Awards concluded with a performance by Rachel Lauren, a jazz major at the USC Thornton School of Music. //

> "**Since 1978,** the Viterbi Awards has recognized outstanding members of the engineering community, and those of our own alumni who've made lasting contributions to engineering in all its manifestations."

Commencement 2009

A QUARTER OF USC'S GRADUATES ARE FROM VITERBI



From the top, clockwise, and left to right, are: Simi Singh (MSCS), Snehal Sirmukaddam (MSEE) and Nidhi Kurani (MSCS); Sidney Harman, speaker at the undergraduate ceremony; Alexis Livanos (third from the left), speaker at the graduate ceremony with some of the platform party; and Kimberly Boynton (BS+MSCE), undergraduate ceremony valedictorian.

At USC's Commencement, held May 18, 444 Viterbi undergraduates received B.S. degrees. Another 1,451 Viterbi students earned M.S. degrees, 358 of whom accomplished their studies through the school's Distance Education Network. And 164 students received Ph.D.s.

"That's an impressive figure for a school our size," said Dean Yannis C. Yortsos about the doctoral degrees, which accounted for about half of the total Ph.D.s awarded by the university. The 2,057 degrees awarded to Viterbi scholars comprised a quarter of USC's total of more than 8,000.

"With your new tools, you'll devise the new alternative energy sources; solve vexing climate problems; master the miracles of biology to eradicate diseases, educate and enlighten; and help lift millions from poverty by relighting the engine of economic development," said Yortsos.

For the second consecutive year, the USC valedictorian was an engineering student. Paul VanWieren, who achieved a perfect 4.0 GPA while earning a B.S. in biomedical engineering with an emphasis on electrical engineering, paraphrased Luke 12:48 when he urged USC's Class of 2009 to give back: "From he to whom much has been given, much will be expected, and we have been given much," he said.

Kimberly Boynton, the valedictorian at the Viterbi undergraduate ceremony, said, "It is our turn to make an impact" and "as engineers we are the most prepared to make changes to society." Boynton earned both B.S. and M.S. degrees in civil engineering through the progressive degree program, while still finding time to be the featured baton twirler and a section leader for the Trojan Marching Band, among a slew of other activities. Coincidentally, both Boynton and VanWieren are from Michigan; Boynton from Troy and VanWieren from tiny Grant.

At the Viterbi undergraduate ceremony, commencement speaker Sidney Harman, the 89-year-young founder of the renowned Harman-Kardon audio company and husband of Congresswoman Jane Harman (D-Venice), who also attended, spoke eloquently, passionately and sometimes humorously for 10 minutes without notes. "The mind of a Viterbi graduate is a singularly astonishing instrument," he deadpanned. "It turns on when you wake up and does not turn off until the commencement address begins."

He told the new graduates to reverently invent themselves, rejecting orthodoxy, avoiding specialization and embracing the technological changes that have transformed life. "Previously, people lived synchronously, one step after another," he said. "The new world is asynchronous with challenges arising in waves and rushes."

At the graduate ceremony, Alexis Livanos, corporate vice president and chief technology officer of Northrop Grumman, spoke of "the relationship of science and engineering to a life well-lived" as first articulated by the ancient Greeks. "Personally, I think those Greeks were on to something. They believed that understanding the natural world and understanding how best to live your life were one and the same," he said. "Those of you who choose to apply your education to your lives and your world will be in good company indeed." //

USC Valedictorian Paul VanWieren

THE CROWNING ACHIEVEMENT OF AN ADVENTUROUS ENGINEERING UNDERGRADUATE

In four years at USC, Paul VanWieren emerged with an unblemished record of straight A's in biomedical engineering with an emphasis on electrical engineering, all while retaining the humility and work ethic learned in his hometown of Grant, Mich., population 881, where he once worked on a turkey farm.

And, the soft-spoken engineering undergraduate was chosen to represent USC's Class of 2009 as valedictorian.

"Ride the buses, walk the sidewalks or bike along the gutters of Los Angeles, and you'll encounter much of what a college degree from a prestigious university gives us: the luxury to forget poverty, hunger and homelessness," he told USC's Class of 2009, as he called on them to give back.

VanWieren made the most of his years in Los Angeles. He lived on campus all four years and never had a car. But that didn't stop him from exploring the city by bike, bus and foot. "I like the sense of being connected with whatever neighborhood I'm in. When you're biking or running or riding the bus, you can see what the culture is like in each neighborhood," he said.

"It keeps you grounded. It's so easy to get sucked into this bubble of academic life. Most of the people in the world have a different frame of mind. Getting out in neighborhoods reminds you that it's not all about you."

> "If you consider that it's partially luck on where you're born and how you're brought up, then it allows you to retain humility about what you accomplish."

So VanWieren would bike long distances–say, to the Getty Center and back, sometimes with Adam Benkato, of Houston, Texas, whom he met in the dorm during his freshman year and who shares an adventurous spirit. Or he would take a break from studying by running north on Figueroa Avenue to Fifth Street, then riding the glass elevator at the Westin Bonaventure Hotel to the top and enjoying the panoramic view before running back to campus. One of VanWieren's favorite haunts is Broadway in downtown Los Angeles, home to many once-grand theaters and small ethnic businesses.

He also worked in the labs of teachers who became friends, such as Edward Maby, who teaches electrical engineering, and Darrell Judge, who teaches physics.

VanWieren arrived at USC without knowing anyone, lured by a barrage of letters the university sent him while in high school and a generous merit scholarship. Both of his parents, Gerald, a physician, and Suzanne, a nurse-practitioner, had gone to college in California and approved of his decision to "get utterly away from what I knew." They were at Commencement, as was his older brother, Andrew, who's in medical school in Rhode Island, and his sister, Rachel, who's studying for a Ph.D. in Latin American literature at UCLA.

"If you consider that it's partially luck on where you're born and how you're brought up, then it allows you to retain humility about what you accomplish," he said. "You start thinking about how you can use what you've learned to help others who weren't as fortunate."

To that end, VanWieren is involved with Engineers Without Borders, an organization that brings engineering solutions to problems in developing countries.

Following graduation, he planned to work for a while to help pay off student loans, and before Commencement, already had a job with Edwards Life Sciences in Irvine, doing research on a continuous glucose monitor. VanWieren plans to enroll in a joint M.D./Ph.D. program, so he can help design neuro-prostheses to aid those with spinal cord injuries and other debilitating problems. That is, unless he goes to law school or studies philosophy or goes into politics—all among his interests. //

The Shipping News

STUDENTS FIND CONCRETE SUCCESS WITH THEIR CEMENT CANOE

Lily Aung, left, and Katie Hickey, both civil engineering majors, paint Viterbi's concrete canoe.

The Viterbi School's 20-student concrete canoe team, members of the school's chapter of the Society of Civil Engineers, took home several prizes in this year's concrete canoe competition held in Hawaii.

To compete in the cement canoe challenge, students have to design and build a canoe that floats with a mixture of concrete, aggregate and water. The canoes have to be shown to float before competing in three canoe races held on the ocean. This year, the students faced an additional challenge of making sure their canoe was shipped safely to Hawaii.

"This year's canoe had to withstand the rigors of multimodal and ocean transport to get to Hawaii, rough handling during racing and then the trip back to USC," said Lance Hill, lab manager for the Astani Department of Civil and Environmental Engineering, in an e-mail interview. "Very few past canoes could undergo that kind of mistreatment and come out in one piece like this year's canoe. Yet it was light enough to float on water and strong enough to carry four people."

"Overall, canoe has been a great experience for me," says Trevor DeLuca, a junior who was a co-captain of the team in charge of supervising the design. "Not only has it vastly supplemented my course work, but it has also given me real-world experience that I couldn't have gotten from class alone. The issues that we, as a team, had to deal with parallel exactly what I expect to see when I start my career. Being one of the captains on the team also allowed me to work on my management skills—something that companies definitely like to see when hiring."

"Our competitors' faces when we beat them out for third (in the theme category), were really awesome," says Katie Hickey, a sophomore in Civil Engineering and the other co-captain of the team. The canoe group began preparing for the competition last September, but didn't pour its canoe until February. The judges "liked our theme, which also means our specs were good and we did a good job finishing. Some teams poured their canoes in October, so it felt good to get that (third place)."

"The Pacific Southwest Region has always been a tough region to compete in as there are three teams (Cal Poly SLO, Cal Poly Pomona, and UCLA) that perennially compete for two spots to nationals," says DeLuca.

The students paddled in three different races. Since they're more engineers than athletes, they didn't do quite as well in that segment of the contest. "Some schools practice two, three times a week, with one team doing the construction, and other teams in the actual races," Hickey explains.

An already experienced sophomore, Hickey joined the canoe team in her freshman year, when there were no old timers who could help guide the rookies on the intricacies of building a cement vessel that would float. Wanting to build institutional memory, Hickey decided to stay another year in the team and recruit young civil engineers willing to be part of the process more than once. It paid off.

Hickey's already planning to continue in the cement canoe team next year and reach out to faculty members to help with the process. And even though this year's performance turns the pressure on, the budding civil engineer feels the process will nonetheless be easier. //

"Overall, canoe has been a great experience for me. Not only has it vastly supplemented my course work, but it has also given me real-world experience that I couldn't have gotten from class alone."

Flight Operations

VITERBI TAKES THIRD IN THE ANNUAL NATIONAL DESIGN/BUILD/FLY COMPETITION THAT TESTED BOTH ENGINEERING AND FLYING SKILLS

A team of USC undergraduate engineering students won third place at the Design/Build/Fly Competition sponsored by the American Institute of Aeronautics and Astronautics.

In this year's competition, all of the radio-controlled planes were powered by electric motors and batteries, and each aircraft had to achieve several ground and air missions. Originally 65 teams entered the competition, 54 from the United States and 11 from abroad, but due to the rigors of the competition, only 41 planes showed up for the contest.

The planes had to be housed in two boxes, each less than 2 feet by 2 feet by 4 feet, and teams were timed when they assembled them. The total weight of the plane and the two boxes was multiplied by the assembly time and was used in the calculation of the final score. Flying scores were divided by the assembly time and weight to obtain the final flight scores.

Thus, aircraft with the least weight and shortest assembly times had an advantage. In addition, no plane could have more than 4 pounds of batteries for propulsion, and all the components of the planes had to be off the shelf.

Flights were made between two pylons 1,000 feet apart, including a required 360-degree turn during the downwind flight. In three different flight missions, planes had a take-off distance of no more than 100 feet.

The first mission was a timed flight of two laps in which planes carried a gallon bottle under the fuselage that added considerable drag to the streamlined aircraft. The second was similar, except this time, the bottle was full of water—a load of 8.8 pounds—and four laps were required to complete it.

In the third mission, the planes carried four rockets, each weighing 1.5 pounds, under the wings. The inboard rockets had to be at least 24 inches from the centerline, and the two outboard rockets were 30 inches from the centerline. After one lap, the plane had to land and remotely drop one rocket in a specified area. Then it had to take off, with the asymmetrical load of three rockets, fly one lap, land again and drop another rocket in the same area. This was repeated until only one rocket remained on the last lap.

USC's entry fared very well in the flying. The plane, weighing only 6.2 pounds without the batteries, had the fastest time in Mission No. 1 (64 seconds), and was one of only three planes to successfully complete the grueling Mission No. 3.

At least half of USC's team members were from aerospace engineering, but there were also several mechanical engineering, industrial and systems engineering and other majors on the team. The two co-leaders were program manager Caitlyn Fahey and chief engineer Tanner Yaberg. Wyatt Sadler was the pilot and Cesar Valladares served as the program administrator. Ben Reader was the group captain for propulsion, while Dan Orr was in charge of the landing gear. Geoff Martindale supervised the construction of the plane, and Nazareth Escobedo was the test flight coordinator. Matt Pieper was the captain of the payloads group. Shanling Yang was the captain for aerodynamics, stability and control, and Joe Oorebeek was the structures captain. Ron Blackwelder was the faculty advisor for the team. Mark Page, of Swift Engineering, was an industrial advisor to the group, as was Sadler, the pilot. //

The team (above) who created USC's 6.2-pound aircraft (bottom) for the Design/Build/Fly competition.

New Faculty

THE DISTINGUISHED GROUP INCLUDES A NEW CHAIR FOR COMPUTER SCIENCE AND A NEW DIRECTOR OF THE SAE PROGRAM

Shang-Hua Teng

Jernej Barbic

William G.J. Halfond

Malancha Gupta

Azad Madni

Shang-Hua Teng, a theoretical computer scientist with experience in academia and industry, has joined the USC Viterbi School Department of Computer Science as professor and chair.

"I'm thrilled to have such a distinguished scholar as Shang-Hua Teng for our new computer science department chair. His rich experience in both academia and industry, his global ties and his leadership potential augur well for the future of our department," says Dean Yannis C. Yortsos.

Born in Beijing, Teng earned dual undergraduate degrees, a B.S. in computer science and a B.A. in electrical engineering, from Shanghai Jiao Tong University in 1985. Two years later, he received a master's degree from USC, and, in 1991, a Ph.D. from Carnegie Mellon University, both degrees in computer science.

Since receiving his Ph.D., Teng has become a distinguished researcher and has taught extensively. He was a research scientist at the Xerox Palo Alto Research Center, the NASA Ames Research Center, the IBM Almaden Research Center, Intel Corp., three separate Microsoft research centers and Akamai Technologies.

Immediately before coming to USC, he served as a professor of computer science at Boston University, a research affiliate professor of mathematics at MIT and a visiting professor at Tsinghua University in Beijing. Previously, he held faculty appointments at the University of Illinois and the University of Minnesota.

Teng is a theoretician with broad research interests, a strong record of publications, industry collaborations involving real-world products, and 14 years of teaching experience at the undergraduate and graduate level. He has also served as editor for the *Journal of Combinatorial Optimization*; the *Journal of Computer and System Sciences*, as book editor for *Algorithms and Computation*, and has been awarded more than 10 patents.

His most distinguished research has involved the smoothed analysis of algorithms, computational game theory, nearly linear time-graph algorithms, combinatorial scientific computing, mesh generation and computational geometry, and spectral graph theory and graph partitioning.

"I like interdisciplinary research and studies that intersect both theory and applications," Teng said on his Web site. "Although these topics appear to be diverse, the underlying principle of my research has been the same, that is, to understand the mathematical structure of these problems in order to design efficient algorithms and software."

Teng has received a number of prestigious awards, including a National Science Foundation Career Award, a Sloan Fellowship, an IBM award for faculty development and the 2008 Godel Prize (awarded by the Association for Computing Machinery) for developing a rigorous framework to explain the practical success of algorithms on real data and real computers that could not be clearly understood through traditional techniques. He was also named as the top undergraduate student from 1981 to 1985 at Shanghai Jiao Tong University.

There are two other newcomers to the Department of Computer Science:

Jernej Barbic, a new assistant professor, earned his Ph.D. from Carnegie Mellon University and was a postdoctoral fellow at MIT. His research interests are in computer graphics, computer animation, physically based modeling, interactive simulation, haptics, sound simulation and virtual medicine.

William G.J. Halfond is also a new assistant professor in computer science. Halfond received his Ph.D. from Georgia Tech and his research interests are in software engineering, with a special focus on quality assurance techniques for Web applications.

Malancha Gupta is a new assistant professor in the Mork Family Department of Chemical Engineering and Materials Science. Gupta received her M.S. and Ph.D. degrees from MIT and her B.S. from the Cooper Union, all in chemical engineering. She was also a postdoctoral fellow at Harvard.

Gupta's research interests include functional polymer films and coatings, chemical vapor deposition, surface modification and patterning, biologically inspired nanomaterials, composites, hydrogels and low-cost microfluidic devices.

Azad Madni, founder and CEO of Intelligent Systems Technology, Inc., has joined the Daniel J. Epstein Department of Industrial and Systems Engineering faculty. Madni succeeds Professor


Terence Sanger


Veronica Eliasson


Qiang Huang


Alex Dimakis

Stan Settles as director of the Systems Architecting and Engineering (SAE) Program. Settles will continue to teach and act as SAE co-director.

In the past six years, the SAE program has rapidly grown into one of the Viterbi School's largest master's degree programs offered by the Distance Education Network.

"Azad Madni's addition will be highly instrumental in our ability to exploit new developments in the fiercely competitive and rapidly expanding field," says James E. Moore II, Epstein department chair.

Madni founded and grew Intelligent Systems Technology, Inc., a leading provider of business process management and performance support systems. He's internationally recognized for his pioneering research and technology innovations in modeling and simulation, process-aware systems, human-system integration, intelligent tutoring, concurrent engineering and distributed training.

Madni is the recipient of several awards, including the U.S. Chamber of Commerce 2000 Blue Chip Enterprise Award for entrepreneurship, the Developer of the Year Award winner from the Software Council of Southern California (2000, 2004), and Computerworld's selection to the elite 100 Emerging Companies to Watch in 2000.

Madni is a Fellow of the IEEE, the Society of Design and Process Science (SDPS), International Council on Systems Engineering (INCOSE), and is an associate fellow of the American Institute of Aeronautics and Astronautics (AIAA).

He received B.S., M.S. and Ph.D. degrees from UCLA and an M.B.A. from Stanford.

Terence Sanger, a physician and engineer, is Provost Associate Professor in the Department of Biomedical Engineering (BME) and the Keck School of Medicine. He is the first Viterbi School faculty who has been awarded the title Provost Associate Professor, a distinction reserved only for a select group of interdisciplinary scholars at USC. Sanger will hold appointments in biomedical engineering, neurology, biokinesiology and physical therapy.

At Stanford, Sanger was the director of the Pediatric Movement Disorders Center. His research focuses on understanding the origins of pediatric movement disorders from both a biological and a computational perspective. The primary goal of his research is to discover new methods for treating children with movement disorders. His training includes backgrounds in electrical engineering, signal processing, control theory, neural networks and computational neuroscience.

Sanger's M.D. was awarded by the Harvard Medical School, and his Ph.D. is in electrical engineering from MIT.

In welcoming Sanger to the faculty, BME Department Chair Michael Khoo said, "Terry is a one-of-a-kind pediatric neurologist who'll treat patients at Childrens Hospital, Los Angeles and also establish at USC a unique research program that uses computational models to account for and predict abnormal neuromuscular control in children with movement disorders, such as cerebral palsy."

Veronica Eliasson has joined the Department of Aerospace and Mechanical Engineering as an assistant professor. Eliasson comes from Caltech, where she was a postdoctoral scholar. She was also a visiting scholar at UC Berkeley.

Eliasson's research interests include shock waves in gases and liquids, layered media where liquid-solid coupling is present, and visualization techniques for wave propagation in both fluids and solids.

She received a Ph.D. in mechanics and an M.Sc. in vehicle engineering from the Royal Institute of Technology in Stockholm.

Joining the Epstein Department as an assistant professor is **Qiang Huang,** a specialist in nanomanufacturing. Huang previously served as an associate professor at the University of South Florida in Tampa. His research interests are in quality and productivity improvements for complex systems, and in how to improve process repeatability and quality in nanomanufacturing.

Huang received an M.S. in statistics and a Ph.D. in industrial and operations engineering from the University of Michigan. He also earned B.S., M.S. and Ph.D. degrees in mechanical engineering from Shanghai Jiao Tong University.

Alex Dimakis joined the Ming Hsieh Department of Electrical Engineering in June 2009 as assistant professor after completing a postdoctoral fellowship at the Center for Mathematics of Information at Caltech.

His research interests include communications, coding theory, signal processing, and networking, with a current focus on network coding, message-passing algorithms and sparse graph codes.

In 2003, Dimakis received the Diploma degree in electrical and computer engineering from the National Technical University of Athens, graduating with highest honors. He received his M.S. in 2005 and his Ph.D. in electrical engineering and computer science in 2008, both from UC Berkeley.

Dimakis earned the Eli Jury award from UC Berkeley in 2008 for his thesis work on codes for distributed storage, two outstanding paper awards, the UC Berkeley Regents Fellowship in 2003, and the Microsoft Research Fellowship in 2007. //

A BIM Boost for Better Building

A NEW ASTANI DEPARTMENT ARRIVAL REACHES OUT TO ARCHITECTS, ENGINEERS AND BUILDING TECHNOLOGY PROVIDERS

Burcin Becerik-Gerber

Between 1964 and 2003, non-farming manufacturing industries in the United States doubled their productivity. During the same time period, the construction industry's efficiency actually declined to 80 percent of its 1964 value. Now, an explosive new idea called Building Information Modeling, or BIM, is revolutionizing the oldest engineering discipline and beginning to improve this low number.

Burcin Becerik-Gerber, an assistant professor in the Sonny Astani Department of Civil and Environmental Engineering, who joined the Viterbi School earlier this year, aims to make USC a growing interdisciplinary center for BIM study and practice.

She says the foundation for what she hopes will be a vibrant effort came out of a highly successful workshop held last May at the school, in which industry professionals signed on to be part of ongoing USC research and development in the field of advanced uses of information technology. A total of 30 participants from 26 companies, including contractors, architecture, technology and building companies, as well as Viterbi students, attended the workshop.

Karen Kensek of the School of Architecture, who last year won the Autodesk Revit Building Information Modeling Experience Award, was co-organizer and co-host of the event, held under the auspices of the AEC, an umbrella group of Architects, Engineers and Construction professionals.

BIM was also the focus of another major event, the Astani Department's Associated General Contractors Symposium, which was held the same day, and which featured Frank Gehry, a celebrated architect and USC alum whose Gehry Technologies is a leader in BIM technology.

BIM, Becerik-Gerber explains, is a still-emerging, integrated, IT-based paradigm for the entire lifecycle of buildings. BIM encompasses planning, design, engineering, construction, management, operations and execution. BIM is not just technology, but a process, she emphasizes.

She says BIM began about a decade ago, and has accelerated in recent years with use in celebrated structures such as the Beijing Olympics Stadium and the Los Angeles Walt Disney Concert Hall, which Gehry designed. BIM is being used on the USC campus in the Cinematic Arts Complex project.

Feedback from the event was very positive and Becerik-Gerber said after analyzing workshop findings, the Astani Department and the USC School of Architecture will initiate three projects based on the experience and needs discovered.

"We're establishing a common ground," she says, "one that looks like it will be producing an intriguing harvest." //

New Director for CREATE

STEPHEN C. HORA IS AN EXPERIENCED ACADEMIC LEADER AND

Stephen C. Hora is the new director of USC's Center for Risk and Economic Analysis of Terrorism Events (CREATE), the nation's first Department of Homeland Security (DHS) Research Center of Excellence.

Hora is an experienced academic leader and a prominent decision analyst who has already led several CREATE studies. He served as the University of Hawaii-Hilo's Interim Vice Chancellor for Academic Affairs from 2005 to 2007 and has been a professor of management science and statistics at UH-Hilo. Hora earned both his DBA and his bachelor's degree from USC. Hora will hold research professor appointments in the USC School of Policy, Planning and Development and in the Daniel J. Epstein Department of Industrial and Systems Engineering in the Viterbi School.

Established in 2004 and renewed by the DHS in 2007, CREATE is the nation's first university-based Center of Excellence, supporting research in response to the threat of terrorism. A model of interdisciplinary collaboration—thus the engineering-planning and policy partnership—CREATE continues to break new ground in applying advanced risk, decision and economic analysis and modeling tools to evaluate the costs and consequences of terrorism.

DHS selected USC as the site for CREATE from among 71 competing proposals. CREATE develops predictive models that gauge how and where terrorist events might occur, estimates the economic consequences

The Young and the Inventive

ARMANI AND MENG ARE TWO OF TECHNOLOGY REVIEW'S TOP 35 YOUNG INNOVATORS FOR 2009

Two members of the Viterbi faculty, Andrea Armani and Ellis Meng, have been named to the 2009 class of the TR35, an annual list of the world's top, young innovators selected by the editors of *Technology Review*, the much-admired MIT magazine.

Each year, the magazine selects 35 people under age 35. Previous winners include such world-changing innovators as Jerry Yang of Yahoo, Google co-founder Larry Page, and Linus Torvalds of Linux fame. Previous Viterbi awardees include computer scientists Maja Mataric´, senior associate dean for research, and Paul Debevec, a computer graphics wizard at the USC Institute for Creative Technologies.

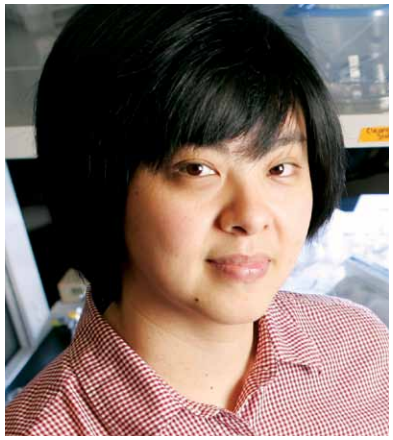
We're immensely proud of this fantastic recognition for Andrea and Ellis," "They are two out of 35 and Viterbi is one of only two engineering schools with that distinction," said Dean Yannis C. Yortsos.

Andrea Armani is an assistant professor in the Mork Family Department of Chemical Engineering and Materials Science. Her research focuses on

Andrea Armani

demonstrating the first label-free, single-molecule biosensors. The work is highly interdisciplinary, Armani says, involving the physics of a sensing mechanism, the chemistry of surface functionality and fluid transport in a sensing chamber, in addition to understanding the underlying biological principles at play.

Armani's innovative work previously led to an Office of Naval Research (ONR) Young Investigator Award for her proposal titled "Interferometric Optical Biosensor."



Ellis Meng

Ellis Meng is an assistant professor of biomedical engineering and a holder of a Viterbi Early Career Chair. Meng's primary research interests are the development of micro- and nanotechnologies for ultrahigh-performance, biocompatible electrochemical analysis of biological materials and fluids.

Meng is also associate director of education and diversity programs in the Viterbi School's Biomimetic Microelectronic Systems (BMES) Engineering Research Center. BMES is a National Science Foundation-funded interdisciplinary research center dedicated to developing novel implants for the treatment of disabilities such as blindness, paralysis and memory loss.

As TR35 awardees, Armani and Meng have been invited to attend this year's Emerging Technologies Conference, an exciting three-day event with world-renowned innovators and leaders in technology and business participating. In addition to honoring the TR35 recipients, the conference considers how to get innovations from the lab to the market, the influence of increasing interconnectivity, and how to turn the challenges presented by the world's limited resources into opportunities. //

PROMINENT DECISION ANALYST

of such attacks and identifies where the country's vulnerabilities reside.

A CREATE study helped the State of California strategically allocate infrastructure protection funds received from the Department of Homeland Security. Another study serves to guide DHS analysts as they weigh the costs and benefits of devices that could protect commercial jets from shoulder-fired missiles. In addition, a CREATE-funded research team led by Prof. Milind Tambe of the Department of Computer Science developed randomization software for vehicle checkpoints at airports with significant success.

To date, CREATE has generated 256 publications, including reports on biological threats, border security and seaport vulnerabilities, as well as maintaining an active conference schedule. CREATE's research team includes more than 45 faculty researchers and more than 40 research assistants from USC and other universities across the nation. //

Funding for a Brain Prosthesis

BERGER TEAM TO PARTNER WITH WAKE FOREST AND KENTUCKY MEDICAL SCHOOLS

Building on decades of basic research, a team led by Theodore Berger of the Viterbi faculty has won a four-year, $16.4 million grant to restore lost memory function.

Berger, a professor in the Department of Biomedical Engineering who holds the David Packard Chair and directs the Center for Neural Engineering, will partner with Vasilis Marmarelis from the same department and chip design expert John Granacki of the school's Information Sciences Institute. Wake Forest Medical School and the Kentucky Medical School are also part of the project.

The research will build upon and coordinate with Berger's work in the National Science Foundation (NSF) funded Biomimetic MicroElectronic Systems Engineering Research Center.

Berger has been working on decoding the functionality of the brain's hippocampus cells for more than three decades. The hippocampus, seated deep within the brain's temporal lobe, is where the brain creates new memories. In recent years, the Viterbi researchers have been collaborating with a Wake Forest team to design a prosthesis that would perform brain function lost due to damage to the hippocampus from a stroke or injury.

The project, funded by NSF and the Defense Advanced Research Projects Agency, could eventually go further by enhancing normal memory or helping to deduce the particular codes needed for high-level cognition.

The new grant, says Berger, will pave the way to the next steps on this path. //

Viterbi Shares in $2.3 Million Grant

USC COLLEGE NEUROBIOLOGIST AND A FRENCH PHARMACEUTICAL FIRM WILL WORK WITH BIOMEDICAL ENGINEER TED BERGER'S LAB

Prof. Theodore Berger's brain prosthesis research has gathered support from two new large grants.

Two faculty members in the Viterbi School's Department of Biomedical Engineering are sharing a $2.3 million award from the National Institute of Neurological Disorders and Stroke, with a French pharmaceutical firm and a USC College of Letters, Arts and Sciences neurobiologist.

Professor Ted Berger and Jean-Marie Bouteiller, a research assistant professor in Berger's lab, will work with Michel Baudry, USC professor of neurobiology, and drug discovery company Rhenovia Pharma on an intense study of the amino acid L-glutamate, which regulates countless biological systems. Baudry is the principal investigator of the project.

Berger says the research effort will develop a new technology of mathematical modeling and computer simulation tools to systematically explore molecular processes underlying glutamatergic synaptic transmission, the effects of those synaptic processes on multi-synaptic cellular dynamics, and ultimately, a small network of hippocampus neurons. He says, "several neurological conditions, e.g., schizophrenia, are believed to be related to regulatory disruption of the glutamatergic system."

Baudry says that while the ultimate goal is to enable effective development of new drugs, the research proposed will work to expand basic understanding.

"The problem with glutamate in terms of pharmaceuticals is that this molecule is absolutely ubiquitous throughout the body," Baudry says. "What is therapeutic in one area can be toxic in another. The trick is to find a way to hone in on the specific neural cells you want to affect, without disturbing the others."

The research is centered on a detailed model of glutamatergic synaptic transmission, called EONS, first developed by Bouteiller in Berger's lab. Their research on EONS was, and still is, supported by the NIH-funded Biomedical Simulations Resource (BMSR), which is dedicated to the development of new methods for mathematically modeling physiological systems." //

Diane Ainsworth, 1952-2009

THE VITERBI SCHOOL WRITER, EDITOR AND PHOTOGRAPHER COMMUNICATED SCIENCE AND TECHNOLOGY AT FOUR MAJOR CALIFORNIA UNIVERSITIES

Diane Ainsworth, a science writer for the USC Viterbi School of Engineering and editor of USC Viterbi Engineer, died of a brain aneurysm March 29 in her Altadena home. She was 56.

Ainsworth had more than 25 years of experience covering science and technology at four major California universities.

She joined USC in 2003, where she became a prolific writer and editor, contributing hundreds of stories to USC media, including the *USC Viterbi Engineer* magazine, the Viterbi news Web site, the *USC Chronicle*, and *Trojan Family* magazine.

She also aided faculty and engineering administration in the preparation of fact-sheets, mailers, brochures and other material. A skilled photographer, she illustrated many of her own stories. "Diane was a very dedicated, hard working employee," says Viterbi School Dean Yannis C. Yortsos. "In 2008, she took over as editor of the *Viterbi Engineer* magazine, an activity she was particularly proud of. Under her management, the quality of the magazine significantly improved. Diane related very well to faculty and staff, which is reflected in the quality of stories she generated about Viterbi School activities.

"She was very interested and curious about research at the school and was the person in charge of a number of stories. We will miss her professionalism, kindness and dedication."

Before coming to USC, Ainsworth worked as a science writer for the *Berkeleyan*, the faculty-staff newspaper at UC Berkeley, in the school's Public Affairs office. She had spent 12 years as a media relations specialist at the Caltech Jet Propulsion Laboratory in Pasadena, covering such landmark events as NASA Mars missions and earth observation satellites, and arranging media access to shuttle missions. Ainsworth was a senior staff writer in the UCLA public affairs office and had also worked as a reporter for media, including the Associated Press, and as a public information officer at the RAND Corporation

Ainsworth received a B.A. degree from UCLA and an M.A. from California State University, Northridge, both in cultural anthropology. She's survived by her parents, Donald and Virginia of La Crescenta, and her brothers, Stephen John Ainsworth of Sunol and Donald Ainsworth III of Ventura.

The Viterbi School held a memorial on April 13 on the USC campus at the United University Church. //

"**Diane was a very** dedicated, hard working employee. In 2008, she took over as editor of the *Viterbi Engineer* magazine, an activity she was particularly proud of. Under her management, the quality of the magazine significantly improved. Diane related very well to faculty and staff, which is reflected in the quality of stories she generated about Viterbi School activities."

Faculty Accolades

VITERBI FACULTY EARN RECOGNITION, HONORS AND AWARDS


Stan Settles


Alice Parker


Terence Langdon


Dan Dapkus


David Kempe


Sven Koenig


Shahram Ghandeharizadeh

A recent parade of honors awarded to Viterbi faculty was led by **Stan Settles,** the IBM Engineering Management Professor in the Daniel J. Epstein Department of Industrial and Systems Engineering and director of the school's Systems Architecting and Engineering Program. Settles received the Institute of Industrial Engineers' highest honor, the Frank and Lillian Gilbreth Industrial Engineering Award. It recognizes "those who have distinguished themselves through contributions to the welfare of mankind in the field of industrial engineering. The contributions are of the highest caliber and nationally or internationally recognized."

Alice Parker, a professor in the Ming Hsieh Department of Electrical Engineering, is the 2009 recipient of the American Society of Engineering Education (ASEE) Sharon Keillor Award for Women in Engineering Education. The award recognizes outstanding women engineering educators who have an exceptional record in teaching, research and service.

Terence Langdon, the William E. Leonhard Professor of Engineering in the Department of Aerospace and Mechanical Engineering and the Mork Family Department of Chemical Engineering and Materials Science, has added another honor to his long list of distinguished international awards. He received the Honorary Medal "De Scientia Et Humanitate Optime Meritis" from the Academy of Sciences of the Czech Republic. The medal, awarded for "exceptionally meritorious contributions in the area of science and the promotion of humanitarian ideas," is the highest award the Academy bestows.

The 2009 USC Associates Award for Creativity in Research and Scholarship went to **Dan Dapkus** of the Ming Hsieh Department.

Maja Mataric´, the Viterbi School's Senior Associate Dean for Research, along with her computer science colleagues **David Kempe** and **Sven Koenig**, received a 2008-2009 USC Mellon Award for Excellence in Mentoring. She mentored students working on robotics. Kempe and Koenig are recipients of awards for undergraduate mentoring for their coaching of USC teams that successfully competed in computer programming contests. Kempe, who holds the Robert G. and Mary G. Lane Early Career Chair, also was one of three USC faculty members to win one of the most competitive and highly prized awards in science, the Sloan Fellowship.

Shahram Ghandeharizadeh of the Department of Computer Science was a recipient of the Association for Computing Machinery's 2008 Software Systems Award. Ghandeharizadeh received the honor for his work on the Gamma Parallel Database System, the first system of its kind able to run the same query, with the same performance, on larger data sets by simply adding hardware nodes.

In a rare sweep for a single school, the USC Academic Senate chose **Solomon Golomb**, **Sandeep Gupta** and **Maja Mataric´** as recipients of this year's Distinguished Faculty Service Awards.

Alan Willner of the Hsieh Department is the winner of the 2009 Leadership Award-New Focus/ Bookham Prize from the Optical Society of America. He is also one of 59 academics to receive a 2009 HP Labs Innovation Research Award.

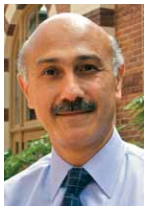

Solomon Golomb


Sandeep Gupta


Maja Mataric´


Alan Willner


James Moore II


Najmedin Meshkati


Roger Ghanem


Milind Tambe


Fernando Ordoñez

James Moore II, the chair of the Daniel J. Epstein Department, has been named a fellow of the Institute of Industrial Engineers (IIE), and also was elected to a two-year term on the IIE Board of Trustees as a senior vice president.

Najmedin Meshkati, who holds appointments in both the Epstein Department and the Sonny Astani Department of Civil and Environmental Engineering, has been selected by the National Academies as a 2009 Jefferson Science Fellow in the U.S. State Department's Office of Science and Technology Advisors. He will serve as a specialist on issues related to human-systems integration and the safety, reliability and efficiency of complex, large-scale technological systems.

Roger Ghanem, who holds appointments in the Department of Aerospace and Mechanical Engineering and the Sonny Astani Department, will receive the U.S. Association for Computational Mechanics' 2009 Computational Structural Mechanics Award.

A team led by **Milind Tambe** (Computer Science) and **Fernando Ordoñez** (Industrial and Systems Engineering) earned a best paper award at the 2009 International Conference on Autonomous Agents and Multi-agent Systems, for its work with the Federal Air Marshals on airport security.

Jerry Mendel and **Bart Kosko** of the Hsieh Department have been named fellows of the International Fuzzy Systems Association (IFSA).


Jerry Mendel


Bart Kosko


Krishna Nayak


Andreas F. Molisch


Paul Debevec


Petros Ioannou


Viktor Prasanna

Krishna Nayak of the Hsieh Department received a 2009 General Electric Healthcare Thought Leader Award for his research in magnetic resonance cardiac imaging.

The Global Wireless Education Consortium has named Hsieh Department faculty member **Andreas F. Molisch** "Wireless Educator of the Year" for outstanding contributions in teaching, research and collaboration with academic peers and the industry.

Paul Debevec, a research associate professor in the Department of Computer Science, best known for his pioneering work in high-dynamic-range imaging and image-based modeling and rendering, is the winner of an Elan "Visionary" Award. Now three years old, the Elan award program honors exceptional achievements in computer graphics.

Debevec works at the USC Institute for Creative Technologies.

Petros Ioannou of the Hsieh Department has received the IEEE Intelligent Transportation System Society's Best Practice Award for his smart-vehicle research.

Viktor Prasanna of the Hsieh Department has been named an Outstanding Engineering Alumnus by Penn State.

Visit our website for the latest Viterbi news:

viterbi.usc.edu

Ignition and Liftoff!

YES, IT IS ROCKET SCIENCE. Viterbi students from the USC Rocket Propulsion Lab have designed, built and blasted rockets as high as 50,0000 feet over the deserts of Southern California and Nevada. The launch sequence here is actually two launches. The Turbo Encabulator and the Silver Spur 2 both soared high over the Black Rock Desert in Nevada. Groups of students also went to the Lucerne Dry Lakebed in California to test rocket engines and a smaller rocket called Nike Smoke. Most of the students are studying astronautics, but other majors participate as well. Photos were taken by David Reese and Chris McNutt. //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Carbon: It's a Good Thing in Nanotubes

COULD CARBON NANOTUBE TECHNOLOGY SUPPLANT THE $272 BILLION ANNUAL CMOS BUSINESS?

by Eric Mankin

Roll up a one-atom thick sheet of pure carbon into a cylinder about a single nanometer in diameter—one billionth of a meter—and you have a carbon nanotube. Nanotubes have striking electronic properties, especially when you leaven them with metal nanowires set in indium oxide films. This emerging nanotube technology could replace complementary metal oxide semiconductor (CMOS) circuits—a $272 billion industry in 2007—and spawn a new generation of smaller, more powerful and more versatile electronic devices.

In recent months, engineers and scientists led by Chongwu Zhou at the USC Viterbi School have demonstrated stunning breakthroughs involving new technologies with carbon nanotubes. Zhou, who holds the Jack Munushian Early Career Chair, is an associate professor of electrical engineering in the Ming Hsieh Department of Electrical Engineering.

AN ALTERNATIVE TO CMOS

Zhou says his team has made major progress in assembling the tiny, delicate carbon nanotube threads into functional circuits and their process could be used to manufacture nanotube wafers about the size of a compact disk able to perform all the functions of silicon chips, at a potentially competitive cost. The nanotube wafers also contain metal nanowires set in indium oxide films.

"We solved major challenges, such as the synthesis of massive aligned carbon nanotubes over four-inch quartz and sapphire substrates," says Zhou. "In addition, we have developed a method to transfer carbon nanotubes from one substrate to another using thermal releasing tape, which can pick up carbon nanotubes and then release them onto substrates at very low temperature."

Zhou's group chemically dope the nanotubes and produce defect-tolerant designs of logic circuits. The group has demonstrated prototypes of integrated nanotube circuits, which could work as building blocks for integrated chips, such as CPUs or digital signal processors for computers and portable devices.

FLEXIBLE TRANSPARENT SUPERCAPACITORS

Another nanotube device emerging from Zhou's lab, with help from Stanford researchers, is a supercapacitor, a component that stores electrical energy for release when needed. The new supercapacitor has a higher stored energy and a greater stored capacitance than conventional designs.

Zhou's group incorporated metal oxide nanowires (oxides of iron, indium, manganese and rubidium) with the nanotubes to form heterogeneous films and attached the films to transparent plastic substrates that can be bent or twisted like playing cards.

Combining nanotubes with metal nanowires improved performance over earlier supercapacitors that used carbon nanotubes or graphite alone. And those devices were neither flexible nor transparent, limiting their applications. The new devices also "demonstrated enhanced specific capacitance, power density, energy density, and long operation cycles," Zhou says. After a large cycle of charge/discharge measurements, the researchers believe their supercapacitors are stable and suitable for long-term applications.

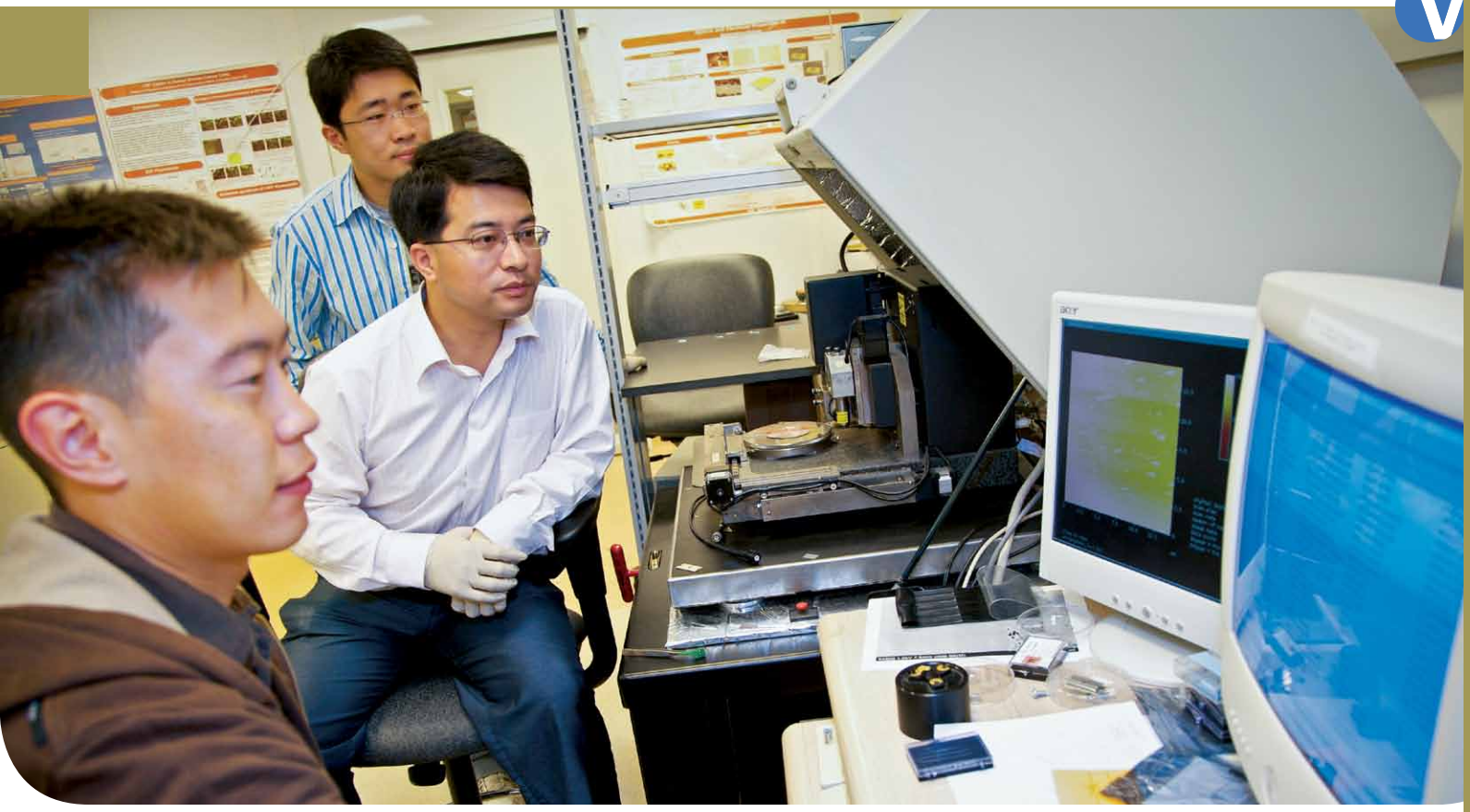
PRINTING TRANSPARENT NANOTUBE TRANSISTOR LATTICES

A third new device from the fertile Zhou lab looks much like the first two in that it's a clear, colorless disk about five inches in diameter that can be bent and twisted. Printed on the disk through a potentially inexpensive low-temperature process is a lattice of more than 20,000 nanotube transistors capable of high-performance electronics.

Zhou believes this prototype points the way to heads-up displays on car windshields; cheap, ultra-thin, low-power "e-paper" displays; or fabric that changes color and pattern for clothing, wall coverings, nametags and signs.

Zhou's team attached the dense matrices of carbon nanotubes to heat-resistant glass as well as flexible and highly heat-vulnerable transparent plastic substrates. They printed circuit lattices to the transparent plastic and connected them to commercial gallium nitrate light-emitting diodes that change their luminosity by a factor of 1,000 as they're energized.

The carbon nanotubes are the active channels for the circuits, controlled by iridium-tin oxide electrodes that function as sources, gates and drains. Earlier attempts at transparent devices used other semiconductor materials with disappointing electronic results. They enabled n-type transistors, but not p-types, and both are needed for most electronic applications. The critical improvement came from the ability



Prof. Chongwu Zhou, seated with graduate students Alexander Badmaev and Chuan Wang, is developing carbon nanotube technology that could begin to replace CMOS circuits—a $272 billion industry. His circuits are produced on transparent, flexible wafers about the size of a compact disk.

to produce extremely dense, highly patterned nanotube lattices rather than random tangles and clumps.

"These aligned nanotube transistors are easy to fabricate and integrate, as compared to individual nanotube devices. The transfer printing process allowed the devices to be fabricated through a low-temperature process, which is particularly important for realizing transparent electronics on flexible substrates," says Zhou.

NANOTUBES TO GO

A year ago, Zhou described a new way to "grow" orderly arrays of carbon nanotubes on sapphire. This year, he described how to roll these arrays up off the sapphire into neat parcels of working transistors ready to insert into large-scale integrated electronic systems. This approach "has great potential for high-density, large-scale integrated systems based on carbon nanotubes for both micro- and flexible electronics," he says.

Nanotubes had been grown on silicon substrates that have electrochemical properties interfering with those of the nanotubes and required elaborate, difficult, expensive and not very successful efforts to make the nanotubes grow into useful configurations.

Zhou, who established that nanotubes could naturally grow in orderly configurations on some surfaces of sapphire crystals, is now making nanotubes into transistors right on top of the sapphire surface. A well-established photolithography process creates an array of source-drain pairs that are dropped down on top of the nanotubes perpendicular to the parallel nanotubes.

"Electrical measurements of the source-drain electrode pairs revealed that 98 percent of the devices were connected by carbon nanotubes and exhibited significant conduction," says Zhou who found that there was no conduction or cross-talking between adjacent devices. But while transistor arrays on sapphire are striking as a demonstration, the crystal is not as good a substrate as would be an insulator, such as a plastic that doesn't conduct electricity at all, like plastics used for some silicon devices.

Zhou now believes nanotubes on insulator architectures are possible, and that may be the most far-reaching implication of this recent paper. He notes that, once the nanotubes were deposited on the sapphire, his team could deposit a thin layer of plastic insulator on top and when they peeled this film off the sapphire, the nanotubes came up with the film and the titanium-gold gate arrays dropped right on top of the insulator-embedded nanotubes. Zhou's paper goes on to describe other circuitry that could be deposited on top of that.

Zhou's team includes Xiaoolei Liu and Song Han. The research was supported by the National Science Foundation and the Defense Advanced Research Projects Agency. //

Light My Fire

HAI WANG AND DENIS PHARES PURSUE A NEW COMBUSTION METHOD FOR PRODUCING THIN-FILM SOLAR CELLS TO BRING DOWN THE COST OF SOLAR TECHNOLOGY

by Diane Ainsworth

Harnessing the sun's energy in thin-film solar sheets the size of a backyard swimming pool and the thickness of a sheet of paper is one of Aerospace and Mechanical Engineering (AME) Professor Hai Wang's current ambitions. In fact, the idea keeps him in his lab long after students have gone home and the sun has set.

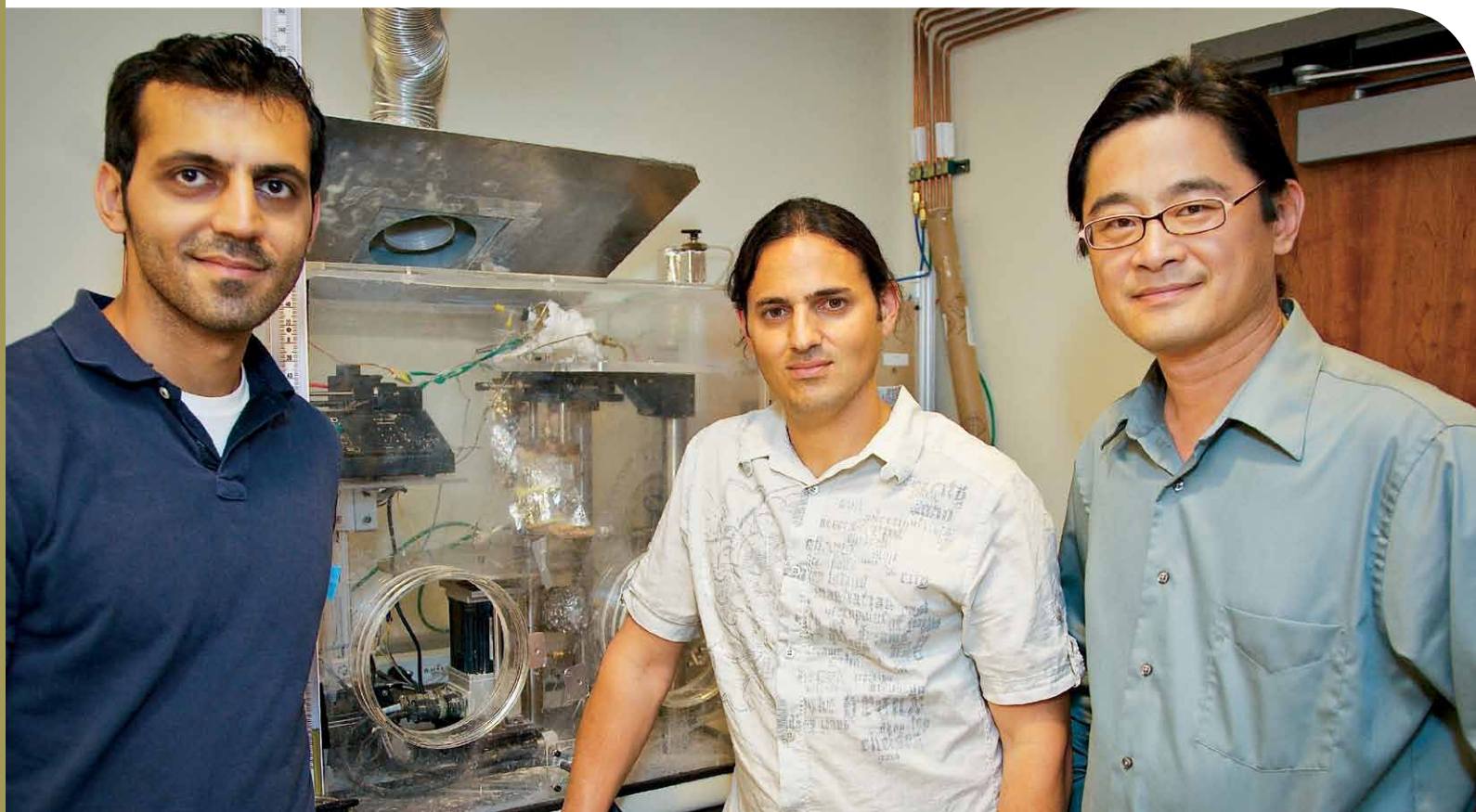
Intrigued by the processes used to create solar cells, Wang is experimenting with a promising new method of producing dye-sensitized solar cells, using a flame technique rather than the conventional process of screen-printing. The method cuts current processing costs in half and could be scaled up for mass production at a fraction of the cost of today's solar cells.

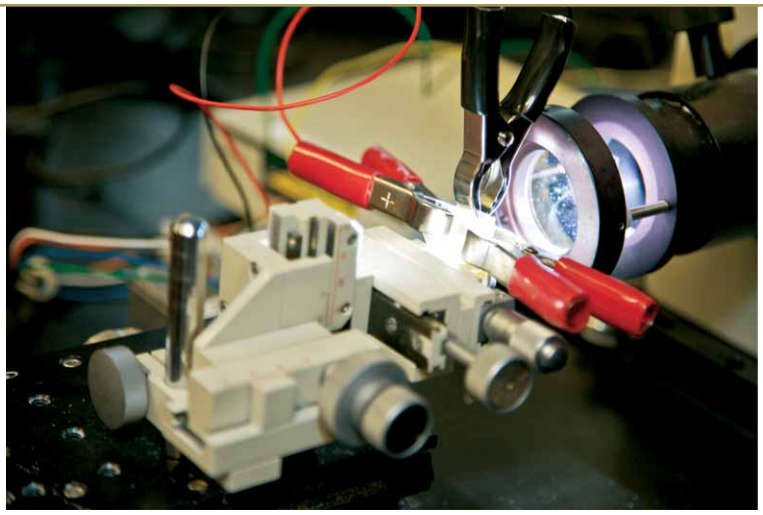
One day, Wang says, this process could yield "designer cells"—solar sheets so thin, flexible and inexpensive that homeowners would be able to pick out rolls of any size, shape and color at their local home improvement store and self-install them over pools, gardens, rooftop windows or any other choice location to generate electricity.

Wang spends a lot of his time in the USC Combustion Kinetics Research Laboratory in Tutor Hall, cooking thin sheets of titanium oxide nanoparticles with his colleague, Denis Phares, an assistant professor in the Aerospace and Mechanical Engineering Department. It takes them many hours to prepare different types of nano-particle films and sensitize them, using a dye that can be made from California blackberries. Wang and Phares have been working for several years now on this combustion experiment to demonstrate that flame works better than screen-printing. It's a much simpler process, Wang says, which gives it an advantage over current, multi-step processes.

Wang studies combustion at the molecular level–and is currently under contract with the Air Force and NASA to model the next generation of cleaner, more fuel-efficient jet engines. Like all of his projects, the work involves understanding what happens to materials that burn, and that applies to all sorts of processes, from car engines to airplanes, spacecraft and solar cells. His areas of expertise are reacting flows, chemical kinetics, catalysis, and combustion and transport theories.

The physics of reacting flows, whether they apply to jet engines or solar cells, are the same, Wang says, but they're not well-understood. That puts Wang and his colleagues in





The researchers are developing a combustion method to produce dye-sensitized solar cells instead of the conventional process of screen printing.

a special category of researchers across the country who are interested in discovering the physics controlling these reactive flows, so that new materials for eco-friendly technologies can be developed.

"The great thing about solar-cell technology," he says, "is that developing countries don't have to invest huge amounts of money on infrastructure. In fact, you could create 'designer sheets' of solar cells so paper-thin and lightweight that they could be rolled up and stuffed in the trunk along with the suitcases and camping gear when the family goes on vacation.

"Right now, we'd be able to provide all of the energy needs for the United States by covering an area equivalent to one-fifth of Texas with solar panels, operating at just 10 percent efficiency. To supply energy to the entire world, we'd need to cover an area the size of California with solar panels."

Solar cells use semiconducting materials, such as silicon, to convert sunlight into energy. When photons of light strike a solar panel, they're absorbed by the semiconducting material, knocking electrons loose from their atoms and allowing them to flow through the material to produce electricity. An array of solar cells will convert solar energy into direct current (DC) electricity.

Part of the way to minimize costs is finding better light-absorbing materials, Wang says. Historically, crystalline silicon has served as the light-absorbing semiconductor material in most solar cells, even though it is a relatively poor absorber of light. The material yields stable solar cells with good efficiencies (15 to 20 percent of the practical solar conversion efficiency), and uses well-understood process technology derived from the electronics industry. The downside is that the material is expensive and energy intensive. The cell has to be fairly thick in order to absorb enough light, which makes the panels large, bulky and expensive to install. And installation costs are one of the major culprits in the high cost of solar technology; they account for nearly one-half of the cost of adding solar panels to a roof, Wang says.

Left to right, graduate student Saro Memarzadeh, Prof. Denis Phares, and Prof. Hai Wang hope their thin-film solar cells will cost a fraction of those made with today's technology.

"For instance, if you put a two-kilowatt solar system on your roof, it will cost roughly $25,000 after government rebate, and half of that is installation," he says. "So we need to bring that cost down to a dollar a watt rather than $12.50 per watt. Thin-film solar cells will reduce the total cost because installation is cheaper. Of course, we must manufacture them cheaply."

Recently, solar-cell companies have been experimenting with different absorber layers and semiconductor materials in search of cheaper ways to produce the cells. Some companies began using a highly conductive metal foil rather than glass or stainless steel for the top and bottom layers of the cell, hence increasing the amount of power that can potentially be carried through the film. Other companies are experimenting with second-generation materials, including cadmium telluride (CdTe), copper indium gallium selenide (CIGS), amorphous silicon and micromorphous silicon, which produce higher conversion efficiencies and are cheaper to manufacture.

Dye-sensitized solar cells are the latest generation of solar cells to come along, inspired by the metabolic process of photosynthesis that plants use to convert light into energy. Wang is impressed with these cells because they can be made into such paper-thin sheets and seem to show so much promise. But a lot of experimentation still needs to be done before the technology can be declared a viable alternative worth developing.

"**Right now,** we'd be able to provide all of the energy needs for the United States by covering an area equivalent to one-fifth of Texas with solar panels, operating at just 10 percent efficiency."

"We think the flame approach will achieve lower costs and make this material advantageous, because it basically combines several steps of thin-film preparation into a single step," Wang says. "Now we're working on increasing the performance efficiency…and I think we're going to be able to get that up to above 11 percent, the record, before too long." //

ENGINEERIN EDUCATI

AT VITERBI

By Bob Calverley

THE RAPID ADVANCE OF TECHNOLOGY AND GLOBALIZATION THAT HAS ALREADY TRANSFORMED THE 21ST CENTURY DEMANDS EQUALLY RAPID CHANGES IN ENGINEERING EDUCATION. AT THE USC VITERBI SCHOOL, THAT TRANSFORMATION IS WELL UNDERWAY. UNDERGRADUATES ARE BROADENING THEIR STUDIES TO APPLY ENGINEERING TO THE ARTS, BUSINESS, COMMUNICATIONS AND SCIENCE, INCLUDING THE SOCIAL SCIENCES, ALL WHILE HANDLING A CURRICULUM THAT HAS MAINTAINED, EVEN INCREASED, ITS RIGOR. THERE ARE INNOVATIVE NEW DEGREE OFFERINGS AND SHORT-COURSE NON-DEGREE PROGRAMS AT THE MASTER'S LEVEL FOR PROFESSIONAL ENGINEERS AND GROWING FINANCIAL AND ACADEMIC SUPPORT FOR THE DOCTORAL STUDENTS WHO CONSTITUTE THE NEXT GENERATION OF TOP TIER RESEARCH LEADERS.

On the Cover, left to right:
Bardia Zandian, Ph.D. student from Iran; **Trevor Orr**, Ph.D. student, from Dana Point, Calif.; **Mystie McCormick**, senior, chemical engineering, from Washington State; **Warren Tichenor II**, sophomore, aerospace engineering and economics, from San Antonio, Texas; and **Surbhi**, master's student, biomedical engineering, from India.

G
ON

A Visionary Undergraduate Curriculum

Every fall, another 400 new freshman, invariably brighter than the previous year's class, and with even higher expectations, arrives at the USC Viterbi School.

"There are only a little more than 400 of them because the university limits the number of freshmen each year, and that makes them a very special and precious group," says Viterbi Dean Yannis C. Yortsos. "We have high expectations for them."

In the past century model of engineering education, only 60 percent of engineering freshmen would successfully negotiate the rigorous engineering curriculum and receive degrees.

"That was once the case at USC. But we're steadily conquering this challenge," says Yortsos. "We're highly selective, and if we admit a student, we know that student can handle the rigor. Then, it becomes our obligation to do everything possible to help them be successful." Successful means they'll graduate as 21st-century engineers with an understanding of innovation and entrepreneurship, a familiarity with the arts, an exposure to different cultures and a feel for societal relevance. "We prepare our graduates to be the leaders in today's complex global economy."

In 2004, the National Academy of Engineering (NAE) issued a far-reaching report, *The Engineer of 2020: Visions of Engineering in the New Century*, recommending "ways to improve engineering education and prepare for the complex technical, social and ethical questions raised by emerging technologies." Last year, the NAE raised the bar further with a list of 14 Engineering Grand Challenges facing 21st-century engineering and the world. (See Spring 2009, *USC Viterbi Engineer*.)

"The curriculum is no less rigorous, but we've introduced new elements, so students understand team-building, communication, globalization and societal relevance," says Cauligi Raghavendra, senior associate dean for strategic initiatives, who heads the school's Division of Engineering Education. "We expect our engineers to be the leaders when working on teams that include members from other countries, other cultures and disciplines outside of engineering."

The Viterbi School was already well on its way to implementing most of the NAE recommendations when the 2020 report came out. But the school got a significant boost with an $8 million gift from alumnus Ken Klein (BS BMEE '82) in 2006 to establish the Klein Institute of Undergraduate Engineering Life (KIUEL). The pillars of KIUEL are leadership, cross-disciplinary activities, service learning and globalization.

"We're here to provide the resources and support to be successful in what is a very challenging curriculum."

MATTHEW O'PRAY, DIRECTOR OF ADMISSIONS

With KIUEL, the Division of Engineering Education has been driving the innovations in the school's undergraduate programs, inside and outside the classroom.

Freshmen Academies Build Student Enthusiasm and Retention

Freshman year is critical. Idealistic and enthusiastic, freshmen suddenly face demanding, competitive, detail-oriented mathematics and science courses that form a critical foundation, but are only part of their attraction to engineering. It's too easy to lose sight of the joy and creativity in engineering; and no surprise that when students drop out of engineering, most leave in their freshman or sophomore year.

In 2005, all incoming Viterbi freshmen began taking a Freshman Academy seminar in their first semester, where they're exposed to timely engineering issues. The seminar helps them understand engineering from a global perspective. Freshman academies introduce them to the big picture, imparting an understanding of the way engineering affects society, technology, history and politics. They provide an opportunity to build community with each other as well as other undergraduate students, faculty and the university.

Student coaches for Freshman Academies gather at the Viterbi Student Affairs' Luau held every August to welcome new undergraduates.

These academies are small, taught by senior faculty, with two or three upper division students acting as mentors. They're not discipline-specific; students from all departments take them together. Freshmen hear from distinguished guest speakers, usually working engineers and often Viterbi alumni. There are lab tours, and the class often culminates in a hands-on team project. In fall 2008, Hossein Hashemi, associate professor of electrical engineering and holder of the Gordon S. Marshall Early Career Chair, asked the freshmen to perform a miracle—to walk on water.

"A core part of engineering is to find out what's wrong with a design and how to fix it," Hashemi says. "All of my students were telling me that, on paper, their ideas seemed to work, but when they tried testing them in reality, they didn't. So I asked them what changes they'd make in their projects, if they were allowed to do them again. I told them it's not about failure, but about learning from failures and coming up with a better design next time."

"One of the greatest things about this class is that it helps you make the huge transition from school to college life," says Rebecca Sekar, a biomedical engineering major who was a coach for Hashemi's academy a year after she had taken a Freshman Academy class.

Louise Yates, associate dean for admissions and student affairs, says the academies are an important part of an overall program to help acclimatize freshmen to USC and to engineering, called the First Year Excellence Program. Student Affairs provides centralized advisement, monitors grades, offers a variety of success-oriented workshops and helps foster peer connections rather than competition.

"One of their primary resources is their peers," says Yates. "We want them to work with—not against—each other."

"We're here to provide the resources and support to be successful in what is a very challenging curriculum," says Matthew O'Pray, director of admissions. "I'm not here to answer my phone at 1:30 in the morning, but their best buddy that they met in the Freshman Academy is."

Another key change for Viterbi freshmen is that some of the core calculus section courses are now taught by engineering faculty.

"Math is wonderful and fundamental to all engineering," says Yortsos. "And when engineering faculty teach lower-division math classes, they tend to use real-life examples that resonate directly with our engineering students. The result is improved retention and more enthusiasm for engineering."

Academic Support Services Help Ensure Success

The Viterbi Academic Resource Center, or VARC, supports students by providing a host of academic services including peer tutoring and supplemental instruction. At the end of the semester, VARC, along with the Center for Engineering Diversity (CED) and Women in Engineering Program, offers study sessions, primarily aimed at freshmen, to help them prepare for final examinations, a stressful event for all college students. Undergraduate study partners, who've successfully completed the courses, conduct study sessions for some of the difficult early courses, mostly math but also basic physics and chemistry. Students receive tips on how to prepare for and take finals. Coffee, cocoa, bagels and a care package full of snacks are available. This past spring, at the end of their studying, students could even get a free 10-minute back-and-neck massage to relieve stress.

In Spring 2009, the first annual KIUEL Senior Design Expo allowed seniors to present and explain their capstone senior design projects on the Engineering Quad.

Another program to assist freshmen, as well as other undergraduates, is the Spotlight Series. Working with faculty and recent alumni, the school organizes discussion-based workshops that are discipline-specific. Students, mainly freshmen and sophomores, learn about a discipline from industry representatives, Viterbi alumni, faculty and their upper-division peers. This helps them choose a major and understand where their engineering degree will take them.

All Viterbi students are essentially admitted to all majors, and changing a major is neither unusual nor difficult. Freshmen usually take a discipline-specific course, "Introduction to ___," but that doesn't lock them into that major.

Results from these changes have been very encouraging: Almost 92 percent of the 2007 engineering freshman cohort returned to Viterbi in fall 2008, representing an almost eight point gain compared to the fall 2005 cohort. (See graph, page 31.)

Student Design-Build Projects: Interdisciplinary, Creative, Marketable

Every engineering major has a senior capstone design course where teams of seniors draw on all of their varied skill sets to design and create. Capstone design courses are intrinsically interdisciplinary. They also have the potential for engaging lower-division students, the rest of USC and industry. For the first time, this past spring, electrical engineering students worked in teams with business (marketing) and fine arts students on their design project. The goal was not just to create something and make it work, but to make it attractive and marketable. This three-way collaboration was received enthusiastically and is a model to

NAE Grand Challenges Scholars Program Established

face the challenge

This year, the Duke University Pratt School of Engineering, the Olin College of Engineering and the USC Viterbi School established the Grand Challenges Scholars program to prepare groups of exceptional engineering students to solve a set of problems designated by the National Academy of Engineering (NAE) as the most urgent and critical issues facing the world today.

NAE's 14 Grand Challenges include developing clean-energy alternatives, making solar energy economical, preventing nuclear terror, advancing health informatics, ensuring clean water for all people and reverse-engineering the brain.

The new program followed the highly successful Summit on the Grand Challenges organized by the same three schools and held at Duke in March. Students experience (and are evaluated in) five key program areas—both curricular and extra-curricular:

- Research involves students in a project or independent research relating to one of the Grand Challenges.
- The interdisciplinary curriculum called "Engineering +" prepares engineering students to work on problems in public policy, business, law, ethics, human behavior and risk management, as well as medicine and the sciences.
- Entrepreneurship teaches students how to translate invention to innovation by developing market ventures that scale to global solutions in the public interest.
- Global Dimension develops students' global perspectives and abilities to lead innovation in a global economy.
- Service Learning deepens students' social consciousness and their motivation to bring technical expertise to bear on societal problems. Programs such as Engineers Without Borders or Engineering World Health could be adapted to satisfy this component.

The Grand Challenges Scholars Program was initially envisioned to attract a select cadre of 20 to 30 students at each school, and the three schools hope it will spread to other engineering schools across the country. Moreover, the program will serve to pilot innovative educational approaches that could eventually become the mainstream educational paradigm for all engineering students.

Each participating institution is expected to develop its own specific realization of the five components; students receiving the Grand Challenges Scholar distinction will be endorsed by their own institution, as well as by the NAE. //

be implemented more widely in the future. Next year's capstone design courses will all have a common theme: "Assisting people with disabilities," thus emphasizing the societal aspect of engineering. Other themes will be applied in subsequent years.

In another first, this year, seniors presented their projects at the KIUEL Senior Design Expo held in May on the Engineering Quad, where they found themselves explaining their projects to crowds of students who dropped by. KIUEL targeted freshmen and sophomores with a special outreach effort, so they could see firsthand what they'd soon experience. A panel of representatives from industry judged the projects.

"These were some very cool projects, something the younger students could get excited about," says O'Pray. They included a thermo-acoustic refrigerator, a liquid-propane rocket engine, a Microsoft Surface application for hotel lobbies, an airport safety-management system, and a golfing-social networking application for the iPhone.

Yates and Raghavendra hope soon to introduce a hands-on project and design experience for sophomores into the curriculum. Raghavendra says these projects will relate to the 14 NAE Grand Challenges.

The creative involvement doesn't stop in the design classes. Last year, more than 100 undergraduates in chemical engineering, materials science, and biomedical engineering did research in the new Undergraduate Nanotechnology Laboratory. And one of the most unique facilities at Viterbi is the GamePipe Laboratory, where computer science students not only create video-games, in collaboration with Cinematic Arts and Fine Arts students, but also regularly show off those creations to dozens of industry representatives.

Students get involved in a myriad of hands-on projects outside the curriculum, such as designing, building and competing in contests with bridges, concrete canoes, small aircraft, racecars and robots. Astronautics and aerospace students have launched rockets to 50,000 feet over the Southern California desert, and others are working on a spacecraft to land on the moon.

TV star Alan Alda, center with some of the Viterbi students who attended, hosted a communications skills workshop for undergraduates.

The Viterbi School maintains a close relationship with industry. Every Viterbi department has an industry advisory board, as does the CED. "This is an important opportunity to get feedback and input," says Raghavendra. "Students are our product, and our aim is for them to be attractive to industry and gainfully employed."

The Career Services Office in Ronald Tutor Hall hums with activity most days, and particularly during career fairs. Each semester, the center holds a Career Expo, filling the Engineering Quad with booths for more than 100 companies, where hundreds of engineering students line up to talk to company representatives.

Training the Next Generation of Engineer-Leaders

Viterbi students learn leadership both in and outside of the classroom. Engineering students work in teams on numerous projects during their undergraduate years. "For most students, the engineering concepts are not as difficult as communicating and organizing the group so they can move forward. That's often the hardest part of a project," says O'Pray.

The Viterbi Student Affairs Office supports more than two dozen student organizations, everything from service groups and honor societies to discipline-specific clubs. The student organizations run on a small-business model, and students not only gain leadership skills, but some entrepreneurial smarts as well. "They manage budgets, apply for funding and raise money for projects. They have to communicate their ideas across the group. They hold elections, and students rise to leadership positions. They know when they have good years and when they have bad years," says Paul Ledesma, associate director of admission, who also serves as a staff advisor to the Viterbi Student Council.

KIUEL holds leadership seminars and workshops throughout the year and, in the fall, has an off-campus weekend leadership retreat for rising student leaders. These events provide alumni and industry speakers an opportunity to advise students. Recent leadership development workshops, sponsored by Student Affairs, have featured guests such as Alexis Livanos, chief technical officer of Northrop Grumman, and Sidney Harman, co-founder of audio giant Harman-Kardon.

The ability to communicate clearly is an essential leadership skill and a crucial component in every engineer's toolbox. However, communication was long considered a shortcoming for many engineers. The Viterbi School's Engineering Writing Program (EWP) helps both undergraduate and graduate students develop their written and oral communication skills. Jointly with KIUEL, EWP also offered a workshop last

> **"Students are** our product, and our aim is for them to be attractive to industry and gainfully employed."
>
> CAULIGI RAGHAVENDRA, SENIOR ASSOCIATE DEAN FOR ADMISSIONS AND STUDENT AFFAIRS

year on communication skills for undergraduates hosted by TV star Alan Alda.

Directed by Steve Bucher, EWP not only teaches students to become better communicators, but also promotes student participation in community service projects. Through EWP, students have been designing a community center in Limpopo, South Africa; helped provide clean water and power for a village in the Democratic Republic of the Congo; installed a new barcode system for the Los Angeles Police Department; and, again with KIUEL, ran a computer literacy project at the Alexander Science Center School, as part of the USC Neighborhood Outreach program. EWP also produces and publishes *Illumin*, a student webzine with a worldwide audience, which showcases student writing by explaining everyday technology and science. Finally, the EWP serves as a focus for engineering ethics and academic integrity.

As a result of globalization, the information technology revolution, and dramatic advances in the various engineering technologies, engineering is broadening its impact on society and, increasingly, is a discipline that enables others.

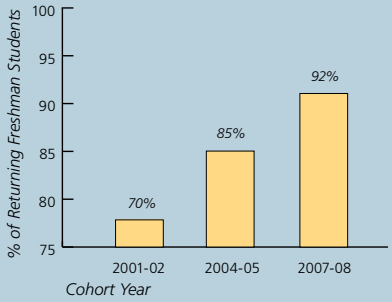
"The power of 'Engineering +' can most readily be seen in medicine, where engineering plus health is leading to biomimetic devices, such as advanced prosthetics for limbs, the eye and the brain, to a burgeoning bioinformatics revolution, and to simulation and modeling methods that speed new drug development," says Viterbi Dean Yortsos. "But it doesn't stop there!"

For engineering students, 'Engineering +' spills over to minors such as theater or anthropology or music. In the 17 professional schools at USC, there are more than 120 minors for a student to choose from, or they may even do a double major. That's what Robyn Strumpf did. She majored in mechanical engineering and political science, graduated last May, and was named as a USC Renaissance Scholar Prize winner.

"Engineers helped produce the great tools of the 20th century, especially computing and communications. The influence of the Internet has been enormous," says Yortsos. I don't know what magical changes lie ahead, but we're sure that some will be shaped by one or more of the 400 incredibly bright, young people who elect to join us every year." //

UNDERGRADUATE HIGHLIGHTS

- High freshman selectivity in the Viterbi School, with only 10.6 percent of all applicants enrolled.
- In Fall 2008, 15% of Viterbi undergraduates were underrepresented minorities (Hispanic, Native American and African American).
- Viterbi has 27% female undergraduates versus the 17% national average.
- In Fall 2008, the freshman class return rate to engineering was 92%, continuing an increasing trend.



Adding Value Through Diversity


Tracy Thomas-Navarro

In 20th-century America, the profession of engineering was largely a white male realm. Losing 40 percent of the students who began studying engineering was bad enough, but having more than half the population uninterested in, or feeling unwelcome to the profession because of their gender or ethnicity, was worse. So in recent years, engineering schools have been working hard to attract women and underrepresented minorities.

Now, **27 percent** of Viterbi undergraduates are women, and **15 percent** are underrepresented minorities, well above the national average in both cases. Last fall's freshman cohort was **one-third female**. Women and underrepresented students receive extra support and help from the Center for Engineering Diversity (CED) and the Women in Engineering Program office.

"Being involved with the Society of Hispanic Professional Engineers (SHPE) and the National Society of Black Engineers (NSBE) is very important to some underrepresented students," says Tracy Thomas-Navarro, CED's Director. "But they're a very diverse group, and not just ethnically. They come from families of different income levels. Some have done a lot in high school, both in and out of the classroom. Not all are first-generation college students. Some are children of two practicing engineers."

The Society of Women Engineers has been one of the Viterbi School's most active student groups, receiving the University Tommy Award for the best undergraduate student organization for the past two consecutive years. //

The Viterbi School is adding new masters programs in gre

A New Master's Paradigm

By Eric Mankin

Among the trio of academic degrees, the master's has long been something of an oddity. A bachelor's is a certificate that starts a non-academic career; the doctorate does the same for university-level teaching and research.

In other fields—business, for example—its status is different: an MBA is the rule. But in most academic fields, including engineering, the master's has long been mostly the prelude to a Ph.D. A combination of internal and external factors, including the Viterbi School's close relations with industry and dramatic changes in the economy and in the discipline of engineering, are redefining the Viterbi master's degree.

Masters and Professional Programs

The Viterbi School's new Office of Masters and Professional Programs (MAPP), headed by Associate Dean Kelly Goulis, is developing a new master's model, including the creation of non-degree short programs for M.S. technologies.

"Both the practice of engineering and the needs of the economy are changing," says Dean Yannis C. Yortsos. "We believe the structure that we're evolving is a creative, proactive response to this new environment. And the response we're getting from students shows we're moving in the right direction."

The Viterbi School now offers master's and professional programs in high-growth engineering fields, in addition to the traditional path to a Ph.D. In fact, the school sees a strong need to differentiate between the M.S. as a pathway to a Ph.D. and the M.S. as a terminal professional degree. Many of the programs are available with flexible class options–on-campus or remotely.

A very popular MAPP option is a post-B.S., one-year terminal master's program, now offered to qualified undergraduate engineering students at USC, as well as to students in selected undergraduate engineering programs nationwide, such as Olin College and California Polytechnic University, San Luis Obispo. At least 100 students every year elect to pursue this option.

As laid out by Yortsos and Goulis, the program responds to national and global trends and needs:

- The growth of knowledge and of new specialties in the field of engineering. Even though Viterbi's undergraduate engineering curriculum remains one of the most intensive, four years is still often not enough to bring a student up to the level of practice in many fields.
- The national need for professionals in new specialty fields is exploding, creating a training bottleneck.

"We've had our ear to the ground for a long time," says Goulis, "Now we're expanding by developing and delivering relevant professional education programs that address important emerging areas, either driven by research advances or by technology.

Goulis notes that Viterbi has been uniquely well-situated to develop educational programs addressing real-world needs, thanks to its long association with industry.

A classic example of this was the evolution of a special M.S. program in systems architecting and engineering, which has found a home in a number of engineering and defense companies. The Viterbi School became a systems engineering center upon the arrival of the late Eberhardt Rechtin, often called the founder of the discipline. Rechtin's legacy was carried forward by former Associate Dean Elliott Axelband and then by Stan Settles, professor in the Epstein Department of Industrial and Systems Engineering.

More than a decade ago, Boeing realized the need for a systematic master's-level program for systems engineers. Axelband, who worked with Settles on the USC response, recollects that the winning USC proposal competed with 17 universities, including many elite institutions.

"The important thing about the USC program," says Leroy E. Hanneman, who worked on the effort from Boeing's side, "was that it emanated out of an identified industry need, and was a prototype of an ideal systems engineering program as applied to the industry. We also wanted to take advantage of distance learning, which allowed the flexibility our employees would need."

> "**Now we're** expanding by developing and delivering relevant professional education programs that address important emerging areas, either driven by research advances or by technology."
>
> KELLY GOULIS, ASSOCIATE DEAN OF THE VITERBI SCHOOL'S MASTERS AND PROFESSIONAL PROGRAMS



een technologies, health systems, construction and infrastructure and electrical power engineering.

Across the board, the MAPP message is clear. "The aim," says Goulis, "is to combine flexibility with engineering talent, continually focusing on national needs. We need a whole generation of new kinds of experts, professionals who can apply talent and knowledge—a new breed of engineers. And we're proud of leading the way."

New Master's Programs

The Viterbi School has always responded with agility to emerging needs, from programs in astronautics to biomedical devices to engineering management. Earlier this year, four new M.S. degrees were approved: construction and infrastructure, green technologies, health systems, and financial engineering.

The construction and infrastructure degree responds to the emerging field of building information management: a new, unified construction process that attempts to integrate the construction process far more thoroughly than has been the general industry practice. The Astani Department's Burcin Becerik-Gerber is a specialist in this field.

The new M.S. in green technologies brings together traditional engineering disciplines—from efficiencies, to solar energy, to energy conversion and energy distribution—and promotes the intersection between information technology and energy.

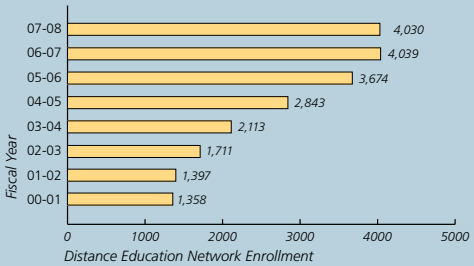
In health, David Belson of the Epstein Department of Industrial and Systems Engineering, a leading expert on the application of engineering techniques to health systems delivery, is offering both short courses for working professionals in such areas as process improvement in health care and patient safety-management systems, while also offering a new degree program in health systems engineering.

In addition, a new degree in electrical power engineering is soon to be offered, responding directly to an IEEE report stating that the nation faces a growing shortage of electric power and energy engineers "to design, build, operate and maintain the kind of reliable electric energy system that is required in the future."

Finally, a financial engineering degree program that includes expertise from the USC Marshall School of Business will use tools from finance and economics, engineering, computer science, applied mathematics and statistics to address problems such as derivative securities valuation, strategic planning, dynamic investment strategies and risk management. //

DISTANCE EDUCATION NETWORK HIGHLIGHTS

- The Distance Education Network (DEN) is the largest e-learning professional engineering program of any leading research university, and offers 37 Master of Science degrees.
- 20% of DEN enrollment is female.
- DEN enrollment has tripled since 2000.



30 Years of Distance Education at Viterbi


Kelly Goulis

The Distance Education Network (DEN) started more than 30 years ago as a television option, first broadcast, then satellite, helping mostly aerospace engineers in Southern California obtain advanced degrees in the workplace. Interest from Boeing accelerated the changeover to Internet distribution in 2002, a pioneering step at the time.

The exceptional quality of the DEN interface, says Kelly Goulis, associate dean for MAPP, who was director of DEN when the new technology was implemented, was a direct outgrowth of demand from Boeing and other clients for advanced delivery systems, leading DEN to move from satellite TV to the Internet.

More than 700 systems degrees later, the program is now established within the industry. Another similar example grew out of the Chevron-funded Center for Interactive Smart Oilfield Technology (CiSOFT), which in addition to developing new oil production tools, also developed an educational program to teach them. DEN offers more than 36 M.S. programs from every department in the Viterbi School and reaches students all over the world—more than 1,200 of them at any given time. In spring 2009, 358 of the 1,451 students who earned M.S. degrees at Viterbi were DEN students.

DEN has now stabilized its enrollment, and the focus at MAPP is more on growth in offerings than on building its student base. //

Doctoral Education at the Viterbi School

By Bob Calverley

Last May, 164 Viterbi Ph.D. students received their Ph.D.s, "an impressive number for a school our size," noted Dean Yannis C. Yortsos at Commencement ceremonies. Indeed, the number of Viterbi Ph.D. graduates has recently been on the rise, more than doubling during the current decade.

The number of Ph.D. students enrolling at Viterbi, like the number of graduates, is trending upward, and their quality, as seen in GRE (Graduate Record Examination) scores, is also increasing. More than 20 percent of the students are female, and a third are domestic students, which roughly parallels national trends. A very rough rule of thumb approximates the number of incoming Ph.D. students with that of the tenure-track faculty in the school.

"The average time to the degree is five years," says Margery Berti, associate dean, who coordinates doctoral programs, "and it's a very intense period."

Funding Support

Fundamental to the Ph.D. education is the model for its support. In the Viterbi model, a Ph.D. student is supported by one year of unrestricted fellowship, one year by a teaching assistantship, and three or more years by research assistantships. Fellowships and assistantships pay for tuition and health benefits, and come with a substantial stipend to cover living expenses.

Viterbi Ph.D. students are eligible for three main unrestricted fellowship programs: the USC Annenberg Graduate Fellowship Program, the Provost's Graduate Fellowship Program, and the Viterbi Dean's Doctoral Fellowship Program. There are also fellowships funded by Chevron, by the Mork Family and Hsieh endowments (namesakes of the Mork Family Department of Chemical Engineering and Materials Science, and the Ming Hsieh Department of Electrical Engineering, respectively), and by other endowments and start-up funds. "Last year, we offered more than 110 unrestricted one-year fellowships and a substantial number of fellowships supported by start-up funds, putting us a step closer to our goal to fully fund all first-year Ph.D. students," says John O'Brien, senior associate dean for academic affairs.

"By the end of two years, the student should have identified an advisor and passed the screening procedure," says O'Brien. Viterbi's eight departments have different screening procedures that range from written or oral examinations, to a faculty review of a student's performance.

The teaching assistantship year in the typical model is fully funded by the school. With more than 850 Ph.D. students in residence, the typical remaining three years are to be supported by research assistantships. "We believe that Ph.D. students should get some teaching experience," says O'Brien. "Their teaching assistantship may happen in the second year, or it may happen later; it could be split into two different semesters. However, most of their program is supported by research assistantships."

The Viterbi School's large volume of varied and interdisciplinary research, spanning its various institutes and centers, presents significant funding opportunities for Ph.D. students. The school generates significant annual research expenditures, including graduate student support.

"Our research volume reflects the excellence of our research enterprise. It

Prof. Milind Tambe, of the Computer Science Department (standing behind the desk) discusses a research project with his students.

> **"Last year,** we offered more than 110 unrestricted one-year fellowships and a substantial number of fellowships supported by start-up funds, putting us a step closer to our goal to fully fund all first-year Ph.D. students."
>
> JOHN O'BRIEN, SENIOR ASSOCIATE DEAN FOR ACADEMIC AFFAIRS

means that our faculty won grants with proposals that went through a competitive review process," says Maja Mataric´, senior associate dean for research.

During his or her tenure, a Ph.D. student will publish a number of quality research papers, distinguished enough to attract attention from other researchers in the field. "The research could bring about a noteworthy incremental change in an area where a lot of other researchers are already working," says O'Brien. "Or it might be a paper that heads in a completely new direction, where little work has been done."

Faculty Mentoring

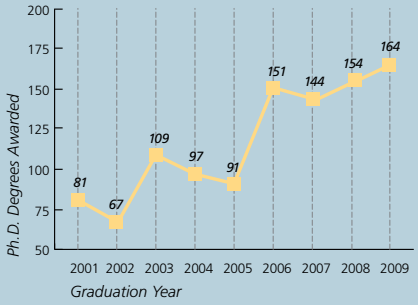
A significant part of the faculty-Ph.D. student interaction involves mentoring. Earning a Ph.D. is an arduous undertaking for students, and when they reach that pinnacle, it's a supremely rewarding moment for the professor as well. The close relationships that develop between faculty and Ph.D. students lead to lifelong friendships.

This past spring, Mataric´ organized a mentoring forum for Ph.D. students and postdoctoral fellows, where five faculty members related their diverse experiences in becoming academics. They covered everything from the mechanics of applying for an academic position, to the importance of believing in themselves, to how they should balance concerns outside of academia such as family life and support networks.

Recognizing the value of Ph.D. student mentoring, USC bestows mentoring awards each year to faculty who have excelled in this dimension. In the last three years, four Viterbi faculty members won Ph.D. student mentoring awards: professors Krishna Nayak, Bhaskar Krishnamachari, Maja Mataric´ and Stefan Schaal.

Ph.D. PROGRAM HIGHLIGHTS

- 1 in 7 applicants is admitted into the Ph.D. program.
- 21% of the Viterbi School's Ph.D. students are women.



The Viterbi School has also established awards to honor best Ph.D. theses in three different categories: Outstanding Thesis in Theoretical Research, Outstanding Thesis in Creative Research, and Outstanding Thesis in Experimental Research. The winners in the past year were, respectively, Jorge Silva, now a faculty member at the University of Santiago in Chile; Alireza Barzegar, now a postdoctoral fellow at Princeton; and Harish Krishnaswamy, now a faculty member at Columbia University. //

Annenberg Fellows—Digital Communications Scholars

The USC Annenberg Graduate Fellowship Program annually funds at least 100 of the brightest graduate students at USC from the Annenberg School for Communication, the School of Cinematic Arts and the Viterbi School of Engineering.

USC Annenberg Fellows conduct innovative communication and digital media research, and advance important new programs in the communications arena. They constitute an internationally recognized and highly regarded group of communication research scholars and creative practitioners.

The Annenberg program encourages fellows to interact and explore the intellectual space where the three schools overlap; fellows also enjoy opportunities that extend beyond the core activities of their individual graduate programs.

Last April, Annenberg fellows displayed their research in a poster and video session at the First Annual Research and Creative Project Symposium.

In 2009-2010, 41 Viterbi Ph.D. students from electrical engineering and computer science will be new or continuing Annenberg Fellows. //

USC ANNENBERG GRADUATE FELLOWSHIP PROGRAM

ALUMNI NEWS

VITERBI ALUMNI RELATIONS

Your membership in the Trojan Family does not end at graduation. The USC Viterbi School's Office of Alumni Relations is here to build and sustain your connection to USC, to the Viterbi School and to your fellow Trojan Engineers—a connection that is truly lifelong and worldwide.

You are part of a distinguished group of more than 55,000 Viterbi School alumni. We hope you take advantage of the many opportunities to build connections with this group through volunteering, guest lecturing, career mentoring and supporting the school.

Alumni also stay connected to the engineering community through our online database, lifetime email forwarding, networking and attendance at annual events such as Homecoming and the Viterbi Awards.

Stay Connected

We rely on your accurate mailing and emailing addresses to ensure you receive our many publications and invitations to special events. Please update your information online at http://viterbi.usc.edu/alumni or by contacting the VSoE Office of Alumni Relations at 213.821.2424.

Alumnus Charles Bolden to Lead NASA

THE ASTRONAUT ATTENDED THE USC INSTITUTE OF SAFETY AND SYSTEMS MANAGEMENT

Charles Bolden

President Barack Obama named USC trustee and alum Charles F. Bolden Jr. (M.S. Systems Management '77), a former combat pilot, Marine Corps major general and veteran space shuttle commander, to serve as NASA's next administrator.

In 2003, Bolden received the Asa V. Call Award, the highest distinction bestowed upon a USC alumnus, and has served on the USC Board of Trustees since that year. He also received the USC Alumni Award of Merit in 1989.

"Charlie is an outstanding and inspirational leader," says Dean Yannis C. Yortsos. "The whole school joins me in congratulating him on his great new challenge to restore space as a key part of human endeavor."

Bolden retired from the United States Marine Corps in 2003 as the Commanding General of the Third Marine Aircraft Wing after serving more than 34 years. He was senior vice president at TechTrans International, Inc. from 2003 until 2005. Before assuming the NASA post, he was CEO of JackandPanther LLC, a privately held military and aerospace consulting firm.

In 1972-73, he flew more than 100 sorties in Vietnam. In 1980, he was selected as an astronaut by NASA, flying two space shuttle missions as pilot and two missions as commander. Following the Challenger accident in 1986, Bolden was named the chief of the Safety Division at the Johnson Space Center. He became assistant deputy administrator of NASA headquarters in 1992.

Bolden received a B.S. in electrical engineering from the U.S. Naval Academy and an M.S. in systems management from USC.

The third African American to fly in space, Bolden met with President Obama at the White House on the same day the Hubble space telescope was relaunched from the shuttle Atlantis, marking NASA's fifth and final visit to the storied telescope since Bolden helped launch it in 1990.

The announcement naming Bolden as Obama's candidate to head the civilian space agency came four months after the departure of former Administrator Michael Griffin, a rocket scientist and Viterbi alum appointed by the Bush administration to oversee the shuttle's 2010 retirement and a planned return to the moon.

"The president could not have made a better choice," Griffin told CBS News. "Charlie Bolden is an accomplished pilot, a veteran astronaut and an old friend. He has spent his life in the service of his country, and our nation is the better for it. NASA will be in good hands." //

Engineering Me

MY NAME: Frank He

DEGREE: M.S., Materials Engineering, 2006

JOB TITLE: Project Engineer II

LIFELONG DREAM: I would like to become successful enough to donate at least one building to each of my alma maters.

FAVORITE VITERBI PROF: It's hard to pick among Mike Kassner, Ed Goo and Florian Mansfeld.

BOOK I'M READING: Other than textbooks, I'm reading *The Way to Wealth* by Benjamin Franklin.

ON MY IPOD: I don't waste my time with frivolous toys.

WORDS TO LIVE BY: "Ask, and it shall be given you; seek, and ye shall find, knock, and it shall be opened unto you." (Matthew 7:7, the *Bible*).

ENGINEERING HERO: There are three: First is my adviser at UC Berkeley, Ron Gronsky (a materials engineer). Second and third are USC engineering alumni Ron Tutor and John Mork.

NEXT TRIP: Bandon Dunes in Oregon to play golf

BEST TIME OF DAY: Early morning

FAVORITE GADGET: Titleist wedges and ProV1 Balls

BEST USC MEMORY: Playing nine quick holes of golf with my friend John Buckhalter between classes and going back to work, sometimes sneaking out of class a bit early!

TOUGHEST ENGINEERING CLASS: Electrochemistry

NUMBER ONE URL: www.jacobs.com. I work for the company and own the stock.

NUMBER OF TROJANS IN MY LIFE: Other than friends and co-workers, I don't have any family who graduated from USC. Sadly, none of my current girlfriends are Trojans either, but that can always change.

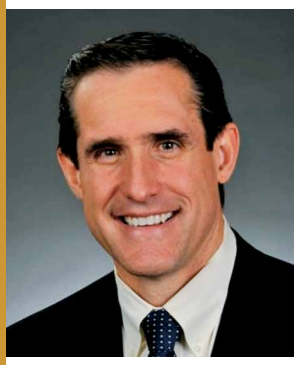
PROUDEST MOMENT: I hope it'll happen soon, but it'll probably be the moment I get married. Or the moment I donate my building.

BIGGEST CHALLENGE: My pet project to build my own golf course. I need to sell the land, which is too small for an 18-hole course and get more land with a better view. Marriage and kids have taken away some potential partners.

Me...Engineered

A Demanding Issue

TO MEET THE FUTURE DEMAND FOR RELIABLE AND AFFORDABLE ENERGY, WE'LL ALSO HAVE TO MEET THE DEMAND FOR SUPERBLY TRAINED 21ST-CENTURY ENGINEERS, SAYS VITERBI ALUM JEFF WOODBURY



Jeff Woodbury

Where will the world find the resources to meet the estimated increase in the demand for energy between now and 2030?

"We'll need the whole suite of energy alternatives, not just the mainstay hydrocarbons," says Jeff Woodbury (BSPTE'83 and MSPTE'90), who's executive vice president of ExxonMobil Development Company and a member of the USC Viterbi School's Board of Councilors. "In order to provide economic growth and social welfare, the world needs reliable and affordable energy, with a focus on energy efficiency and environmental management."

While 80 percent of the future energy demand will be met with oil, natural gas and coal, alternative sources of energy will play an increasing role, he says. "Oil will grow at just under one percent, and natural gas, a cleaner-burning fuel, will grow at about two percent. Nuclear will grow at more than two percent, while wind, solar and biofuels will grow at just under ten percent per year."

Energy efficiency and environmental management are key parts of the equation. ExxonMobil is working on an array of technologies, such as lighter-weight plastics, to reduce the weight of automobiles; tire linings that are not only lighter but also will better retain inflation; and lower-viscosity synthetic motor oils.

"If you take just these three technologies and apply them to a third of U.S. cars, you could realize savings of about 5 billion gallons of gasoline and savings in greenhouse-gas emissions equivalent to taking 8 million cars off the road," he says.

Advances in technology are also needed to make carbon capture and storage viable for reducing greenhouse-gas emissions. In Wyoming's LaBarge field, ExxonMobil is investing more than $100 million for a commercial demonstration project to extract carbon dioxide from natural gas and re-inject it into the substructure of the field for long-term storage.

"The energy industry operates in a highly competitive global economy and it requires technology innovation, development and application to provide the world with reliable and affordable energy," says Woodbury.

> "**We'll need** the whole suite of energy alternatives, not just the mainstay hydrocabons...in order to provide economic growth and social welfare, the world needs reliable and affordable energy, with a focus on energy efficiency and environmental management."

The energy industry also requires superbly trained engineers. While Woodbury believes the demand for energy can be met, meeting the demand for engineers, as well as scientists, remains a key priority and ongoing challenge.

"The quality of engineers and scientists coming out of universities today is very good," he says. "We must continue our focus on quantity, and the starting point is in primary education. We have to start early on to introduce math and science."

Woodbury believes that universities are doing a good job and that the fundamentals are right in engineering education. But non-technical attributes, such as commercial and negotiating skills and the ability to relate to different cultures in the global energy industry, are critical for 21st-century engineers.

He also believes the focus on developing women and minorities for engineering careers is particularly important. That means communicating the opportunities engineering offers in a positive way to these groups at a young age, along with providing positive role models.

"I've always been impressed with the diversity at USC, especially initiatives aimed at facilitating diversity such as the Center for Engineering Diversity (CED) at the Viterbi School. The CED provides an additional support structure for students to be successful."

Visit our website for the latest Viterbi news:

viterbi.usc.edu

Woodbury has fond memories of attending USC, where he says the petroleum engineering department was a tight-knit group, with students spending time together inside and outside classes. And he says that the faculty's close industry ties gave him and his fellow students an advantage when they entered the job market.

"Dr. Ershaghi was a real mentor to me. He was engaging and encouraging; even today you see his vested interest in the students," says Woodbury. "Of course, Dean Yortsos was a young professor at the time, but very knowledgeable and, over the years, has provided strong leadership to Viterbi.

"Campus life was and is great at USC, and it offered such a breadth of knowledge," he says. "When I talk to high school students, I share that perspective and urge them to take full advantage for that short period of time they'll spend at university."

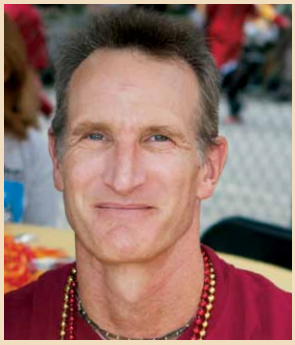
One other memory remains vivid, and that's football. Woodbury's days as a student coincided with Marcus Allen and some of the glory days of Trojan football.

"I don't have a lot of free time now, but Trojan football remains a priority," he says. //

DISTANCE EDUCATION NETWORK

Master of Science Programs Online:
For 35 years, the Viterbi School's innovative Distance Education Network (DEN) has enabled thousands of engineers to earn their M.S. degrees from USC without having to set foot on campus. With just a high-speed Internet connection, students throughout the country can view the same courses as our on-campus students. More than 30 M.S. programs are available entirely online—visit **viterbi.usc.edu/mapp** to see how to get started this spring semester.

Engineering Me



MY NAME: Darren Marsh

DEGREE: M.S., Systems Management, 1991

JOB TITLE: Engineering Systems & Control Manager

LIFELONG DREAM: Leave the world a better place

FAVORITE VITERBI PROF: Andrew Ford

BOOK I'M READING: *How the World Makes Love …and What It Taught a Jilted Groom,* by Franz Wisner (sequel to *Honeymoon with My Brother: A Memoir*)

ON MY IPOD: Talking Heads, Bruce Springsteen, Adele, Afro-Cuban All Stars

WORDS TO LIVE BY: "Try not to become a man of success but rather to become a man of value." Albert Einstein

ENGINEERING HERO: My dad…an innovator, a leader and a USC Alum

NEXT TRIP: Angkor Wat, Cambodia & Phu Quoc Island, Vietnam

BEST TIME OF DAY: Early morning

FAVORITE GADGET: iPhone

BEST USC MEMORY: When I hear the USC Marching Band play *Conquest* every fall.

TOUGHEST ENGINEERING CLASS: The one my classmates told me not to take.

NUMBER ONE URL: www.craigslist.org

NUMBER OF TROJANS IN MY LIFE: There are so many!

PROUDEST MOMENT: Obtaining my degree from USC

BIGGEST CHALLENGE: Work-life balance

INSPIRATION: My cousin, Ken, who despite battling lymphoma and recent setbacks, still manages to stay positive and strong.

Me...Engineered

USC and Boeing Celebrate a Proud Partnership

BOEING'S RICK STEPHENS CITES THE VALUE OF USC MS DEGREES

USC alumnus Rick Stevens addresses...

...Boeing's Trojans

A long and mutually rewarding relationship between USC and Boeing and its predecessor companies was celebrated with nearly 300 USC alumni, who are Boeing employees. The event, which took place at the end of a workday, celebrated the strength and endurance of the Boeing-USC partnership, at the Long Beach assembly line for the C-17 Globemaster III cargo aircraft.

The event was hosted by Boeing, the USC Marshall School of Business and the Viterbi School, and featured a slide show highlighting recent accomplishments by USC faculty and students, as well as short speeches by Boeing Senior VP for Human Resources and USC alumnus Rick Stephens, Marshall School Dean Jim Ellis, and Viterbi Dean Yannis C. Yortsos.

The talks highlighted the long and active partnership, which began more than 70 years ago with Boeing's legacy firms in Southern California, including Douglas Aircraft, McDonnell-Douglas, North American, Rockwell, and Hughes Aircraft, as well as the ongoing success of USC distance education programs in both business and engineering, in meeting the needs of Boeing employees.

Stephens particularly emphasized the return-value for Boeing from money invested in USC master's degrees, while also encouraging Boeing employees to give generously to their alma mater through the company's matching gift program.

Yortsos detailed the closeness of the relationship between the Viterbi School and the aerospace leader, noting that USC engineers who have worked for Boeing and its predecessors now number in the thousands, and pointing out that Boeing is a founding member and continuous sponsor of the highly successful Center for Systems and Software Engineering, now in its thirteenth year. He also thanked the company for its undergraduate scholarships and postgraduate fellowships, including grants aimed at women and underrepresented minorities; the company's support for the Center for Engineering Diversity; and the number of Boeing senior engineers who serve as advisors for Viterbi departments.

The dean's speech ended with a bang—a guest appearance by ten members of the Spirit of Troy Marching Band, playing "Conquest" and other Trojan favorites, to the delight of the crowd. //

VITERBI STORE

Visit the Viterbi Store. Show your pride with custom-designed Viterbi gear and gift items. Shop at the USC Bookstore on campus or online at the Viterbi Store, viterbi.usc.edu/viterbistore/ to purchase your Viterbi items today!

Calendar of Events

VITERBI EVENTS

We look forward to seeing you at Viterbi School events, where you'll join fellow alumni and friends who share a passion for USC engineering. We have a fun and diverse schedule, so make plans now to join us at one or more of the following:

Alumni Event at Qualcomm
September 2009
San Diego, CA

13th Annual Viterbi Career Conference
October 10, 2009

USC Visions and Voices with guest Thomas C. Reed (MSEE '59)
October 14, 2009
Town and Gown, 7:00 pm

Fall 2009 Engineering Career Fair
October 15, 2009
10:00 am–3:00 pm

Viterbi Bay Area Alumni Weekender
Weekend of
November 3, 2009

USC Homecoming 2009
Annual Viterbi Picnic
November 14, 2009
South Lawn of Doheny Library, 3 hours prior to kickoff

USC EVENTS

Fall Semester Classes Begin
August 24, 2009

USC vs. San Jose State
September 5, 2009
L.A. Coliseum

USC at Ohio State*
Alumni Pep Rally, Game and Alumni Tailgate:
September 12, 2009
Columbus, OH

USC at Washington
Alumni Association
Pep Rally:
September 18, 2009
Game and Alumni Tailgate:
September 19, 2009
Seattle, WA

USC vs. Washington State
September 26, 2009
L.A. Coliseum

USC at California*
Alumni Association
Pep Rally:
October 2, 2009
Game and Alumni Tailgate:
October 3, 2009
Berkeley, CA

USC at Notre Dame*
Alumni Association
Pep Rally:
October 16,2009
Game and Alumni Tailgate:
October 17, 2009
South Bend, IN

USC vs. Oregon State
October 24, 2009
L.A. Coliseum

USC Global Conference
October 29-31, 2009
Taipei

USC at Oregon
Alumni Association
Pep Rally:
October 20, 2009
Game and Alumni Tailgate:
October 31, 2009
Eugene, OR

USC at Arizona State
Alumni Association
Pep Rally:
November 6, 2009
Game and Alumni Tailgate:
November 7, 2009
Tempe, AZ

USC vs. Stanford (Homecoming)
November 14, 2009
L.A. Coliseum

USC vs. UCLA
November 28, 2009
L.A. Coliseum

USC vs. Arizona
December 5, 2009
L.A. Coliseum

*Look for the Viterbi School of Engineering at the USC Alumni Association's pep rally and pregame tailgates.

Check out **http://viterbi.usc.edu/alumni/events/** and **http://alumni.usc.edu/events/** for details on upcoming events and for event details.

Gulf States Visit Energizes USC Alums

DEAN YANNIS YORTSOS MEETS 60 OF THE SCHOOL'S MOST ENTHUSIASTIC ALUMS

Left to right are Katherine Aschieris of the Viterbi School External Relations Dept; Nabeel Al-Afaleg (MSPTE'92 + PHDPTE'96), chief technologist at Saudi Aramco's EXPEC Advanced Research Center; Dean Yortsos; and Muhammad Al-Qahtani (MSPTE'92 + PHDPTE'96), executive director of Petroleum Engineering and Development for Saudi Aramco.

On a recent trip to the Gulf States, Dean Yannis Yortsos spoke to approximately 60 very enthusiastic USC Viterbi School alums who are now in the process of establishing the Gulf States USC Alumni Club.

"We wanted to re-connect with our alumni there and it was a very successful trip," said Yortsos. "There was a large group of our alums who were among those attending the Middle East Oil and Gas Show and Conference, which was sponsored by the Society of Petroleum Engineers and held in Bahrain."

Bahjat M. Zayed (BSPTE'85), who is the manager of the Sea Water Injection Department in the Exploration and Producing Business Line at ARAMCO, remembered Yortsos as one of his professors at USC and was gratified to see him at the oil and gas conference and visiting with alumni.

"I am not surprised that he became the dean of the Viterbi School of Engineering," he said. "Dr. Yortsos was probably the most articulate and professional in my eyes and in the eyes of some of my colleagues.

"My favorite professor was (the late) Dr. Lyman Handy. His character and self composure rubbed off on me."

Katherine Aschieris of Viterbi's External Relations Department who also went on the trip said she had found at least 35 Viterbi alumni alone at ARAMCO, but there were also contingents of Viterbi alumni at Shell Oil, Schlumberger and other corporations. All of the alumni she met on the trip were anxious to connect with USC.

"It was a point of prestige with them," she said. "When they attended USC, they learned about America and they formed a network of American friends and contacts that they still rely on today. Most of those friends are alums of the Viterbi School."

Zayed said that the highly competitive programs and the elite students he associated with at USC earned him respect and proved a significant career advantage.

The dean made presentations on the Viterbi School and answered questions. Alumni asked about the school and brought up technical issues with the dean, who is a chemical engineer, about energy, petroleum and chemical engineering.

"But they also wanted to know how well USC's football team will do this year, and they asked me about Pete Carroll," laughed Yortsos. "They watch our games on television and they are just as big fans of Trojan football as our domestic alums."

Aschieris said all of the Viterbi School T-shirts, caps and other items were snapped up. The most sought-after items were "Beat UCLA" buttons.

On the trip, the dean also met with ARAMCO leaders to talk about the possibility of making graduate engineering programs available through the school's Distance Education Network, and of research collaboration.

"Aramco employs a large number of engineers who could benefit from many of our graduate programs," said Yortsos. "They have state-of-the-art labs and other research facilities. Equally importantly, I was gratified to see that key research and engineering positions in the company are held by Viterbi alums."

Since the trip, Aschieris said the Middle Eastern alums have begun organizing a new USC Viterbi Middle East Alumni Club, tentatively to be based in Bahrain. //

In Memoriam

Samuel Mellos (BEEE '53), 83, died April 28 in Salt Lake City, Utah. He was known for launching the first test satellite from Vandenberg Missile Range to be caught in mid-air in the late 1950s. He is survived by his beloved wife Helen, daughter Faye (Michael Holland), son James, grandson Eric Peterson and many nieces and nephews.

Philip Rushton Blood (BSEE '61), 76, of the Tellico Village Community in Tennessee, passed away April 24. A Korean War veteran who flew jets for the U.S. Air Force, Rushton worked as an electrical engineer at Hughes Aircraft. He is survived by his wife, Helen; son, Philip; daughter, Rhonda St. Laurant; granddaughter, Kianna; step-children, Suzanne Peak and Stephanie Taylor; step-grandchildren, Kourtney Zine, Brittany Martin, Troy Martin and Alva Taylor; and many nieces and nephews.

James Ernest Foxworthy (BSCE '55, MSCE '58, PHDCE '65), a 50-year resident of San Pedro, died April 5. He was a Recon sergeant in the U.S. Army's 578th Combat Engineer Battalion serving in Japan and Korea and taught and mentored thousands of students in a long career at Loyola Marymount University. He is survived by his wife, Peggy; sons, Michael, John, and Timothy; daughter, Maryellen; son-in-law, John Stuckmeyer; and 11 grandchildren.

Edward C. Kraft, Jr. (MAOM '65), 72, died May 14 in Lancaster, Penn. He retired from the U.S. Air Force as a lieutenant colonel in 1984 after 26 years or service and worked as the business manager of the Lancaster County Prison for 11 years. He is survived by his wife of 50 years, Shirley Mayer Kraft; two daughters, Jill Kraft Petersen of Miami, Fla.; Jean Elizabeth Kraft of Lancaster; son Edward C. Kraft III of Smithfield, Va; six grandchildren; a great granddaughter; two brothers, Charles, and Gordon; and two sisters, Susan and Christine.

Harry R. Dangler (BSISE '49), 87, died Dec. 30, 2008, in Los Angeles. A Navy veteran of War II, he was a plant engineer and supervisor for Owens-Illinois Glass for 24 years in Portland, Ore. and a maintenance supervisor for Portland State University. Survivors include his wife Millicent; sons, David and Allen; and three grandchildren.

Leslie Thomas Peart (BSME '58) passed away at his home in Lake San Marcos on December 26, 2008. He served in the U.S. Army Corps of Engineers during World War II and worked as an engineer and plant manager for Beckman Instruments, Helipot Division and for Bourns Corporation. He is survived by his wife Emma Reay Peart; two sons, Douglas of Poway, Calif. and David of Centennial, Colorado; five grandsons; and three great-grandsons.

Richard Sieger (BSChE '43), 86, of Ojai, Calif. died Dec. 30, 2008, in Ojai. He served on an aircraft carrier in the Pacific theater during World War II and worked as a certified public until his retirement in 2004. He is survived by his wife Helen; sons, Richard of Lancaster and Gregory of West Linn, Ore; stepchildren, Lana Fredell of Ojai, Bill Lucking of Ventura, Ruth Col of Henderson, Nev., and Carly Ford of Ojai; 12 grandchildren; 10 great-grandchildren; and two great-great-grandchildren.

Rudolph "Rudy" Peterson (BSChE '51), 83, died May 3. He served in the Navy during WWII as a Radar Repair Specialist and worked for Aerojet for 31 years. He is survived by his wife of 61 years, Doris Peterson of Fair Oaks, Calif; four sons, Eric of Atlanta Ga., Leif of Placerville, Calif., Neil of Galt, Calif., and Kris of Applegate, Calif; five grandchildren; and five great-grandchildren. //

Q&A

Q&A with Louise Yates

Louise Yates is associate dean for admissions and student affairs.

What distinguishes the Viterbi School's undergraduate program from others?

Our curriculum is designed so students can start learning about their intended major in their first semester. We offer a wider variety of engineering options than many schools. Students learn from and are mentored by amazing faculty. They can combine engineering degrees with minors such as cinema, business or music recording. And they have a variety of co-curricular opportunities, such as participating in undergraduate research, overseas programs and the Klein Institute of Undergraduate Engineering Life (KIUEL). We provide lots of support to help them get through a rigorous program.

Are there changes you'd like to see in the future?

It's incredibly important for students to have room in their curriculum for electives in the arts, communication, marketing, international relations, leadership development, etc. That opportunity can only help them as future engineering leaders. Also, most of our students chose engineering because they want to design, develop or create "things," so the more opportunities we can provide for hands-on projects, the better.

Is engineering as rigorous as it used to be?

Possibly, even more rigorous. The freshmen are more talented and they're looking for the rigor. They often challenge our faculty. They typically arrive very prepared academically. The majority waive out of the first and often even the second semester of calculus! But most don't know what engineering really entails, and many have interests beyond engineering that they don't want to give up.

How are engineering students different today from past years?

They used to be more focused on just engineering, and the undergraduate class was far less diverse. Now, the number of women and students traditionally underrepresented (African-American, Native American and Hispanic) has grown significantly. Students today are more involved and interested in solving societal problems through community service and globalization, as well as in areas outside engineering.

How have the recent economic difficulties affected students?

The Viterbi School is an elite option for students, so we have to work harder to ensure they see the value in receiving a USC engineering degree. This year, a record number of students applied for scholarships. We can always use more scholarships, which helps in equalizing the cost of their engineering education with other top schools around the country. Many companies reduced the number of summer internships, so students who depend on summer earnings are struggling a little more.

The Viterbi School competes with the most elite institutions. What are the main factors that a student considers when choosing a school?

Most students are looking for end results—how will getting a degree from X school benefit their future career goals? They look at cost and the value-added of a higher-cost institution vs. one that's less expensive. They look seriously at who will be in the classroom with them—both faculty and peers—and opportunities outside the classroom. Our Viterbi Student Ambassador program has been helpful because prospective students often see themselves in these students or see them as colleagues and peers.

How do we get more young people interested in math and science and becoming engineers?

Some kids shy away from math and science in grade school and junior high because these subjects aren't perceived as "cool." Then, we've lost them! Kids need more role models who are engaged and interested in using math and science to solve problems. Engineering should be viewed as an exciting and dynamic profession that can change the world including societal aspects as well. //

I would like to become a member of the Viterbi Society

5008

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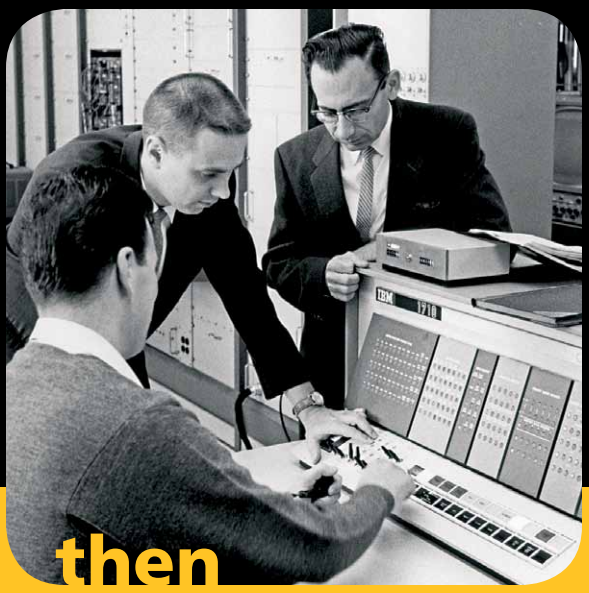

For more than 100 years, the USC Viterbi School of Engineering has provided world-class education and training to engineers who used their talents and innovations to shape Los Angeles, the nation and even the world. Ours is a proud history of accomplishment and success.

Help to continue this legacy by sending the pledge card above in the envelope provided in this magazine. Your gift will create opportunities for engineering students and faculty, and for all who will be impacted by future innovations from the Viterbi School. Your gift will improve and revolutionize everyday life for millions.

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