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# USC Viterbi // Engineer

FALL 2008



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## Affection, Enchantment and Trust

Educational institutions cultivate the human mind and the human spirit. They are entrusted with helping young adults negotiate their final separation from a protective

environment and realistically dream of their own unique life voyages. They are also crucibles of scientific research, laboratories of discovery and global nodes of innovation. But, to accomplish these tasks, they depend in more ways than one on philanthropy.

The Viterbi School is no exception. In 2001, we embarked on an ambitious initiative, "Destination: the Future," to raise \$300 million in seven years, with at least half of the funds to be raised for endowment. As described in this magazine, we have reached both goals three months ahead of schedule. We are eagerly looking to the continuation of the initiative with new ambition and new goals. But we'll have more on that in the next issue.

Indeed, in this globally competitive environment, we must be in a constant state of fundraising. In many ways, the act of a gift to an academic institution is a very intimate one. Successful fundraising requires three deeply emotional donor states: affection, enchantment and trust. It requires affection for the place, its heritage, its culture and its people; enchantment for its vision and its mission; and trust in its institutional leadership and its human resources. And in some very special cases, the gift ties one's legacy to the institution for generations to come.

Successful fundraising leads to a virtuous cycle, creating a positive feedback loop. We have seen that in the last seven years. In that span, the school was named after two wonderful human beings, Andrew and Erna Viterbi; we named four major departments, three of which were named one after the other in the last three years; we earned many national, record-breaking titles; and we received one of two pioneering, institution-naming gifts that aim to alter engineering education and research.

We were fortunate that thousands of alumni, friends, corporations and foundations responded eagerly to our call in this initiative. Very fortunate that among them a select few tied their name to the school with acts of amazing generosity. But more than anything else, we are grateful for the affection, enchantment and trust that has been displayed by thousands whom we count as part of our Trojan family.

The impact of their gifts has been immediate and will have lasting effects on the academic mission of the school. We have already seen a dramatic transformation in the school's trajectory. Equally importantly, we've seen the inspirational effects our transformation has had on others, who will continue investing in the school for the benefit of its students and faculty for generations to come.

This mission of the Viterbi School has been strongly supported in its modern history by the vibrancy of its affiliated Information Sciences Institute (ISI). Starting more than 30 years ago, when information technology was in its infancy, ISI has played a determining role in leading the information revolution by making technological breakthroughs one after another.

In the pages of this magazine, you will read about the spectacular history of ISI, which, along with beautiful vistas from its Marina Del Rey campus, has helped attract brilliant researchers. One of the Viterbi School's crown jewels, ISI has always been an integral part of the school's success and a step ahead of everyone else in information technology.

In ancient Greece, many cities claimed to have been the birthplace of Homer. The modern analogy is the birthplace of the Internet. With historical justification (and with the added advantage of the Internet's distributed nature), ISI can be credited as one of its birthplaces. With this glorious past, ISI is flexing its research muscles to shape with equally bold vision the future of engineering.

I invite you to read about the success of our fundraising initiative, ISI's remarkable achievements and more about the school in this issue of *Viterbi Engineer* magazine.

Yannis C. Yortsos  
Dean, USC Viterbi School of Engineering

## Three Win Early CAREER Awards

NSF RECOGNIZES JUNIOR FACULTY FOR EXCEPTIONAL WORK  
IN CIVIL, ELECTRICAL AND AEROSPACE ENGINEERING



Michael Neely, Amy Rechenmacher and Tait Pottebaum

Three Viterbi School junior faculty members have won highly competitive Early CAREER Awards from the National Science Foundation (NSF) for exceptional work in the areas of civil, electrical and aerospace engineering.

The recipients are Michael Neely, assistant professor in the Ming Hsieh Department of Electrical Engineering; Amy Rechenmacher, assistant professor in the Sonny Astani Department of Civil and Environmental Engineering; and Tait S. Pottebaum, assistant professor in the Aerospace and Mechanical Engineering Department.

Early CAREER Awards recognize and support individual early career efforts to advance and effectively integrate cutting-edge research and education in the recipient's academic discipline. The awards can vary, but usually fund research over a three- to five-year period.

Neely's research interests fall into the areas of queuing analysis and stochastic optimization for communication networks, including wireless and ad-hoc mobile networks. He won the award for his project, "Analysis and Control of Network Delay," which involves fundamental research in the area of network theory, particularly focusing on networks with highly dynamic environments.

Rechenmacher's research touches on some of the most fundamental science and engineering problems in civil engineering today, such as building and improving infrastructure, improving earthquake predictability and better understanding other seismic events.

Her NSF-supported project will address the behavior of local flows in different contexts: in shear bands, or fractures, that appear in dense sands and cause them to slip or collapse; in fault gouges, which are crushed and ground-up rock produced by friction between the two sides when a fault moves; and in laboratory studies to help researchers understand the thermodynamics of the flows.

Pottebaum, whose research focuses on tiny, temperature-controlled microfluidic devices—such as microelectromechanical system (MEMS) pumps and inkjet printer nozzles—will work to develop a new measurement technique and apply it to flows that scientists need to understand in order to develop the next generation of microfluidic devices. Those devices include medical testing devices, electronics cooling systems and sensors for detecting hazardous substances. (For more faculty honors, see page 20.) //





# Slowing Light to Speed Data

TWO PHOTONICS SPECIALISTS WIN \$4.3 MILLION DARPA CONTRACT

Two prize-winning USC specialists hope to break a bottleneck that has long limited systems that use photons (light) instead of electronics for data processing.

Alan Willner and Robert Hellwarth, both professors in the Viterbi School's Ming Hsieh Department of Electrical Engineering, have received \$4.3 million in funding from the Defense Advanced Research Projects Agency (DARPA) to develop "continuously tunable optical delays," which they hope will change the rules of manipulating photonic data at ultrahigh speeds.

According to Willner, 2006 president of the Institute of Electrical and Electronic Engineers' (IEEE's) Lasers and Electro-Optics Society (LEOS), optical fibers can carry enormous volumes of information coded in photonic form, with far greater bandwidths than metal electrical cables.

Still, "photonics usually can't compete with electronics when it comes to processing data," Willner says, "because silicon transistors are extremely cheap and can perform processing operations that have long been very difficult to do with light. With electronic systems, it's easy to temporarily store information.

"Therefore," he continues, "we're left with a significant

mismatch—data transmission is performed optically, but data processing is done electronically. Normally, transmitted photonic data would need to be turned into electronic data for processing and then turned back into photonic data for further transmission."

Willner says that if such photonic-electronic conversions can be avoided, great savings in expense and energy will be possible.

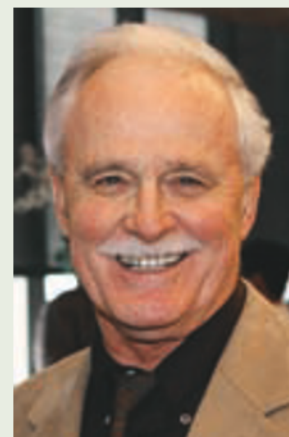
For example, numerous low-speed branch data streams can feed into larger trunk lines. While the trunk cable has more than sufficient capacity to carry all the information, before it can do so, the information has to be "multiplexed"—i.e., data bits and packets have to be collated in such a way that different channels don't interfere with each other within the same time slot.

To do this now, the laser-coded information has to be converted into electronic form, multiplexed and then reconverted to laser pulses. "This is energy inefficient, cumbersome and takes away system capacity," says the scientist.

Their technique is to convert the photonic information from one color to another and then pass the data through an element that has a speed-of-light that is dependent on the color of the light—i.e., red



Alan Willner



Robert Hellwarth

photons could travel slower than blue photons. Each photonic data stream is given its own "color," or delay value, and then seamlessly woven together and sent on its common way without ever going through an electronic interface.

"The technical community is still missing a simple way to tune the time delay of one photonic data stream relative to another, which is a key building block for many types of data-processing functions," says Willner. "We think we've found it." //

**"The technical community** is still missing a simple way to tune the time delay of one photonic data stream relative to another, which is a key building block for many types of data-processing functions. We think we've found it."



## Too Close for Comfort

TOP ISE STUDENT WINS HIGHLY COMPETITIVE UNDERGRADUATE RESEARCH GRANT TO STUDY NEAR MISSES ON THE RUNWAY



Catherine Ricafort in front of a McDonnell Douglas DC-8 airplane on display at the California Science Center.

When Catherine Ricafort boards an airplane, she always takes a window seat. Not to enjoy an aerial view of the city from aloft, but to check out the runway traffic on the ground.

Ricafort, a USC Presidential Scholar, isn't your typical traveler. For the last two years, she has been studying runway incursions and the role human error plays in those accidents. The more she learns about runway accidents, the more she thinks there are ways to improve things.

She will have a chance to test her ideas this fall, using a newly awarded Undergraduate Research Associates Program (URAP) grant. The prize will enable Ricafort to organize an interdisciplinary team of undergraduate students to investigate aviation safety at Los Angeles International Airport (LAX).

"I'm sure I'll understand the issues much better when I talk to the tower controllers and airfield employees about their jobs and the technology they rely on to coordinate air traffic," Ricafort says. "I want to find out what they think the biggest problems are in air traffic control because that could help us identify the human factors contributing to runway incursions."

Ricafort, a junior majoring in industrial and systems engineering, is a Viterbi Merit Research Scholar who has also done quite a bit of traveling for her minor in musical theater.

She is a multitalented singer-dancer-actress who performs on stage and in musicals. In her most recent performance at the Bing Theater on campus, she starred as Louise in the musical "Carousel." Ricafort also sings with USC's premier a cappella group, the SoCal VoCals, which performed in New York City this spring and won an international championship.

Ricafort has been studying incursion prevention for some time under the supervision of faculty adviser Najmedin Meshkati, a leading expert on the topic. Meshkati has joint appointments in the Daniel J. Epstein Department of Industrial and Systems Engineering and the Sonny Astani Department of Civil and Environmental Engineering and teaches in USC's Aviation Safety Program. His field research focuses on the safety, human factors and risk management of complex, large-scale technological systems, such as aviation and railway systems, and petrochemical and nuclear power plants.

Ricafort's URAP grant will support three teammates who will bring their expertise in electrical engineering, business, computer science and economics to the study. As the students begin a case study of LAX runway design and air traffic control, the group will interview airfield employees and traffic controllers.

### "I want to find out

what they think the biggest problems are in air traffic control because that could help us identify the human factors contributing to runway incursions."

"We want to take full advantage of our proximity to LAX and Dr. Meshkati's contacts to gather information and develop an action plan for runway safety, advise management on potential runway incursion issues and recommend strategies," Ricafort says. "The study is timely, in light of so many airport near misses recently, and really appropriate at LAX because that airport is considered one of the worst offenders in runway close calls." //





Engineering faculty and deans from USC and Tsinghua University met this spring for the second annual Workshop on Emerging Information Technologies. The conference is held to foster collaborative research and educational opportunities.

## Emerging Information Technologies

### SECOND ANNUAL WORKSHOP UNITES USC AND TSINGHUA UNIVERSITY

Top leadership and faculty from China's preeminent technical research institution spent three days at the Viterbi School in April participating in the second annual USC-Tsinghua University Workshop. This year's conference was devoted to new research on emerging information technologies.

The workshop is part of "a unique partnership between two leading schools in information technology to foster collaborative research and educational opportunities in emerging information technology areas," said Viterbi School Dean Yannis C. Yortsos during opening remarks. Jun Li, executive vice dean in Tsinghua's School of Information Science and Technology, also welcomed conference participants.

The delegation spent three days in talks and meetings with USC engineering faculty and administrators, and toured several laboratories in the school. The annual series, coordinated by Cauligi Raghavendra, senior associate

dean for strategic initiatives, was made possible with support from Feng Deng, who is an alumnus of both Tsinghua University and USC, and a member of the Viterbi School Board of Councilors.

Keynote talks were given by two computer scientists: Tsinghua Professor Bo Zhang, academician of the Chinese Academy of Sciences, and Viterbi School Professor Leonard Adleman.

After the talks, faculty members from both institutions offered presentations on microelectronics and nanotechnology, wireless communications, optical networks, computations and system control, and signal processing and databases. The schedule also included talks by department co-chair Alexander Sawchuk of the Ming Hsieh Department of Electrical Engineering, and Computer Science Department Professor Ramesh Govindan, who presented overviews of research in their units. //

## Andrew Viterbi: A 2008 Millennium Technology Laureate

### FINNISH ACADEMY HONORS LEGENDARY COMMUNICATIONS PIONEER

Andrew J. Viterbi, legendary pioneer in the field of digital communications and namesake of the USC Andrew and Erna Viterbi School of Engineering, was honored in June in the Finnish capital as a 2008 Millennium Technology Laureate.

Viterbi was one of four laureates named by the Technology Academy Finland. Dean Yannis C. Yortsos, USC Provost Max Nikias and University Professor Solomon Golomb flew to Finland to attend events paying tribute to the quartet. At a culminating ceremony in Helsinki on June 11, 2008, fellow laureate Robert Langer of MIT was named the winner of the Technology Millennium Prize, which the Academy awards every other year.

The Millennium Technology Prize is given for "a technological innovation that significantly improves the quality of human life, today and in the future."

The prize consists of 1.15 million euros (approximately \$1.8 million) and a crystal-tipped trophy, grown from silicon, which has become the symbolic foundation of modern electronics. The winner is selected by the Technology Academy Finland, an independent foundation established by Finnish industry in partnership with the Finnish state. //



USC Provost Max Nikias, Professor Solomon Golomb, Andrew J. Viterbi, Dean Yannis C. Yortsos and UCSB Chancellor Henry Yang.



# Airbus Research Projects Take Flight

THREE COLLABORATIVE PROJECTS COULD BENEFIT COMMERCIAL AVIATION



Gérard Medioni



Ulrich Neumann



Steve Nutt

The Aerospace Institute for Engineering Research (AIER), made up of the USC Viterbi School of Engineering, Korea Aerospace University (KAU) and Inha University in Incheon, South Korea, as well as two global corporations, has embarked on three ambitious, collaborative aerospace research projects that could benefit commercial aviation worldwide.

AIER was established in 2004 in collaboration with Korean Air and is supported by an initial research budget of \$5 million provided by Airbus, the European aircraft manufacturer.

"We are now working successfully across several engineering disciplines with two top global companies and two foreign universities, spanning three continents and two oceans," says Yannis C. Yortsos, dean of the Viterbi School. "This sort of global collaboration is defining the future of engineering."

The projects are expected to benefit the entire airline industry.

Professor Steve Nutt, director of the Viterbi School's M. C. Gill Foundation Composites Center, is collaborating with Professors Won Jong Choi of KAU and Jin Yeon Cho and Chongdu Cho at Inha to create new processes for making and repairing lightweight composite materials used in Airbus aircraft. Nutt is developing an "out of autoclave" composite fabrication technique to manufacture composite materials without using the large, energy-consuming ovens currently required.

"With the significant increase in the use of lightweight composite materials in commercial aircraft, this new process could be very useful," says Nutt. "It could revolutionize the aircraft manufacturing industry, resulting in even safer, lighter-weight and more energy-efficient aircraft."

Choi is developing a bonded repair process that will allow damaged composite panels on aircraft to be repaired in place, saving significant time and money. The two professors said their collaboration and parallel research efforts should make it easier for airlines to operate aircraft made with large quantities of composite materials.

Ulrich Neumann, associate professor of computer science in the Viterbi School and a researcher at USC's Integrated Media Systems Center, is working with Research Assistant Professor Suya Yu of USC and Professor Geunsik Jo at Inha on Intelligent Augmented Reality (IAR) technology, which promises to reduce errors and rework in complex maintenance processes. IAR technology uses image recognition techniques to identify specific components in complex systems, such as aircraft landing gear, and then superimposes various graphics and text messages on each component in a video display.

For example, a technician repairing a component, such as a hydraulic actuator, could point an IAR-equipped video camera at the actuator and see graphical imagery showing warnings, cautions, maintenance procedures and material history references superimposed on the actuator. Neumann and Jo have held a series of technical meetings that also included engineers from Korean Air and Airbus.

Neumann says IAR technology is poorly understood and that some people confuse it with existing virtual reality and animation systems.

"There is currently nothing like IAR commercially available. It could eliminate serious errors and accidents caused when maintenance technicians fail to heed warnings or don't precisely follow correct maintenance procedures," he says.

Gérard Medioni, professor of computer science at the Viterbi School and an expert in computer vision, video recognition and tracking technologies, is working with professors Myeong-Jin Lee at KAU and Sanggil Kang at Inha to develop a video-assisted tracking system to help pilots recognize runway hazards during approach and landing.

"The challenge is to be able to identify obstacles on the runway and promptly alert the pilot to abort the landing," says Medioni, whose USC Viterbi team is creating the software and computer platform in their lab to process the video imagery in real time. He has already delivered preliminary video tracking software to his Korean colleagues for initial testing.

Kang and his research group at Inha are working on the decision-making logic and pilot-warning parts of the system. Lee and other KAU researchers are responsible for aerial video data collection, integration and real-time acceleration of the system aboard a test aircraft and actual flight-testing.

"This is a win-win situation for everyone, including the universities, the companies and airline passengers," says Yortsos. "These projects will allow the commercial aviation industry to operate with even greater safety and efficiency across the globe." //





## Project: Possibility

VITERBI GRADUATE CHRISTOPHER LEUNG RALLIES STUDENTS TO DESIGN SOFTWARE TO HELP THE DISABLED



You could say that Christopher Leung, a Viterbi School graduate student who recently earned his master's degree in computer science, is an idealist. But he'd tell you that he's a realist. A realist with a mission to make life easier for people with medical limitations.

That's what Project: Possibility is all about. The effort shifted into high gear in November 2007 and has continued to build momentum, gain corporate support and attract industry mentors. Last semester, it led to work for 25 students who developed five projects before semester's end. One of the teams worked on a project to develop software so sophisticated that it would enable, say, the paralyzed patient-protagonist in *The Diving Bell*

and the *Butterfly* to communicate more easily than by using the "eye-blink" code seen in the film.

"I have a passion for software," says Leung, who hails from Contra Costa County, Calif. "I looked around and found that

there's a lack of free—or any other software—for the many needs of disabled persons."

So he became the catalyst for the work, forming a group at NASA's Jet Propulsion Laboratory, where he worked. Then he got together with the right people, like directors at *Knowbility*, an Austin, Texas-based nonprofit organization dedicated to making the Internet and other technology accessible to all people. Since then, his projects have attracted interest from other key corporate sponsors, such as the Mozilla Foundation and Microsoft.

"We are planning to meet with educators to talk about getting this type of work into the university curriculum at USC and beyond," Leung says, "so university students can not only receive credit for doing this work, but also gain awareness. And once they're actually working in industry, they can make technology more accessible to disabled persons."

After graduating, Leung moved to Shanghai, China, where he plans to work toward increasing awareness about assistive technology and continue developing new software for Project: Possibility. //

## Deep Space Anniversary

Earlier this year, the Jet Propulsion Laboratory (JPL) celebrated the 50th anniversary of Explorer 1, the first successful U.S. satellite. Distinguished Professor of Electrical Engineering and Mathematics **Solomon Golomb**, who is on the faculty of the Ming Hsieh Department of Electrical Engineering (third from the left, front row), attended a reunion of the scientists and engineers. He delivered a 40-minute lecture on the history of communications at JPL. Golomb was part of the "orbit determination" group that also included **Lloyd Welch**, professor emeritus in the Ming Hsieh Department, and **Andrew Viterbi**, presidential chair at the USC Viterbi School. Golomb said the group "not only defined space communications for decades to come, but really invented digital communications, which, at the time, was considered an oxymoron." //





## New Faces at Viterbi

NINE PROFESSORS JOIN ENGINEERING FACULTY AT USC



Andrea Armani



Burcin Becerik



Rahul Jain



Joseph J. Wang



Michelle Lynn Povinelli

**Andrea Armani** joined the Mork Family Department of Chemical Engineering and Materials Science this fall as an assistant professor of chemical engineering and materials sciences.

Armani earned her B.A. degree in physics from the University of Chicago in 2001 and her Ph.D. in applied physics from Caltech in 2007.

From 2006 to 2008, she was a Clare Boothe Luce Postdoctoral Fellow in biology and chemical engineering at Caltech.

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

**Burcin Becerik** joined the Sonny Astani Department of Civil and Environmental Engineering this fall as an assistant professor in construction engineering and management. She specializes in implementing online collaboration and program management systems to better monitor projects and improve communication among team members.

Becerik graduated from Istanbul Technical University with a B.A. in architecture in 1999 and an M.S. in architecture in 2001. In 2002, she

attended the University of California, Berkeley, where she received an M.S. in civil and environmental engineering, with a special focus on construction engineering and management. She earned her Ph.D. in design in 2006 from Harvard University.

Her research at the Harvard School of Design focused on the implementation and value of online collaboration and project management (OCPM) systems in the design and construction industries. In addition, she has explored the opportunities and benefits that this new technology can provide to the architecture, engineering and construction industries.

**Rahul Jain** joined the Ming Hsieh Department of Electrical Engineering in August as an assistant professor of electrical engineering from the IBM T.J. Watson Research Center in Yorktown Heights, N.Y. His research interests lie in networks and control with a current focus on network economics and games, and stochastic control and learning.

Jain received his Ph.D. in electrical engineering and computer science in 2004, and an M.A. in statistics in 2002, both from the University of California, Berkeley. He also earned an M.S. in electrical and computer engineering from Rice University in 1999. He completed his undergraduate work

with a Bachelor of Technology degree in electrical engineering from the Indian Institute of Technology, Kanpur, in 1997, where he won the TCS Best B.Tech Project Award.

He is an elected member of the Eta Kappa Nu (HKN) honor society and a recipient of an IBM Invention Achievement Award. Jain is also a contributing member of many professional societies, including the Institute of Electrical and Electronics Engineers (IEEE), the Association for Computing Machinery (ACM) and the Institute for Operations Research and the Management Sciences (INFORMS).

**Joseph J. Wang** will join the tenured faculty of the Viterbi School's Astronautics and Space Technology Division next year. His research focuses on advanced space propulsion and space power, spacecraft engineering, plasma and gas physics, and computational engineering.

As a member of Virginia Tech's aerospace engineering faculty since 2001, Wang helped to establish a college-level research and education center in space science and engineering, and was most recently the founding co-director of Virginia Tech's Center for Space Science and Engineering Research.

He was a scientist at NASA's Jet Propulsion Laboratory from 1991 to 2000, where he worked on several NASA missions, including principal investigator of the ion propulsion engine on NASA's Deep Space 1 mission.

Wang earned a B.S. in engineering mechanics from Tsinghua University, China in 1985, a master's degree in aeronautics and astronautics from MIT in 1988, and a Ph.D. in plasma physics from MIT in 1991.





**Michelle Lynn Povinelli** joined the Ming Hsieh Department as an assistant professor in August from Stanford University. She is an optics/photonics specialist studying light propagation in nanostructured materials.

Povinelli did her undergraduate work in physics at the University of Chicago and her graduate work in optics and photonics at MIT. She received a Ph.D. in physics in 2004 and was a post-doctoral researcher at Stanford.

Povinelli is working on the problem of "slow light," which involves the design of tiny devices that could trap light pulses and hold them for a while before releasing them. These devices could be useful for optical communications, such as fiber-optic networks, which are used to deliver Internet traffic. (See story, page 5.)

Grid computing pioneer **Carl Kesselman** has accepted a professorship in the Viterbi School's Epstein Department of Industrial and Systems Engineering (ISE), with a joint appointment in the Computer Science Department, beginning this fall.

Kesselman, director of the Center for Grid Technologies, co-directs the Globus Project, which connects geographically distant computers and allows them to share raw computing power and data. The software

addresses security, data management, execution management, resource discovery and other issues that arise from network sharing.

Kesselman will become a professor of systems engineering, but continue his work in large-scale distributed systems and virtual organizations, with an emphasis in health-care informatics.

**Andreas Molisch**, professor and head of the Radio Systems Group at Lund University's Department of Electrosience in Sweden, will join the Ming Hsieh Department of Electrical Engineering as a professor of electrical engineering. An architect of wireless standards, he received his M.S., Ph.D. and habilitation degrees from the Technical University Vienna, Austria, in 1990, 1994 and 1999, respectively.

His current research interests are multiple-antenna systems, wireless channel measurement and modeling, ultra wideband systems, sensor networks and orthogonal frequency division multiplexing (OFDM). He has authored or co-authored four books, among them the recent textbook, *Wireless Communications*, 11 book chapters and some 100 journal papers.

Molisch is also active in wireless standardization.

**Gerhard Kramer** will join the Ming Hsieh Department as a professor of electrical engineering. Kramer has been with Bell Laboratories in Murray Hill, N.J., since 2000. His research focuses on information theory, communications theory, iterative decoding and source coding.

He received B.S. and M.S. degrees in electrical engineering from the University of Manitoba, Winnipeg, in 1991 and 1992, respectively, and a doctorate of science technology from the Swiss Federal Institute of Technology in Zurich, Switzerland, in 1998.

Kramer is a co-recipient of the IEEE Communications Society 2005 Stephen O. Rice Prize paper award and a Bell Laboratories President's Gold Award in 2003. He also received the ETH Medal from the Swiss Federal Institute of Technology (ETH) in 1998.



Gerhard Kramer



Fei Sha

**Fei Sha** will join the Viterbi School Computer Science Department this fall as an assistant professor. Sha specializes in computer and information science, machine learning, visualization, artificial intelligence, speech recognition and computational models of auditory perception.

Prior to USC, Sha was a visiting scholar in the Computer Science Department at the University of California, Berkeley, and a research scientist at Yahoo! Research in Sunnyvale, Calif. Before that, he worked as a research specialist/postdoc in the UC Berkeley Computer Science Division.

Sha graduated from Southwest University, formerly Nanjing Institute of Technology, Nanjing, P.R. China, with a B.S. in biomedical engineering in 1990 and an M.S. in biomedical engineering in 1993. He earned a Ph.D. in computer and information science in 2007 from the University of Pennsylvania. //



Carl Kesselman



Andreas Molisch



## MySpace Computers Get Viterbi Help

COMPUTER SCIENCE RESEARCHERS DEVELOP WAYS TO KEEP THE RAPIDLY GROWING SOCIAL NETWORKING SYSTEM FAST AND AGILE



Serving the servers, from left: Shahram Ghandeharizadeh, Shahin Shayandeh, Felipe Cariño Jr., Tin Zaw, Jose Juarez-Comboni and Igor Shvager.

Imagine a moment—a thousandth of a second—in the life of a computer that is part of the MySpace social networking system.

In that brief fraction of an eye blink, thousands of fingers on mice, spread across thousands of square miles, have clicked in urgent requests for as many chunks of data: a photo needed in Minneapolis, video needed in Des Moines, a forum comment wanted by an observer in Detroit.

As MySpace grows, each millisecond becomes more and more crowded with requests like these. Now, a Viterbi specialist is working to make sure that the answers keep coming back quickly, even with tens or even hundreds of millions of new users.

“If MySpace were less successful,” notes computer science professor Shahram Ghandeharizadeh, “there would be no problem. But at the current volume of transactions, getting to the data quickly becomes an issue.”

The key to speed and capacity is what is called DRAM. “Ideally,” says Ghandeharizadeh, who is director of the USC Database Laboratory, “you want all the data requested to be in the quick-access cache memory of the servers, rather than having to retrieve it from the servers’ disc drives, which is much slower.”

But the total volume of data created by users is far more than the DRAM cache will hold. And as the user population grows at an accelerating pace, more and more requests arrive to query a larger and larger body of information.

“Now it works,” says Felipe Cariño, who heads MySpace Research, the company’s in-house R&D facility, “but if you double it, it may not.” And he says the population may in fact double as people in China and other areas learn to meet and greet each other on their own sites.

Ghandeharizadeh is working with Cariño, a 1995 USC Marshall School

Executive MBA graduate, to find a way around the impending squeeze. The collaborators have been exploring a new rule for deciding what goes and stays in DRAM.

Up to now, the method used has been simple: the data that has remained in the DRAM longest without being accessed is the first to be replaced. Another method is potentially more effective: “heuristic” replacement, in which data is given simple but useful characterizations, which a program then uses to guide replacement. The program isn’t static, but learns from system behavior and adjusts its criteria to improve performance.

The heuristic algorithm that MySpace Intrapreneurial Research Group is adapting to the MySpace database comes out of a recent Ph.D. research thesis done by USC graduate student Shahin Shayandeh, who is a member of the team, along with three MySpace computer scientists.

Cariño and Ghandeharizadeh are hopeful that this algorithm will adapt well to MySpace demands and deliver the desired improvements in performance. “Simulation studies show the heuristic method is a marvel. But seeing whether it delivers in a real ultra-large system, such as the one at MySpace, remains to be seen,” says Ghandeharizadeh, who cherishes the opportunity to take the software to limits others have not reached.

His specialty is ultra-large computing systems, and only three or four exist in the entire world, of which MySpace’s is one. It includes, says Cariño, “10 data centers, thousands of servers in 30-plus countries supporting local cultures and languages.”

“This is a very hard testbed to find,” says Ghandeharizadeh, “a very rare animal.” //





## Bamboo Houses to the Rescue

CIVIL ENGINEERING PROFESSOR CREATES QUICK-AND-EASY SHELTERS FOR CHINA EARTHQUAKE VICTIMS

A Viterbi School professor on sabbatical in China created a prototype of a sturdy, quick-and-easy-to-build bamboo house, designed to help vast numbers of people displaced by the devastating Sichuan, China earthquake on May 12, 2008.

The first batch of Professor Yan Xiao's houses was sent to the devastated area within weeks after the quake, and more were scheduled to be delivered later in the year.

Xiao, an expert in structural design and retrofit in the Sonny Astani Department of Civil and Environmental Engineering, has been experimenting with bamboo-based materials for highly demanding structural uses in China's Hunan province, and recently built the world's first bamboo truck bridge there, in the city of Leiyang.

He traveled to nearby Sichuan province on May 13, the day after the earthquake, then returned to the Chinese Ministry of Education Key Laboratory at Hunan University, where he has been serving as director, and went to work.

The prototype bamboo quake relief house he built in less than two weeks reflected a modular design that could be adjusted according to specific family needs.

"The modular units were connected by bolts and are easy to manufacture and assemble," Xiao says. "Four to six

**"The cost** per square meter of the units, as manufactured in China and based on local material costs, was about 350 to 500 RMB, the equivalent of \$50 to \$70 in the United States."

workers can assemble a 22.3-square-meter (240-square-foot) house in about four hours. The majority of the structural materials used are processed bamboo veneer sheets, a kind of bamboo-fiber composite."

Xiao says that interior detailing is similar to the wood-frame houses found in North America, and noted that the design conforms to current U.S. building code requirements for quake resistance.

"The relief house contains two windows, fans, locations for a liquefied petroleum gas stove or bath units, satisfying the basic needs of a shelter for a family of up to four," he says. The first batch of 20 units, donated by Hunan University, located nearby, were sent to the affected area in late May. A story about Xiao's work, published in *China Press*, led to contributions that were put toward more units.

Xiao says the cost per square meter of the units, as manufactured in China and based on local material costs, was about 350 to 500 RMB, the equivalent of \$50 to \$70 in the United States.

There are many advantages to using bamboo structures. "Unlike tents, a bamboo quake relief house is insulated for heat and sound, is fireproof, allows residents to secure their possessions, and is more durable," he says. "It is also inexpensive compared with temporary houses using other traditional materials, such as light gauged steel.

"Finally, bamboo is a green and sustainable construction material, widely available in China and other Asian countries."

If the Chinese government decides to build more of the bamboo homes, Xian is likely to be pretty busy the rest of this year. In June, more than 1 million temporary housing units were needed in Sichuan, and no one knew if that estimate would rise. //



Yan Xiao's bamboo quake relief house.



## Ties That Bind

VITERBI DEAN YANNIS C. YORTSOS SWEEPS THROUGH THE FAR EAST, SIGNING SIX COLLABORATIVE AGREEMENTS WITH TOP UNIVERSITIES AND CORPORATE PARTNERS



In a four-country sweep of the Far East this spring, Dean Yannis C. Yortsos and a delegation of Viterbi School administrators and faculty signed six collaborative agreements with top engineering schools and corporations in aviation and information technology.

USC's global prestige produced warm receptions in every city the group visited—in Taipei, Seoul, Hong Kong and Bangalore. By the end of the trip, the school had strengthened ties with alumni, potential donors, academics and corporations.

"There is a tremendous amount of economic development in Asia," says Yortsos, "and in fact, every year that we visit, we see astounding changes, both in China and in India. They're investing in education and technology.

"That changes the dynamics of the world," he adds, "so it is important that we keep our finger on the pulse of the change."

Part of the school's globalization initiative is designed to sustain and nurture existing ties in China, India, South Korea and Japan.

"For instance, we held our very first alumni dinner in Taipei this year and had a terrific turnout of Viterbi alumni," Yortsos reported. (*See also page 52.*) "They were charged up and eager to hear stories about the school's progress."

The trip included the signing of two new Memoranda of Understanding (MOUs) with National Taiwan University

(NTU) and Seoul National University. The MOUs outline a commitment from both schools to develop joint academic programs, undergraduate and graduate educational exchanges, and internships in scientific areas of mutual interest to both institutions.

NTU is a leading institution in engineering; the pipeline of talented students studying and graduating from that institution is important to the Viterbi School.

In Seoul, Yortsos hosted an alumni reception. Following the MOU signing with Seoul National University, he visited the International Free Economic Zone in Incheon, South Korea, a region of free international business and tourism. Then he attended the annual meeting of the Aerospace Institute for Engineering Research (AIER), a collaboration of Airbus, the Viterbi School, Inha University and Hankuk Aviation University of Korea. (*See story on page 8.*) Yortsos also signed another MOU with Inha University for establishing a collaborative program.

The trip included a brief stopover in Hong Kong, where Yortsos visited the Hong Kong University of Science and Technology. Then it was on to Bangalore, India, to formalize a new partnership with Infosys, India's leader in information technology. (*See story on page 16.*) //





## Student Distinctions

### AWARDS AND HONORS OUTSIDE OF THE CLASSROOM



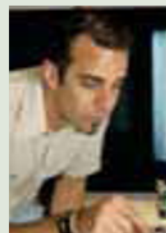
Julianne  
Gale



Reed  
Doucette



Kelly  
Nakamura



John  
McArthur



Ramnath  
Shenoy

Student quality has become a defining mark of the Viterbi School—a trend exemplified by the school's near sweep of major student academic honors at the 2008 USC Commencement.

**Julianne Gale**, a senior in computer science and an artist-community volunteer, was named the USC Valedictorian.

**Reed Doucette**, an aerospace and mechanical engineering graduate, a varsity basketball player and a 2008 Rhodes Scholar, was chosen as USC Salutatorian.

The Viterbi School Valedictorian, chemical engineering senior **Kelly Nakamura**, won the Emma Josephine Bradley Bovard Award for having the highest GPA of all USC graduating senior women.

**John McArthur** and **Ramnath Shenoy** were recipients of the 2008 USC Student Recognition Awards, which honor students who have distinguished themselves not just academically, but by exceptional service to the university and the public.

Two industrial and systems engineering undergraduates—

**Catherine Ricafort** and **Robert “BJ” Takushi**—won 2008 science and engineering fellowships from the Rose Hills Foundation to support research in aviation and railway safety.

The Society of Petroleum Engineers named Viterbi School graduate student **Hamid Jahangiri** a recipient of the Nico Van Wingen Fellowship. The petroleum engineering student is working toward a Ph.D. under the direction of Mork Family Department of Chemical Engineering and Materials Science Professor Dongxiao Zhang.

Outside of academics, electrical engineering student **Michael Johnson** advanced from his regional chair position to national vice-chair of the National Society of Black Engineers. //



Catherine  
Ricafort



Robert “BJ”  
Takushi



Hamid  
Jahangiri



Michael  
Johnson



## X-ray Ethics

Airport x-ray technology can produce pretty pictures of your bones, but its *raison d'être* is to detect anything that might be concealed under your clothing. The x-ray devices “have the potential to become a true superpower for airport security engineers,” reports *Illumin*, the Viterbi School's student-written web multimedia magazine. “However, while Superman may have reserved his ability for good, the employment of backscatter technology does not have such guaranteed results in today's world.” Read “Security Versus Privacy: the Engineering of X-Ray Vision,” and other student-written articles at <http://illumin.usc.edu/>



## Infosys Funds New Software Technology Center

THE BANGALORE-BASED IT GIANT WILL FUND A NEW CENTER FOR RESEARCH AND EDUCATION IN ADVANCED SOFTWARE TECHNOLOGIES AT USC



Infosys Technologies CEO S. Kris Gopalakrishnan and Dean Yannis C. Yortsos.

Infosys Technologies has joined in a collaborative agreement with the Viterbi School to create a software research and education center on USC's University Park campus.

The Bangalore, India-based information technology (IT) giant will fund the new Infosys Center for Advanced Software Technologies (CAST)

under the terms of an agreement recently signed in India by Viterbi School Dean Yannis C. Yortsos and Infosys CEO and Managing Director S. Kris Gopalakrishnan.

The agreement provides that CAST will facilitate joint research and education in such areas as software architecture, service-oriented architectures and information integration, intelligent systems and agents, mobile and wireless systems, sensor networks and computer-aided design (CAD) frameworks and tools for hardware and software.

The new agreement is part of a larger Infosys program to engage with leading Indian and international universities to facilitate research in a variety of areas, including software engineering, information management, knowledge engineering, game theory and intellectual property life-cycle management.

Infosys has previously collaborated with academic institutions with its global internship program, InStep, and its industry-academia program, Campus Connect. Infosys has also been hiring university graduates from outside India, training them in India and sending them back to their home markets.

Yortsos noted that the Viterbi School has more graduate students enrolled from India than any other country.

"The Viterbi School is educating many Indian graduate students," he says. "I'm delighted with this new relationship with Infosys because it promises to benefit both parties significantly." //

**“Through this** collaboration, we hope to work with the best and the brightest engineering talent in the world on innovative technology solutions.**”**

"Infosys' global vision of engineering is compatible with that of the Viterbi School and the University of Southern California," says Yortsos. "This agreement will explore a model of interaction in research, education and training in areas of interest to both Infosys and USC. The collaboration will include joint research, bilateral visits by researchers, student internships and distance education, among other activities."

"The United States is the hub for innovation in science and technology," says Gopalakrishnan. "Through this collaboration, we hope to work with the best and the brightest engineering talent in the world on innovative technology solutions. USC has among the largest number of international students of any U.S. university, and the USC graduate program in engineering is consistently ranked in the top 10 in the *U. S. News and World Report* rankings."







## Learning on the Fly

**KOREAN AIR STUDENTS ARE FIRST GRADUATES LIVING OUTSIDE OF THE U.S. TO EARN M.S. DEGREES THROUGH THE DISTANCE EDUCATION NETWORK**

Byeong Ho Gong and Chan K. Song became the first two students living outside of the United States to earn online degrees from the Viterbi School's Distance Education Network (DEN).

The two, who are Korean Air employees, earned master's degrees this May from the Daniel J. Epstein Department of Industrial and Systems Engineering while living and working in their native Korea. And now they are the proud recipients of advanced degrees and upward mobility in the job market.

Korean Air facilitated the process by giving the two engineers three round-trip flights per semester to Los Angeles. Otherwise, all of their classroom time was spent on the computers in their offices and homes, where they were enrolled in an online degree program.

"This program helped my management skills and knowledge of engineering management," says Gong, who earned a degree in systems architecture and engineering. "I learned collaboration and team work through the team projects as well."



Recent graduates Byeong Ho Gong and Chan K. Song.

"A degree from USC is very important for our careers," adds Song, who earned an M.S. degree in engineering management. He says that he returned to work with a high degree of motivation and managerial skills. His overriding feeling on graduation day at USC—May 16, 2008—was a strong feeling of obligation to the company that had invested so much in him.

"I am proud to be a USC alumnus," says Gong, who has since been promoted to general manager in the

Seoul office of Korean Air. "I strongly encourage my colleagues to take the ticket when the chance is available."

This year, DEN awarded 354 master's degrees to students using the long-distance education network. The total represents a 30 percent increase over 2007, when 272 DEN degrees were awarded. DEN students must meet the same rigorous requirements for degree completion as students attending traditional on-campus programs. //



## USC's Fab Lab is Fab

It's short for the Fabrication Laboratory, a new facility in the engineering school for undergraduate students who need to build, cut, sculpt or carve materials for engineering projects. Now they can build to their hearts' content and turn their fabulous ideas into fabulous fabrication.

The new lab is located in the Rapp Engineering Research Building and is designed to let students fabricate a vast range of physical structures and gadgets they couldn't build in USC facilities before.

"This new facility will be used by engineering undergraduates for their capstone design courses and by student teams," says Linda Rock, associate dean for administration at the Viterbi School. "It will also be available to student inventors—any Viterbi undergraduates who have an idea that they want to build."



## Viterbi Hosts World Robots

ISI TEAM WINS SPACE ROBOTICS COMPETITION



Team Morpheus won the space robotics competition. At top left, Behnam Salemi holds up the robot. At bottom right, the team (from left): Mike Rubenstein, Jacob Everist, Rizwan Khan, Behnam Salemi, Wei-min Shen, Nadeesha Ranasinghe, Harris Chiu and Feili Hou.

This year's mammoth Institute of Electrical and Electronics Engineers (IEEE) International Conference on Robotics and Automation (ICRA) was spearheaded by faculty from the Viterbi School of Engineering.

Professor Maja Mataric, senior associate dean for research at the Viterbi School, and her colleagues, professors Gaurav Sukhatme and Stefan Schaal served as conference co-chairs. University Professor George Bekey, a professor emeritus of computer science, served as honorary conference chair.

ICRA showcases the latest research in every aspect of robotics worldwide. The technical program this year included 661 papers from more than 40 countries and drew more than 1,300 specialists to the conference. The convention featured a robot challenge to students all over the world, who were encouraged to form teams and compete for a top prize.

"Our department is very pleased that we had a group of computer science faculty who have established robotics as a critical research strength of the department," says Viterbi Computer Science Department outgoing chair Ramesh Govindan. "Professors Mataric, Schaal and Sukhatme have collectively established a very strong robotics research program that is among the top-tier programs worldwide."

Aristides A.G. Requicha, holder of the Viterbi School's Gordon Marshall Chair, was honored for his career achievements. Requicha was a co-recipient of the IEEE Robotics and Automation Society Pioneer Award, established in 1998 to recognize "...individuals who, by virtue of initiating new areas of research, development or engineering, have had a significant impact on development of the robotics and/or automation fields."

Requicha has worked to create new families of robotic devices on the micro and even nano scale, and is now director of the Viterbi Laboratory for Molecular Robotics, as well as editor-in-chief of *IEEE Transactions on Nanotechnology*.

The theme of the 2008 ICRA competition was space robotics. Students were asked to simulate a series of unexpected problems occurring at a planetary habitat, where a robotic solution would be quickly developed and deployed, using only existing resources and robotic modules. USC's Information Sciences Institute team won the challenge.

USC's team, named "Morpheus"—after the Greek god of dreams—came from Professor Wei-Min Shen's Polymorphic Robotics Lab. Behnam Salemi led the effort, in which Harris Chiu and Feili Hou contributed to the software development; Nadeesha Ranasinghe contributed to the vision and control; and Rizwan Khan, Mike Rubenstein and Jacob Everist helped in the preparation and hardware construction.

"The robot we designed was very powerful and flexible to adapt to unexpected tasks, and the competition really showed the value of teamwork," says Salemi. //

**"ICRA showcases** the latest research in every aspect of robotics worldwide. The technical program this year included 661 papers from more than 40 countries and drew more than 1,300 specialists to the conference."





## Viterbi Archives Go Digital

USC LIBRARIES HELP CREATE NEW ONLINE RESOURCE,  
CONTAINING 35,000 IMAGES, INCLUDING MANY FAMILY PHOTOS



Michael Hooks

The USC Libraries have opened its largest digital archive consisting of the Andrew J. and Erna Viterbi Family Archives.

"We have many, many digital resources in the USC library system, but this is our largest one," says Claude Zachary, university archivist. "There are more than 35,000 images contained in the digital archive. The hard copies fill 47 of our document cases, each of which can hold approximately 800 sheets of paper. There are also two additional boxes, one containing oversize materials, such as drawings and photographs, and the other containing DVDs and an audiotape cassette."

Curator Michael Hooks, who spent almost two years compiling and processing the archive, says, "It documents the career and professional activities of Andrew Viterbi, noted researcher, scholar, innovator and businessman. It also provides information about the Viterbi and Finci families. Erna's maiden name was Finci."

The archive contains Andrew Viterbi's extensive scientific publications, reports and research materials, as well as awards, certificates, correspondence, memoranda, manuscripts, patents, photographs, presentations and audio and video files.

"I think a lot of young engineers or engineering students will be very interested in following how his career

developed," says Hooks. "But the archive also has strong broad appeal. We digitized many family photos, for example. The only things we left out were the documents that were deemed confidential."

Viterbi is one of the most important of a group of scientists and entrepreneurs whose revolutionary and creative work in the late 20th century ushered in the digital age. His most famous discovery, the Viterbi Algorithm, is a mathematical system that allows a coded digital stream to be transmitted at the highest possible rate with the lowest possible distortion. The algorithm is used in all the world's major cell phone standards. Viterbi is also one of the creators of the spread-spectrum standard used in most of the world's cell phones, Code Division Multiple Access, or CDMA.

A native of Italy whose family immigrated to the United States when he was four years old, Viterbi attended public schools in Boston, graduating from the renowned Boston Latin School in 1952. He earned B.S. and M.S. degrees in electrical engineering from MIT and a Ph.D. in electrical engineering from USC in 1962. Viterbi gained notoriety when he was featured in *Life* magazine as one of the bright young scientists at Caltech's Jet Propulsion Lab, answering Sputnik's wake-up call to launch Explorer I.

In 1956, Viterbi married Erna Finci, who became his lifetime partner. The Finci and the Viterbi families both fled anti-Semitic oppression in World War II.

Since Viterbi stepped down as vice chairman and chief technology officer of Qualcomm in 2000, at the age of 65, he and his wife have devoted their lives to philanthropy and providing counsel and investment to high-tech start-up companies.

Visit the Andrew J. and Erna Viterbi Family Archives online at: [digarc.usc.edu](http://digarc.usc.edu). //

## Micro-origami

USC'S INFORMATION SCIENCES  
INSTITUTE FOLDS UP MICRO-  
PACKAGES FOR DRUG DELIVERY

Egypt has its great pyramids; the Viterbi School's Information Sciences Institute (ISI) now has its micro-pyramids.

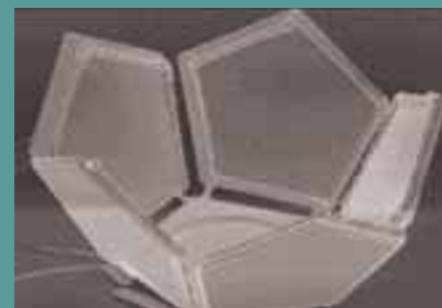
These tiny, submicroscopic containers, made not of paper but of polysilicon sitting on top of a thin film of gold, could be used one day to deliver precise micro or even nano quantities of drugs, says Information Sciences Institute project leader Peter Will.

Creating the three-dimensional shapes was a two-step process. Under Will's leadership, the researchers had to create flat patterns—origami—just like the fold-up shapes kindergarten children use to make paper pyramids, cubes and other geometric objects. But these pyramid containers were only 40 micrometers tall.

The researchers experimented with different methods of folding the material. They found that folding by magnetic actuation and liquid closure yielded the desired result: fully sealed mini-envelopes.

In a paper published in the *Journal of Micromechanics and Microengineering*, the researchers reported that their folding techniques were "extremely promising," and could lead to mass production of large arrays of micro-meter-sized "voxels." Voxels are volume elements representing a value on a regular grid in three-dimensional space.

The research was supported by a National Science Foundation exploratory research grant.





# Faculty Accolades

## VITERBI PROFESSORIAL AWARDS AND ACHIEVEMENTS



**David Kempe**



**Aristides Requicha**



**George Bekey**



**Bart Kosko**



**Alan Willner**



**James E. Moore II**

▶ The Computer Science Department's **David Kempe** added an Office of Naval Research (ONR) Young Investigator award to his earlier CAREER award. The ONR award has similar criteria and standing to the NSF award.

▶ **Aristides Requicha**, holder of the Viterbi School's Gordon Marshall Chair, has just been named a co-recipient of the Institute of Electrical and Electronics Engineers (IEEE) Robotics and Automation Society's Pioneer Award. This honor recognizes "individuals who by virtue of initiating new areas of research, development or engineering have had a significant impact on development of the robotics and/or automation fields."

▶ **George Bekey**, a computer science emeritus professor, has won the USC Faculty Lifetime Achievement Award.

▶ **Bart Kosko** of the Ming Hsieh Department of Electrical Engineering was named one of three recipients of an excellence award from the USC Faculty Senate. He was recognized for his exceptional

contributions to faculty governance and for his advocacy of intellectual-property rights for faculty and students.

▶ **Alan Willner** of the Ming Hsieh Department of Electrical Engineering has been named editor-in-chief of a prestigious journal, *Optics Letters*, published by the Optical Society of America.

▶ **James E. Moore II**, chair of the Daniel J. Epstein Department of Industrial and Systems Engineering, was elected vice president and president-elect of the Transportation Science and Logistics Society. He also won the Pioneer Educator Award from the Orange County Engineering Council.

▶ **Terence G. Langdon** has received the 2008 Blaise Pascal Medal for Material Science from the European Academy of Sciences and the Chinese Lee Hsun Award from the Chinese Academy of Sciences.

▶ **Maged Dessouky** of the Daniel J. Epstein Department of Industrial and Systems Engineering won a best

paper award from the Institute For Operations Research and Management Science's Transportation Science and Logistics Society. He also won the Institute of Industrial Engineers (IIE) Excellence in Teaching award, and was named a fellow of the IIE.

▶ **Daniel Lidar** was named a fellow of the American Physical Society, and **Aristides Requicha** and **Viktor Prasanna** were named fellows of the Association for Computing Machinery.

Prasanna also received the first-ever Outstanding Service Award from the IEEE's Computer Society Technical Committee on Parallel Processing, presented at the International Parallel and Distributed Processing Symposium, where he also won a best paper award.

▶ **Hossein Hashemi** won a best paper award at the IEEE International Solid State Circuits Symposium.

▶ **Ellis Horowitz**, professor of computer science and electrical engineering, has been appointed chair of the Computer Science Department for an interim period. He succeeds Ramesh Govindan, who had served as interim chair since July 2007. Horowitz was chair of the department from 1990 to 1999.



**Terence G. Langdon**



**Maged Dessouky**



**Daniel Lidar**



**Viktor Prasanna**



**Hossein Hashemi**



**Ellis Horowitz**



**Michael Safonov**



**Ramesh Govindan**



**Konstantinos Psounis**



**George V. Chilingar**





► **Ramesh Govindan**, outgoing chair of the Computer Science Department, and fifth-year doctoral student Nupur Kothari have won the Best Paper award at the IEEE Symposium on Information Processing in Sensor Networks.

► **Konstantinos Psounis** of the Ming Hsieh Department of Electrical Engineering won the "Bestand Most Compelling Presentation and Demonstration Award" at a networking workshop on the design of a future Internet held at Stanford University.

► Professor Emeritus **George V. Chilingar** has been named an honorary professor of the Gubkin Russian State University of Oil and Gas in Moscow for his significant contributions in the area of oil and gas field development. Just a few months before, he had been the guest of honor at a campus celebration to honor his 55 years of teaching at USC. Chilingar received a plaque from Viterbi School Dean Yannis C. Yortsos and many kudos from colleagues and friends in the school's civil and chemical engineering departments.

► **Michael Safonov** of the Ming Hsieh Department of Electrical Engineering was elected a Fellow of the International Federation of

Automatic Control (IFAC). Safonov, a leader in the field of robust control, has worked extensively with flight control systems for aircraft.

► **Yannis C. Yortsos**, the Viterbi School's dean, earned the 2008 Western North America Reservoir Description and Dynamics Award from the Society of Petroleum Engineers. Yortsos was also recently elected to the National Academy of Engineering.



**Yannis C. Yortsos**



**Tom Katsouleas**



**Andrew J. Viterbi**



**Michael Neely**



**Tait Pottebaum**



**Amy Rechenmacher**

► On July 1, 2008, **Tom Katsouleas**, professor of electrical engineering and an innovative researcher in plasma physics, became dean of Duke University's Pratt School of Engineering.

► The selection of the School's patron and namesake, **Andrew J. Viterbi**, as a finalist for the 2008 Millennium Prize of the Finnish Academy topped our list of recent honors for Viterbi School faculty. Viterbi, a USC presidential chair in the Viterbi School's electrical engineering faculty, was one of four nominees for the prestigious Millennium Prize, considered the "Nobel

Prize in technology," and awarded for innovation that has significantly improved the quality of life throughout the world.

► **Michael Neely, Tait S. Pottebaum** and **Amy Rechenmacher** are the latest Viterbi faculty to win coveted National Science Foundation (NSF) Early CAREER awards. NSF CAREER awards are among the highest honors for young faculty.

Neely's grant will support his work in network modeling and analysis for the Ming Hsieh Department of Electrical Engineering. Pottebaum, a member of the aerospace and mechanical engineering faculty, earned a grant for his work in fluid dynamics and the development of new microfluidic devices. Rechenmacher's grant in civil and environmental engineering will address specific issues related to granular behavior and improving infrastructure and earthquake predictability.

*Visit our website for the latest Viterbi news:*

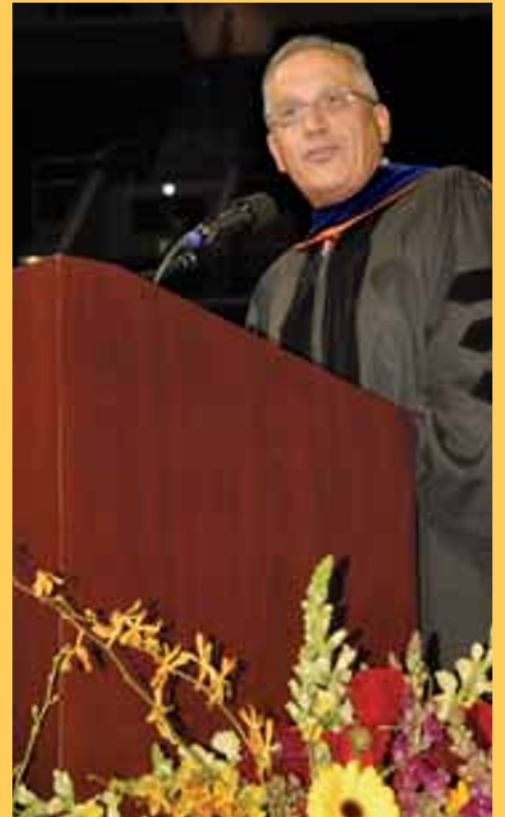
**viterbi.usc.edu**

# COMMENCEMENT 2008: A Glorious Day

**THE UNDERGRADUATE CLASS OF 2008**—all 453—came from many engineering disciplines in eight departments. Lauded as the highest achieving class in the history of the Viterbi School, they came highly decorated, with honorary titles and awards no one could hope to keep straight: Mr. and Ms. USC, Rhodes Scholar, valedictorian, salutatorian, Emma Josephine Bradley Bovard awardee, National Society of Black Engineers vice chair, Division 1 basketball player, Archimedes Circle honoree, Society of Women Engineers alumni awardee...and the list goes on. They were role models, one and all, alongside an equally impressive class of graduate and Ph.D. students—all 1,275 master's degree candidates and 150 Ph.D. candidates. So many, in fact, that the graduate ceremony had to be held in the Galen Center. Not a bad choice for such a hot day. //







## The Large and the Small of It

IT'S A JUGGLING ACT FOR JOHN O'BRIEN, WHO BALANCES HIS RESEARCH ON TINY NANO-PHOTONIC DEVICES WITH THE VERY LARGE RESPONSIBILITIES OF A SENIOR ASSOCIATE DEAN

John O'Brien would be perfectly content to spend all of his time exploring the realm of very tiny photonic devices. But he has made a commitment to serve as the Viterbi School's senior associate dean for academic affairs.

"I think it's important for whoever has this job to be on the faculty and actively involved in research because it gives you a unique perspective," he says.

Meanwhile, there's the small matter of the very small lasers.

O'Brien, a professor in the Ming Hsieh Department of Electrical Engineering, is designing and building nano-photonic devices. Since becoming senior associate dean, which consumes half of his time, he has come to rely more heavily on his graduate students.

"It forces us to be more structured, not necessarily a bad thing, and it might even be good for them," he says. "We meet three times a week and so far everything has been going very well."

Photonics, the technology of generating and harnessing light, seeks to manipulate photons the same way that electrons are manipulated in integrated circuits and microprocessors. O'Brien's photonic devices, and others like them, could eventually replace traditional electronic technology used in telecommunications.

**"We can make** a reasonable claim that they're the smallest lasers ever made...And we can turn them on and off 10 billion times a second, which means that we can code information."

"We have all benefited from Moore's Law, with processors becoming twice as powerful and half as large every 18 months," O'Brien says. "The worldwide demand to communicate faster, with smaller devices that use less power, is not yet saturated. We will continue down that path with photonics."

The lasers and other devices that O'Brien builds are 10,000 times smaller than the cross section of a human hair,

in the range of 100 nanometers to 300 nanometers.

"We can make a reasonable claim that they're the smallest lasers ever made," he says. "And we can turn them on and off 10 billion times a second, which means that we can code information."

Aside from the very small scale, O'Brien's research may appear relatively straightforward, even simple. After all, lasers like the ones he makes have been around 40 or 50 years, and the technology is well understood.

Except for the very small part.

As devices get smaller, they don't behave in the same manner as their larger brethren. They begin to be governed by quantum rather than classical physics. There's no clear boundary where quantum rules take over, so predicting precise behavior is difficult. Or more important, designing a nanoscale device to precisely control light in any kind of predictable way is very challenging.

"Can we just turn them on and off and expect them to act exactly like the lasers we've been using since the 1960s?" he asks. "No. We make measurements and see quantum effects manifesting themselves as noise, and characterizing that noise is very tough to do."

O'Brien's most important tool is the USC High Performance Computing Center, which he calls a unique resource that he uses a lot. The equations he and his research team write in their attempt to predict how their nanoscale devices will act are very large and complex.

"There are no good shortcuts or pencil-and-paper solutions for what we do," he says, adding that when he first came to USC, one of his first acts was to have a student build a 20-processor workstation.

O'Brien and his team spend a third of their research time designing the devices and two-thirds actually building them in clean rooms on the USC campus and studying the finished devices.

Much of O'Brien's research is funded by the Department of Defense and the National Science Foundation and is critical to new discoveries in the field. He predicts that photonics, which already plays a fundamental role in moving streams of digitized information around the world through fiber-optic cables, will move into integrated circuits and, eventually, the microprocessors inside computers.





The Viterbi School's rich history in photonics attracted O'Brien to USC. After he got his B.S. in electrical engineering at Iowa State University and his M.S. and Ph.D. in applied physics from Caltech, he wanted to work with photonics luminaries like Dan Dapkus, Robert Hellwarth and William Steier, all faculty in the Ming Hsieh Department. Dapkus is the electrophysics chair of the department.

Since coming to USC, he has drawn inspiration from and collaborated with other photonics colleagues, such as Alan Willner and Todd Brun, who are also Ming Hsieh Department faculty.

Thinking of what brought him to USC and what continues to inspire his research brings him full circle and back to his role as senior associate dean for academic affairs.

"USC and the Viterbi School have been very good to me. In my research now, I'm leader of a team that includes two members of the national academy, with expertise ranging from quantum mechanics to nano-engineering," he said. "There may be two other places in the world where a team this strong could be put together. It's very special. I wanted to give back." //



## Cold Defense for a Hot Threat

THE DETER LABORATORY MIMICS THE INTERNET, ALLOWING CLEVER COMPUTER SCIENTISTS TO MOUNT CYBER ATTACKS AND CREATE DEFENSES AGAINST THEM

**B**ehind a locked door on the second floor of the Viterbi School's Information Sciences Institute (ISI) in Marina del Rey is an ice-cold room filled with rack upon rack of computers busily blinking under the frigid blast of air-conditioning. These computers, linked to a similar roomful at the University of California, Berkeley, constitute a miniature Internet, says Terry Benzel.

Like the real Internet, this one comes complete with its own addresses, servers, users, traffic and other Web accoutrements. In this Internet, very clever malicious actors are trying to propagate code that can paralyze operations, steal information and compromise vital business or government functions.

That too, unfortunately, is just like the real Internet.

Benzel is director of the DETER laboratory project, which for the past five years has sought to protect the computing community and the nation against cyber attacks. Such attacks have the potential to be far more damaging than most citizens—and lawmakers—realize.

In the DETER lab, the “bad guys” are not hackers, but computer scientists from all over the country who specialize in Internet security. DETER is the computer equivalent of the ultra-secure biological laboratories used to study extremely dangerous, contagious viruses. Researchers can experiment, investigate, invent, share and, yes, attack a carefully isolated virtual network





that faithfully mimics the behavior of the far larger real one.

“The DETER nodes simulate any piece of equipment or connection that might be found on the Internet, including an entire network, if necessary,” Benzel told a reporter from *Homeland Security Today*. “In addition, the DETER test bed is designed specifically to allow our experimenters to run tests with malicious code, so we can have true, live malicious software (malware) running in the test bed.”

Without DETER, each researcher would need his or her own facility. Such a facility would be hard for other researchers to duplicate, and it would be difficult to confirm their findings. And each facility would have to be individually secured. With a single, shared test bed, reproducibility and security are assured.

At first glance, “internationally known computer security expert” would not be most people’s occupational guess regarding Benzel, a mother of two who loves cats and has an easy smile. As a college mathematics major, she thought: “I would get a Ph.D. and teach,” as her father had before her. Then she became interested in computers, “and in 1980, I read a journal article on computer security.” She had found her vocation.

After receiving her M.S. in mathematics, she embarked on a research and development road in the private sector that led through a series of companies and corporate take-overs, and eventually became division vice president with executive responsibilities at Network Associates, where she ran a 125-person research laboratory. Along the way, she picked up her M.B.A. from UCLA.

Six weeks after 9/11, Benzel’s commitment and passion for cyber security research led to an opportunity to testify before Congress.

She presented “Cyber Security—How Can We Protect American Computer Networks from Attack: The Importance of Research and Development,” before the House Committee on Science.

She came to ISI in 2003. In September of that year, the Department of Homeland Security and NSF established DETER with a \$5.5 million grant. The project has grown steadily since then, now numbering more than 150 users. Last April, DETER received an Excellence Award from the American Council on Technology.

DETER takes advantage of ISI’s deep IT expertise. Cliff Neuman, who helped create the widely used Kerberos cyber-authentication system, was an early co-director of DETER. Veteran computer scientist Bob Braden, whose experience dates to the pre-Internet Arpanet, and Braden’s frequent co-worker, Ted Faber, are also on the team. John Wroclawski, who directs ISI’s networking division, has been setting an aggressive research agenda to expand and enhance DETER to

provide new scientific rigor in cyber security experimentation and testing.

Despite the progress, Benzel is worried that the bottom-line threat from her 2001 testimony is still very much alive, and attention and resources devoted to cyber-security are still lagging. She notes that the Department of Homeland Security is funding more than \$1 billion in research, but only \$15 million goes to research on computer attacks.

Computer hackers gaining access to secure facilities are a part of the problem—but the danger goes deeper, beyond just compromised information, say Benzel and Neuman, particularly at a time when jumpy financial markets have seen giant swings, up and down, along with brand-name failures.

“America and the world’s complex banking system depends on digital information, requiring second-by-second updating of the status of trillions of dollars,” says Neuman. There are terrorists who have sophisticated IT knowledge—often acquired in Western universities—who are well supplied with funds to purchase additional expertise and resources.

**“In the DETER lab,**  
the ‘bad guys’ are not hackers, but computer scientists from all over the country who specialize in Internet security...Researchers can experiment, investigate, invent, share and, yes, attack a carefully isolated virtual network that faithfully mimics the behavior of the far larger real one.” //

“Given the reach of ‘botnets’ [networks of software robots] and malware today, massive attacks are quite possible, and I am surprised we have not seen them as of yet,” Neuman says. “Our defenses could be better.”

“The combination of physical and cyber threats is even more alarming,” says Benzel. “In addition to software attacks, terrorists can potentially damage physical infrastructure in a way that creates a cascading series of cyber-infrastructure outages that would undermine citizen confidence. The financial markets, manufacturing sectors and transportation sectors could all be susceptible to these sorts of attacks.” //



## Solving the CO<sub>2</sub> Conundrum

STORING CARBON DIOXIDE UNDERGROUND COULD GIVE SOCIETY SOME TIME TO TRANSITION TO ALTERNATIVE ENERGY SOURCES

Nine years ago, when he was working at the Los Alamos National Laboratory, Dongxiao (“Don”) Zhang began studying how carbon dioxide might be stored underground for thousands of years. At the time, he was one of a handful of investigators in a field fueled by a tiny trickle of research funding.

Now, with mounting concern about global climate change, the field has assumed critical importance. Zhang, who holds the Gordon S. Marshall Professorship in the Sonny Astani Department of Civil and Environmental Engineering, is acknowledged as a leader in the field, and he hopes to help the Viterbi School emerge as a leading center for its study.

CO<sub>2</sub> produced by burning fossil fuels for energy is widely recognized as having a growing effect on the earth’s climate, with potentially damaging consequences.

“We have various things we can do,” Zhang says.

“We can use less. We can be more efficient. We can use renewable sources or nuclear.”

But Zhang says that even the most optimistic forecasts foresee that people will still be burning fossil fuels for decades.

“For the foreseeable future, carbon management will be necessary for the global economy,” he says. Pointing to the work in subsurface flows by colleague Iraj Ershaghi and others, he adds: “CO<sub>2</sub> sequestration in the subsurface offers a very promising technology to this effect.”

**“For the foreseeable future, carbon management will be necessary for the global economy.”**

Zhang believes that it is possible to burn carbon-based fuels without increasing CO<sub>2</sub> emissions. The method involves storing CO<sub>2</sub> in saline aquifers—vast oceans of salt water buried from a half mile to several miles underground. He says the aquifers are very common throughout the world, with more being discovered and mapped regularly. Zhang says there are other potential storage areas, including coal beds that can’t be mined and depleted oil or gas reservoirs. These could hold at least 150 years of the world’s CO<sub>2</sub> production at current levels.

But he cautioned that theoretical capacity is one thing, while the actual technology to accomplish it is quite another.

“The science just started,” he says, and then ticks off a long list of unknowns, from the capacity of individual wells to what effects CO<sub>2</sub> injection may have on the rocks and reservoirs, to the effects of capillary pressure and CO<sub>2</sub> buoyancy and how long various storage mechanisms are likely to last.

Scientists can image underground pockets of CO<sub>2</sub> using the same seismic tools employed for gas and oil, and much is already known about the subterranean behavior of the gas. Oil producers have been injecting CO<sub>2</sub> into older wells to force petroleum up to the surface for many years.

It was a follow-up on CO<sub>2</sub> injected for oil production that Zhang studied in what has become a seminal paper in the field, “Sequestration of CO<sub>2</sub> in a Depleted Oil Reservoir: A Comprehensive Modeling and Site Monitoring Project.”

There are other large challenges in addition to the geology, says Zhang. If CO<sub>2</sub> is to be injected into the earth, it must be captured first from the exhausts of typically very large facilities, such as electrical power plants. It must be separated from other exhaust products, compressed and then transported. The technology to do this is still under development.

The volumes of CO<sub>2</sub> involved are huge, and he notes, the storage has to be very long-term. Even a fraction of 1 percent leakage per year would be unacceptable.

“This costs energy, this costs infrastructure,” he says. Currently, CO<sub>2</sub> used for oil extraction (and to make dry ice) costs oil companies about \$70 per ton to buy, transport and inject into wells. (This CO<sub>2</sub> doesn’t come from emissions, but rather from underground deposits of gas that are brought to the surface, piped to oil fields and then re-injected into the earth. “In the future, we’ll want to leave this CO<sub>2</sub> where it is,” says Zhang.)

Zhang remains optimistic that sequestration can be “an economically viable alternative for continuing a carbon energy economy” until other energy technologies begin to replace fossil fuels.

And he believes that USC can play a significant role in filling the gaps in sequestration technology. Two years ago, another sequestration specialist, Kristian Jessen, joined the USC faculty as an assistant professor in the Mork Family Department. Other faculty, including





Professor Roger Ghanem, a modeling expert in the Astani Department, and reactive separations expert Professor Theodore Tsotsis, who is chair of the Mork Family Department, also have skills that can help illuminate the issues and problems.

“We have a great facility,” Zhang says. “We have world-class faculty and students. We now have the resources to become a national center for study of the

fundamental issues of geological carbon sequestration. I’m very happy to be here.”

Carbon sequestration is only one of Zhang’s specialties. He’s also a petroleum engineer with a joint appointment in the Mork Family Department of Chemical Engineering and Materials Science, and studies water management, another critical environmental area. //



**INFORM**



**For more than 35 years,** the Viterbi School's Information Sciences Institute (ISI) has stood as an international powerhouse of research and development.

At ISI, key elements of the Internet, such as the familiar .com, .gov and .edu address systems were created, along with early e-mail, the world's first laptops, top-ranking software for translating Chinese into English, videogames that teach difficult foreign languages, computer advisors that schedule air operations and much, much more. Here's a look inside USC's Marina del Rey Tech Campus, where the research horizons are as breathtaking as the office views of the ocean.

# ATION SCIENCES INSTITUTE



# Top-tier Research

THE 10TH FLOOR VIEW FROM VITERBI SCHOOL'S INFORMATION SCIENCES INSTITUTE IN MARINA DEL REY IS ALMOST AS SPECTACULAR AS THE RESEARCH

Here's some information about the Viterbi School's Information Sciences Institute (ISI) that you may not know: It boasts USC's most spectacular office views.

Every day sharp, awed intakes of breath are heard as visitors step out of the elevator into ISI's 10th floor lobby and catch sight of the blue Pacific, with Santa Catalina Island shimmering on the horizon, the majestic sweep of Santa Monica Bay and million-dollar yachts glittering in the Marina del Rey harbor below.



Yolanda Gil

Even hard-nosed government funders and no-nonsense corporate executives in search of advanced IT research who visit Executive Director **Herb Schorr's** office are captivated.

"They look at the view," says Schorr with a smile. "I look at them."

The intellectual and scientific view of ISI, which calls itself an "Agent of Innovation," is equally compelling. Dean **Yannis C. Yortsos** sees "a powerhouse for the Viterbi School—intellectually, financially, educationally and in every other way. As dean, I'm continually reminded how much this remarkable institution contributes to every aspect of our operation."

ISI is a highly unusual academic institute. Its founding director, the late **Keith Uncapher**, left the RAND Corporation in 1972 to concentrate on research that led directly to the creation of the Internet. Uncapher wanted—needed—his institute to be part of a major research university, but he also wanted the independence to pursue a more radical course. Other schools were interested, but said they needed months to do it. USC's then engineering dean **Zohrab Kaprielian** made a decision in one week to give Uncapher the creative space he wanted.

The Uncapher model—creation of a wide base of expertise enabling intensive early pursuit of promising ideas across disciplinary lines and driving forward swiftly toward working systems—has now been proven by

decades of practice. ISI has a distinctive organizational structure. It's neither a traditional academic research center, nor a traditional research and development think tank. Rather, it's a happy medium drawing from both traditions. ISI bridges the gap between advanced basic research and viable product prototypes, a gap sometimes called "the Valley of Death."

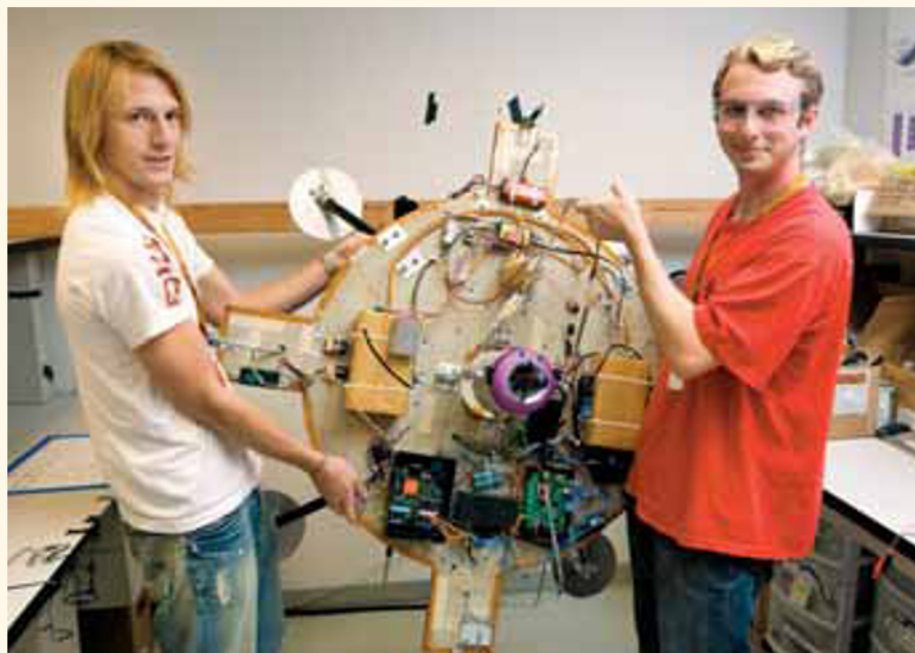
The beneficiaries are not just users of extraordinary new IT systems, but also Viterbi students, graduate and (increasingly) undergraduate, who hone their skills as part of crackerjack research and development teams. ISI's bridge-building across disciplinary lines has fostered a collaborative culture that has spread through the Viterbi School to all of USC. Virtually every new major USC research center in recent years has included a strong component of IT support from ISI.

ISI dress is casual even by academic standards. Many senior staffers are typically in blue jeans and sport shirts, even t-shirts, and everyone is on a first-name basis. But if the atmosphere is relaxed, the science and engineering are assuredly not.

The researchers in Marina del Rey, only 15 minutes from Los Angeles International Airport, along with those in a smaller ISI campus in Arlington, Va., ("ISI East"), attract substantial funding.

Much of it is from government, from the Defense Advanced Research Projects Agency (DARPA), which





Brian Hagemen (left) and Michael Ahern, undergraduate and graduate students in the Viterbi School's Astronautics Division, hold ISI's Lunar Lander Prototype Vehicle, fondly called LEAPFROG. Run by ISI's David Barnhart, the project will simulate lunar landing descent profiles for future landing systems and technologies.

funded Uncapher's early work, and also the National Science Foundation, the National Institutes of Health, NASA and many others. And the net is steadily broadening, with work for private companies.

Both Schorr and many of his top staff, including energetic ISI Assistant Director **Joe Sullivan**, come out of private R&D labs. Schorr came to ISI in 1988 from IBM, where he had been the company's first vice president for computer science research.

Sullivan came to ISI in 2003 from the Fuji Xerox Palo Alto Laboratory and sees ISI's role as a facilitator of research that goes from bright idea to actual working prototype, or as he puts it, "from visionary to viable."

ISI project leaders are the visionaries, who get to viable by forming teams from ISI's deep reserves of in-house talent, supplemented by contributions from graduate students. ISI researchers do not have guaranteed funding, but must successfully compete for grants in an entrepreneurial manner.

This takes a special breed of researcher, as Schorr notes: "We need people who can not only do research, but who can also sell their ideas to funders."

The research covers a wide range of information technology, including hardware, software and networks, and brings a range of disciplines to bear on problems.

The pattern is constantly changing. But here is a brief rundown on the current research lineup:

## E-Science

In all fields of science and engineering, researchers face a common problem: They are drowning in data. Their challenge, called "E-Science," is to effectively use it.

The Interactive Knowledge Capture team led by **Yolanda Gil** is assembling "Knowledge Acquisition" tools that automatically structure raw data to speed its analysis by people. A key element is that the researchers don't have to be experts in computer science.

## ISI: A TIMELINE

### 1972



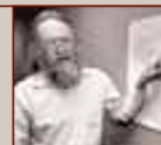
**Keith Uncapher** of the RAND Corporation wishes to pursue research on "packet switching" funded by the Advanced Research Projects Agency (ARPA). USC Dean of Engineering **Zohrab Kaprielian** reaches agreement in one week and leases space in a Marina del Rey tower because of proximity to LAX.

### 1973

**Danny Cohen** joins ISI to work on projects including voice over Internet, video over Internet, MOSIS and FastServe. Local Area Network (LAN) becomes basis of Myricom start-up.

### 1977

Internet architect **Jon Postel** joins ISI.



### 1978

**Paul Mockapetris** joins ISI, beginning work on Internet, including developing the first SMTP server for e-mail.

### 1981

MOSIS chip brokerage is established, allowing chip designers to share costs of fabricating prototypes.

**Jon Postel** authors Request for Comment 793, the basic Internet transmission control protocol (TCP), including its widely quoted Robustness Principle: "TCP implementations will follow a general principle of robustness: Be conservative in what you do, be liberal in what you accept from others."

### 1982

ISI celebrates 10th anniversary with 130 staffers, including 70 with advanced degrees.

### 1983



**Mockapetris and Postel** create now universally used domain name system (.com, .edu, .gov) at ISI, work for which Mockapetris subsequently was named to National Academy of Engineers (NAE).



Carl Kesselman has been repeatedly honored for his pioneering role in grid computing. His new challenge: medical IT.

With his Neuroscholar and NeuArt II projects, **Gully A.P.C. Burns**, founder of ISI's Biomedical Knowledge Engineering Group, has created research tools to enable neuroscientists to go through scientific literature and neural atlases and quickly retrieve the relevant information they need.

Biomedical applications are part of ongoing pioneering E-Science work by **Carl Kesselman**, who began collaborating in the 1990s on Grid Computing with Ian Foster at Argonne National Laboratory. The partnership produced open-source (free, noncopyrighted) software that permits seamless

and secure sharing of computational resources and data between researchers who are physically separated. Their Globus Alliance produced the Globus Toolkit, a software package now in version 6.0, which has exploded into commercial use in what is now called "cloud computing." Academics in fields ranging from particle physics to biology have adopted the software. (See story on page 10.)

Kesselman most recently collaborated with fellow ISI Grid expert **Ann Chervenak** and Children's Hospital medical imaging expert **Stephan Erberich** on Medicus, which (in Erberich's words) "broke the medical imaging barrier" by allowing easy, seamless, secure and user-friendly transmission of X-rays, MRIs and images between hospitals.

Other ISI researchers are pushing the grid-computing envelope in different directions. **Ewa Deelman's** Pegasus Project "chains dependent tasks together, so that a single scientist can complete complex computations that once required many different

people," she says. "It compiles not only software and data, but also the expertise of the people who developed the software."

A closely related E-Science field is the use of IT to assemble the necessary information to guide human decisions made in difficult situations, often under time pressure. **Pedro Szekely** and **Robert Neches**, who have been leaders in this field for more than a decade, created a computer system to guide and quickly schedule the operation of squadrons of fighter aircraft, a task that used to take a highly trained officer several hours. It's now in wide military use, with civilian applications pending. Their follow-on system to help combat commanders make fast and correct decisions recently placed first in DARPA trials, winning Neches a commendation. Neches is also working with ISI's newest project leader, **Ke-Thia Yao**, on a number of other parallel projects aimed at enhancing human commanders and decision makers to assemble, visualize and bring computer power to bear on incoming information.

Neches is applying the same insights to medical decision-making for emergencies, and partnering with Children's Hospital Pediatrician **Jeffrey Upperman** on a \$5 million project to create a system that, after an earthquake, would survive and guide doctors and other emergency workers.

**Michael Oroszcz** is working with Neches and **Tatiana Kichkaylo** in a Department of Homeland Security Center for Risk and Economic Analysis of Terrorism Events (CREATE) project on IT emergencies. The group is trying to automate and systemize the



Ewa Deelman works on the Pegasus project, which "chains dependent tasks together so that a single scientist can complete complex computations that once required many different people."



current ad-hoc approach of analyzing risks, a problem that entails making sense of a vast amount of information and above all, keeping the process rigidly consistent.

ISI has also long played a key role to secure advanced IT tools for local and regional governments. "The federal government has sophisticated technology," says **Yigal Arens**, the ISI division director who has spark-plugged efforts that established the Digital Government Research Center, "but local, regional and state governments do not."

**Craig Knoblock** has been pursuing a different strategy on the problem of analyzing and organizing massive quantities of data. He uses geography as an organizing principle. ISI research on the tools to do this created systems that are now being commercialized

by several spin-offs, one extracting data from Web sources and another automatically aligning data with satellite imagery.

A continuing major focus at ISI is Sensornets, which pull information from multitudes of individual sensor units distributed over a broad area for security or environmental monitoring purposes. At the ISI Laboratory for Embedded Networked Sensor Experimentation (i-LENSE), **John Heidemann** and his team collaborate with UCLA's Center for Embedded Sensor Networks, as well as with the Viterbi School's Chevron-funded CiSoft effort on a variety of projects. One important priority has been to manage inter-sensor communications with minimum energy. Recently the team produced the best algorithm yet to do this. Heidemann's group



Tim Lehman of ISI-East in the Optical Hybrid Networking Research Lab, a major center of research for sending high-resolution video over the Internet.

## 1986

NAE member **Uncapher** steps down as executive director.

ISI sponsored by DARPA begins developing the LOOM knowledge representation system to allow computers to classify and use verbal concepts. LOOM and follow-on systems, including NIKL and PowerLoom, are widely distributed throughout academia and industry and form basis of ISI artificial intelligence research.

## 1987

FAST automated computer parts system brokerage established, using e-mail and computer software to link buyers and sellers, one of the very first on-line businesses—which is still in operation.

## 1988



**Herb Schorr** comes from IBM to take over as ISI executive director.

## 1990

Intensive activity begins in area of structuring, efficiently using and mining of databases, including geographical access, retrieving and integrating data from multiple sources, optimal search strategies and more, as part of the Information Integration Research Group. The effort spins off the companies Fetch Technologies and Geosemble with **Craig Knoblock** as principal.



## 1991

ISI opens ISI East in Arlington, Va.

## 1992

ISI celebrates its 20th anniversary.

## 1993



**Clifford Neuman** co-develops PROSPERO resource manager, later licensed to AOL and others.

## 1995

ISI efforts accelerate to develop MBONE, architecture for multicasting and conferencing over the Internet.



also attracted national attention by carrying out a sensor-net like probe of the entire Internet, producing the first census of responding web addresses in 20 years.

ISI is continuing to expand the capabilities of the Internet and make it more secure with **John Wroclawski**, **Bob Braden** and ISI East's **Thomas Lehman**. ISI East has also pioneered high-definition television via the Web for videoconferencing and other purposes, including a video amphitheater project, and was a center of development for the next-step advanced IP6 Internet protocol.



David Barnhart, astronautics project leader at ISI, examines a space work-in-progress.

At ISI West, **Dan Davis** and **Bob Lucas** created a system to link supercomputers to create enormously detailed simulations and animations, showing activity by virtual populations of millions of “vehicles” moving in a continental dimension battle theater for military war-game training.

The Web is vulnerable to malicious people, including possible unfriendly government operators or even terrorists who create dangerous code. **Cliff Neuman** directs the USC Center for Computer and Systems Security at ISI, and he's studying threats and ways to disarm them. Neuman (along with Wroclawski and Braden) works with **Terry Benzel** on DETER, a sealed-off mini-Internet where hundreds of researchers can do reproducible, standardized study of possible threats in a safe, controlled environment. (See story on page 26.)

Nathan Cox examines a silicon blank, the basic material of solid-state electronics. Each of the discs can contain thousands of electronic processing units, created by a process that first puts a photographic image onto the blank, and then chemically develops the image by etching away silicon layers.

## Artificial Intelligence

Human interaction and communication on the Web leads into a second major area of ISI research, artificial intelligence, where it is arguably the national leader. The challenge here is not so much the analysis of huge volumes of data—though that is often a major part of the work—but to create IT systems that can communicate with humans in their own language.

ISI division director **Ed Hovy** has worked on Artificial Intelligence (AI), including E-Science applications, for decades. Just the list of areas in which he has written papers is an instant introduction to the scope and range of these problems: “Information harvesting and text mining; natural language processing applications, text formatting and multimedia issues; information extraction, opinion identification, parsing and automated text analysis; question answering and information retrieval; interlinguas, dialogue and virtual agents.”

The “interlinguas” mentioned above are one solution to a critical AI





Yigal Arens, director of the Intelligent Systems Division at ISI, one of the world's leading centers of artificial intelligence research, stands in front of a presentation room full of language translation experts.

problem: machine translation. For decades, people have been trying to build software to translate written texts in one language—Chinese or Arabic, for example—into another, say English. Progress has been frustratingly slow, even as computers become more powerful.

Word-for-word dictionary replacement is useless, owing to the profusion of words with multiple meanings and idiomatic uses. Interlinguas are attempts to create a logically rigid and unambiguous artificial language that all languages can be put into—and then retranslated back into another.

Substantial progress has come in pair-language translation recently by mobilizing massive computational resources that reduce texts into word triplets, find an equivalent in the target language and then jigsaw together the resulting triplets until they match sentence patterns found in existing texts. The system works from the huge volumes of texts that are now available online in world languages. ISI researchers **Kevin Knight** and **Daniel Marcu** came up with a system that consistently ranks in the top two in the annual competitive trials carried on by

the National Institute of Science and Technology. (ISI's main rival is Google, whose language translation effort is directed by ISI alumnus **Franz Och**.)

Perhaps more important than translation is simply getting computers to understand ordinary human language, which, despite years of effort, has proven an even more daunting challenge than translation. ISI researchers are pursuing a range of ways to get computers to listen and talk. **Jerry Hobbs**, with longtime collaborator **Andrew Gordon**, is using a formal approach of finding basic patterns in the way language and thought is structured, and turning these into algorithms, which computers can parse. Their project is called "encoding common-sense knowledge."

**Hans Chalupsky** leads a parallel effort developing tools like PowerLoom, "a full-function, logic-based knowledge representation and reasoning system. It represents complex knowledge in a declarative, logic-based language; supports a variety of reasoning mechanisms to make implicit knowledge explicit; has a powerful query engine to retrieve what has been asserted and logically follows from the knowledge base."

## 1996

DARPA grants in natural language begin major ISI research focus, both in translating one language to another and in understanding and summarizing written texts. Research efforts lead to spin-off, Language Weaver and to translation software consistently ranked first or second internationally in yearly competitive trials.



**Carl Kesselman** of ISI begins long-running collaboration with Ian Foster of Argonne National Laboratories on Grid Computing, which allows physically separated researchers to share computational capacity and resources.

## 1997

ISI teams take first and third place in 1st RoboCup robotic soccer tournament in Nagoya, Japan, following earlier 2nd place finish by ISI-built "Yoda" robot in 20-robot Oregon competition.

## 1998

ISI researchers create electrochemical fabrication, EFAB, a novel way of "printing out" microstructures. Spin-off company MemGen, now MicroFabrica, established.

**Jon Postel** dies while holding major organizational responsibilities for the Internet, which are handed over to international organization, ICAAN.

## 1999

**Robert Neches** and **Pedro Szekely** begin development of first in a series of successful systems to help human decision-makers, ANT system to automate creation of fighter squadron operations. That system and follow-on systems are now in operational military use.



## 2000

Center for Advanced Research in Technology for Education (CARTE) established, pioneering research activity in childhood and college education, life-long learning and training, utilizing IT to tailor programs to individuals, pedagogical agents, drama-based learning environments and other tools.

## 2001



First generation of ISI modular robots, identical modules using "hormonal" software, which knit into different shapes, created by

**Wei-Min Shen** and **Peter Will**.

ISI hosts conference creating Digital Government Research Association, umbrella organization designed to help local and regional governments use information technology effectively.



ISI is bicoastal. Here, the staff at ISI East gather on their campus in Arlington, Virginia. ISI East Director Robert Parker is on the far right in the first row.

It's a big help to computers if a word or concept can be "tagged." Such a tag can help a machine decide if a "bug" is an insect or a German car.

**Kristina Lerman** is taking advantage of the explosion of social Web sites to extract useful tags in vast numbers, rather than laboriously assigning them one by one, as other researchers have tried. She has been mining big online photo Web sites where users label their photos with tags. And the versatile Hovy has a team that developed tools to analyze online student dialogs to see which students are being listened to by others, and which are ignored.

ISI also specializes in the field of "agents," virtual individuals that independently negotiate with each other. **Stacy Marsella** has pioneered giving such agents virtual emotions to both model human interaction and use inter-agent competition to "motivate" solutions to computational problems.

A parallel effort by **Yolanda Gil** and **Tim Chklovski** uses a different technique—try to get help from humans, including children to teach language to computers. One such project sent a green-eyed virtual robot called "Learner 2" into museums to interact with visitors, including children.

ISI researchers are also using developing new systems to help human students learn better, both from computers and from each other. **Jihie Kim** and **Erin Shaw** are working on the Pedagogical Discourse Project, which will work with students in distance education, including USC's DEN, to provide custom tools to help them get the most out of the resources available.

Perhaps the most outstanding recent success in AI for teaching came out of the ISI Center for Advanced Research for Technology in Education (CARTE), led by **W. Lewis Johnson**, which cre-

ated "Tactical Iraqi," a videogame that quickly helps military personnel heading for Iraq learn basic Arabic language and customs. It has been so successful that Johnson left ISI to create a full time start-up, Alelo, where Tactical Pushtun and sub-Saharan-African French are now in rapid development.

AI also powers robots. A decade ago, **Peter Will** and **Wei-Min Shen** began developing modular units that automatically knit themselves together into different shapes to perform a variety of functions—a real life technical analog of the TV's and film's "Transformers." Shen's talented student team also recently won first place in a competition at the world's largest robotics conference, defeating a team from MIT and four others. (See story on page 18.)



## Hardware

ISI is a major center for creating the prototypes for chips found in computers, robots and other electronics. MOSIS, the decades-old chip brokerage under the direction of **Cesar Piña**, aided by **Wes Hansford**, fulfills a critical national need. Chips are made on large blanks containing space for thousands of individual units. To create thousands of identical prototype chips would be economically crippling and unnecessary. MOSIS divides up the space to manufacture scores of different prototypes, spreading the cost for chip developers; giving academic researchers, and even students, opportunities; and realizing thousands of new designs.

Many of the chips created come from ISI designers. **John Granacki**, a chip design specialist working with two other ISI chip specialists, **Jeff LaCoss** and **Jeff Draper**, produced a flexible superchip called MONARCH.

It's "essentially a supercomputer on a chip," says Granacki, "and not just a supercomputer, but a flexible supercomputer that reconfigures itself into the optimal supercomputer for each specific part of a multi-part task."

Granacki also collaborates with **Ted Berger**, Viterbi professor of biomedical engineering, on chips designed to interface with human neurons and speak to them in their own timed-pulse language.

Chips that go into space are a special and expensive breed because they must be "hardened" against radiation. **John Damoulakis** has found an ingenious alternative—chips with redundant capacity that can heal themselves: When they sense damage, they automatically shift the workflow to undamaged areas.

Draper and LaCoss also collaborate with software architects like **Jacqueline**

**Chame** on new "processor in memory" (PIM) chips that speed up programming by creating a hybrid chip that can save the results of multiple cycles of activity on the chip itself, instead of writing to separate memory. ISI specialists also work on "Field Programmable Gate Arrays" (FPGAs), efficient but tricky-to-program flexible chips that can replace older systems. Using FPGAs to replace massive obsolete "legacy" systems on ship radar systems has become another ISI specialty, led by **Steve Crago** at ISI East. Two hardware researchers at ISI East, **Brian Schott** and **Mike Bajura**, designed and developed a basic sensor intercommunication apparatus.

In addition to robotics work, Peter Will has continued to pioneer in the highly active research area of micro-electromechanical systems (MEMS), which integrate silicon circuitry with mini-machines. This year, he created a MEMS system that folds up microscopic packages for drug delivery. (See story on page 19.)

## Space and Students, the Final Frontier

Will also helped to launch ISI's new space effort, the Aerospace and Technology Center, directed by **David Barnhart** and the Viterbi School's **Joseph Kunc**. There, with a large team of enthusiastic USC students, he's building a variety of mini-space exploration vehicles, all about six feet in diameter, some assembled from existing materials, some made from scratch.

"This is a remarkable range of activity," says Schorr. "And we'll be going on to new areas as we continue. Technology doesn't stand still; neither can we." //

## 2002

DIVA, advanced processor-in-memory chip designed at ISI, fabricated by MOSIS, excels in trials. At ISI East, a team demonstrates an effective way to replace obsolete legacy computer hardware with custom-tailored FPGA able to perform the same functions in 5 percent of the space, using 5 percent of the power.

ISI celebrates 30th anniversary with 325 staffers in two locations. Founding Director **Keith Uncapher** dies at age 80.

## 2003

Answering a challenge, a team of ISI researchers creates a Hindi-to-English translation system in less than a month.

DETER computer test bed established at ISI in partnership with UC Berkeley.

## 2004



An ISI ultra-simulation resource, able to visualize and model millions of vehicles moving across a continent-size landmass, is put in service for strategic planners and war-gamers.

## 2006

ISI creates successful medical information technologies, including "Neuroscholar" software designed to automate retrieval of research information from digital sources, and grid computing Medicus project designed to aid medical image sharing. Medicus wins numerous technology prizes.

ISI-developed Tactical Iraqi game system to teach soldiers basic Arabic and Iraqi customs begins regular use by Iraq-bound military personnel. ISI's **W. Lewis Johnson** leaves to start Alelo and continue development of other language versions. ISI alumni **Paul Mockapetris** and **Danny Cohen** elected to National Academy of Engineering in large part for research carried on at ISI.

## 2007

ISI researchers carry out first complete Internet census in 20 years.

## 2008

ISI researchers use "mini-origami" to fold up tiny drug delivery packets.





# A Global Software Entrepreneur

Dae-yeon Park's long journey began with his humble childhood origins in war-ravaged South Korea and led to his position as a global high-tech entrepreneur advancing his country's IT industry.





A 1996 Ph.D. graduate in computer science, he is the founder, chief executive officer and chief technical officer of TmaxSoft, a rapidly growing global software vendor. Although Park developed TmaxSoft's first product, "Tmax," by himself, he's quick to give credit to others for his company's success.

"The success of this business venture is largely attributable to a base of dedicated employees," he says. Since its founding in 1997, TmaxSoft has grown into the largest software developer in South Korea, with more than 1,800 employees and several dedicated R&D centers.

Park was born in Damyang, South Korea, while that country was still recovering from the devastation of the Korean War.

"This was a period of economic hardship, and as the eldest of six children, I had to make many sacrifices for the good of my family," he says. "In 1968, after completing my elementary education, I became a full-time messenger boy for a small shipping agency and continued my studies at night school."

Park graduated at the top of his class and was offered a job at a bank, a highly sought-after position in South Korea. He was able to support his family and finance his younger siblings' education. Soon after joining the bank, a personnel aptitude test placed Park on the information management team, where he learned information technology skills and developed a growing interest in computer science.

After his siblings completed their education, Park, then 32, knew he needed to supplement his self-taught IT skills with a formal university education, so he enrolled in computer science at the University of Oregon. There, he earned both B.S. and M.S. degrees in computer science.

"Studying overseas is very expensive, and I was plagued with health problems," he says. "But after two years, one of my professors recommended me for a scholarship program at USC, and I was able to complete my doctorate."

"I have fond memories of USC, which was very friendly to students like me from other countries. I played tennis at a USC tennis club and it made me happy and healthy. Sometimes they let me win," he says. "My advisor, Professor Rafael Saavedra, gave me a lot of guidance and support. He even visited me in Korea when I was starting my company."

Park returned to South Korea, where he accepted a position on the faculty of the acclaimed Korea Advanced Institute of Science and Technology (KAIST) as a professor of electrical engineering.

In 1997, while still working at KAIST, Park started TmaxSoft. He had the vision to create software for banks that would allow them to automate systems, engage in electronic processing and accommodate online banking over the Internet, which was a new concept at the time.

"Initially it was a struggle as we tried to build up a customer base," says Park. "But the company rapidly gained a reputation as a dedicated provider of high-quality enterprise

system solutions. TmaxSoft now provides a complete stack of enterprise system solutions—a feat that's virtually unique among the world's IT companies."

In the 11 years since it was founded, TmaxSoft has proven its ability to compete with the long-established international software giants in East Asia. TmaxSoft recorded \$90 million revenue in 2007, the most of all Korean software vendors.

The company has opened offices in China, Japan and the United States, and is planning to open more soon in Singapore, Russia, Brazil and the United Kingdom. TmaxSoft has customers in both industry and government, and its products focus on a variety of areas, including telecommunications, product distribution and manufacturing.



**"I have fond memories of USC, which was very friendly to students like me from other countries...my advisor, Professor Rafael Saavedra, gave me a lot of guidance and support. He even visited me in Korea when I was starting my company."**

"We've become well-known for legacy modernization solutions—helping large companies leverage their existing IT systems and introduce modern technologies," says Park.

In March 2007, Park stepped down from his faculty position at KAIST to devote full attention to TmaxSoft and advancing Korea's IT industry. Now, as both CEO and CTO of the company, Park is involved in all R&D projects at TmaxSoft, oversees domestic business and ensures that his company is an enticing prospect for young engineers looking for creative challenges.

He says the time he spent supporting his younger siblings in post-war South Korea has filled him with a deep sense of purpose and patriotism.

Park has received numerous awards from the government of South Korea, including the Silver Tower Industry Medal of Honor, the Ministry of Science and Technology Award, the Prime Minister's Award and the Ministry of Commerce and Industry Award.

"I want to build a better economic future for all of South Korea and raise the country's overall standard of living," says Park. "I can contribute to that goal by building TmaxSoft into a worldwide company." //



INITIATIVE  
CELEBRATION

# ‘Destination: The Fu

**GIFTS OF ALL SIZES—BIG AND SMALL—MADE THE DIFFERENCE**



Nearly seven years after the seeds of an ambitious fundraising initiative were planted—to build the Viterbi School’s endowment and position the school for world-class leadership in engineering education—“Destination: The Future” surpassed its goal of \$300 million this spring, three months earlier than its target date.

With a stronger foundation, the school is on the verge of charting new territory in several frontiers of engineering, from designing megacities to building a globally connected world via the Internet. None of that could have happened without strong leadership and a vision of the school’s preeminence in engineering education across the country. That, and a commitment to achieve the highest levels of scholarship.

ABOVE PHOTO: Erna and Andrew Viterbi



# ture' Hits Its Mark

## IN A SUCCESSFUL FUNDRAISING INITIATIVE

Viterbi's transformation is the result of a two-fold increase in the school's endowment. The changes are evident everywhere: in an elegantly designed Romanesque-style building, Tutor Hall, with its soaring two-story lobby and vibrant courtyard; in state-of-the-art research laboratories; in rising SAT scores among incoming freshmen; in the increase of faculty, National Academy of Engineering members and number of faculty awards. During the initiative, the school has partnered with other institutions to add two national research centers: the Biomimetic Micro-Electronic Systems Center, a National Science Foundation ERC, and the Center for Risk and Economic Analysis of Terrorism Events (CREATE), the nation's first research center awarded by the Department of Homeland Security. Those research centers are allowing faculty to compete for research at the forefront of scientific and technological change.

The initiative was launched by USC Provost C. L. Max Nikias, then dean of the Viterbi School, who said at the time that it "reflects the commitment of the school's faculty and leadership, and is a validation of the school's great potential to shape new technological frontiers." Nikias asked Mark Stevens (BSEE '81, MSCENG '84) and Daniel Epstein (BSISE '62), "two of the most able people I know," to co-chair the seven-year long effort. Shortly thereafter, legendary alumnus Andrew Viterbi and his wife, Erna, announced a naming gift, the largest ever given to name an existing engineering school, and the initiative gained momentum. Viterbi's \$52-million gift gave the school perhaps the proudest name in engineering—and an implicit charge to live up to its legacy.

Not only was the school named during the initiative, so were four departments, named by leaders in real estate, electrical engineering and the oil and gas industry.

Andrew J. and Erna Viterbi's \$52-million naming gift, announced on March 2, 2004, remains the largest gift ever bestowed on an American engineering school. In 2002, Daniel J. Epstein (BSISE '62), chair and founder of the ConAm Group of Companies, gave \$10 million to name the Industrial and Systems Engineering Department from which he earned his degree. In 2004, Mark Stevens (BSEE '81, MSCENG '84), a general partner in Sequoia Capital, gave \$22 million to create the USC Stevens Institute for Innovation.







Two major donors stepped forward in 2005: Ken Klein (BSBMEE '82), chief executive officer of Wind River, gave \$8 million to establish the Klein Institute for Undergraduate Engineering Life; John Mork (BSPTE '70), chief executive officer of Energy Corporation of America, gave \$15 million to name the Mork Family Department of Chemical Engineering and Materials Science.

In 2006, Ming Hsieh (BSEE '83, MSEE '84), chief executive officer of Cogent, Inc., gave \$35 million to name the Ming Hsieh Department of Electrical Engineering, the largest gift ever to name an engineering department nationwide. And last year, Sonny Astani (BSISE '78), chair of Astani Enterprises, gave \$17 million to name the Sonny Astani Department of Civil and Environmental Engineering.

That kind of generosity has led to improvements in every qualitative and quantitative measure of academic life at the Viterbi School. The growing size and stature of the faculty has positioned the school for remarkable breakthroughs across departments and disciplines. Presidential professor and benefactor Andrew Viterbi, who became a 2008 Millennium Prize Laureate earlier this year, is a shining example of the quality of faculty at the Viterbi School. In addition, the number of endowed chairs more than doubled

during the initiative period, giving the school 49 award-winning faculty now supported by endowment funds.

While the school continues to attract leading faculty, another transformation in the quality of students has been unfolding.

This year, enrollments at the undergraduate level are up again, by 10 percent, which stands as a testament to the Viterbi School's reputation and ability to attract some of the world's best undergraduates. SAT scores are up again—by 15 points. So are the numbers of women and underrepresented students. In retention, the return rate of second-year undergraduate engineering students jumped from 83 percent to 92 percent in three years, thanks to a number of new programs. They include the Freshman Academies, the Klein Institute for Undergraduate Engineering Life (KIUEL), Women in Engineering (WIE) and the Center for Engineering Diversity. These remarkable gains reflect the strength and quality of Viterbi's undergraduate programs.

For the first time, several new scholarships made possible by initiative funds went to Ph.D. students and top master's degree students, strengthening support for very talented students at the graduate level. And the school initiated agreements for partnerships with strong undergraduate domestic feeder schools.

Strong academic programs bolstered by endowment funds have also produced larger numbers of Ph.D. students, and that has had an impact on the school's academic reputation. For instance, the number of Ph.D. students graduated in 2001, at the start of the initiative, was 77. In May 2008, the Viterbi School graduated 150 Ph.D. students.

A new Division of Engineering Education was also formed as a result of the success of the initiative to inspire innovative changes in engineering education. And the school invested more than \$2 million in space renovations this last fiscal year—much of it dedicated to improving







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7



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undergraduate laboratory facilities, such as a new Undergraduate Nanotechnology Instructional Laboratory; a new Undergraduate Fabrication Laboratory (Fab Lab) that opened this spring for student design projects across the school; the renovation of the Microsatellite Systems Center; and the renovation of the Human-Centered Robotics Laboratory.

Industry-sponsored research continued to flourish—in partnerships with General Electric and Chevron, which supports Viterbi's novel Center for Interactive Smart Oil Field Technology (CiSOFT), and a partnership with the Pratt and Whitney Institute for Collaborative Engineering (PWICE). Two other new partnerships with Airbus and Korean Air, and with General Electric and Korean Air, were also established, as well as the recently announced research center with Infosys.

The Viterbi School also expanded its presence in the community, both locally and globally, with a more aggressive outreach and globalization program. Earlier this year, Shanghai Jiao Tong University placed Viterbi twelfth best in the world in engineering, technology and computer science programs.

Christopher J. Stoy, chief executive officer of the Viterbi School's Office of External Relations and architect of the initiative, stressed that it was not just large gifts, but small gifts, that propelled the school's remarkable success. A broad base of donor participation was key to surpassing the \$300-million goal and significantly increasing the school's endowment.

"We received nearly 25,000 gifts of all sizes from alumni, parents, friends, corporations and foundations, here and abroad, and they are all important," Stoy said. "At the beginning of the initiative we set a goal that half of the

funds would be for the endowment. In fact, two-thirds of the funds are earmarked for the school's endowment, which has doubled over the seven-year period."

Successful fundraising comes from "a keen assessment of the present and the future," said USC President Steven B. Sample. "For nearly two decades, I've watched the Viterbi School go from strength to strength. The drive and optimism

**"For nearly two decades, I've watched the Viterbi School go from strength to strength. The drive and optimism I see at the school are simply exhilarating."**

I see at the school are simply exhilarating, and this campaign offers ample testimony to that upward momentum."

"The success of this effort has already produced a profound effect on the school, the university and our community," Yortsos added. "It will enable the Viterbi School to serve its students, the engineering and research communities, the nation and the world. We owe a profound debt to the many donors who have put their faith and trust in us and we will all do our utmost to realize the vision they believe in so strongly."

Now that "Destination: The Future" has arrived, the school is looking forward to a new era of excellence, stimulated by this recent success. Going forward, USC's Viterbi School hopes to pursue more professorships, name more departments, build new facilities and continue to grow its endowment for future generations. //

ABOVE PHOTOS: 1. USC President Steven B. Sample thanks Sonny Astani, right, for his department naming gift. 2. USC Provost C. L. Max Nikias, former dean of the Viterbi School, left, holds up a #22 football jersey for Mark Stevens, who gave \$22 million to the school in 2004. 3. Andrew J. and Erna Viterbi, for whom the school is named. 4. L-R: USC Provost C. L. Max Nikias, former Viterbi School Dean Leonard Silverman and USC President Steven B. Sample applaud as Ronald Tutor, right, cuts the ribbon to open Tutor Hall. 5. C. L. Max Nikias, center, stands with initiative co-chairs Mark Stevens, right, and Daniel J. Epstein, left. 6. Daniel J. Epstein, whose gift named the Industrial and Systems Engineering Department. 7. Ken Klein, right, holds up a KIUEL t-shirt at a 2005 announcement ceremony of his gift; Dean Yannis C. Yortsos is at the podium. 8. Dean Yortsos, left, presents Sonny Astani and wife Jo with new departmental graphics. 9. Ming Hsieh, left, and USC President Steven Sample at Hsieh's gift announcement. 10. John Mork, third from left, and his family join Dean Yortsos, BOC Chair Dwight J. "Jim" Baum, far left, USC President Steven Sample and former Viterbi Dean C. L. Max Nikias for an announcement in 2005 of Mork's departmental naming gift.

# Smart Surfboards

**THAT WAS THE TWO-WORD CHALLENGE** in Professor Ed Maby's capstone class, a blend of electrical and mechanical engineering. Four teams, each with three weeks to develop a concept, then \$700 to finish their projects, used the Viterbi School's new Fab Lab. The results of their creations—"smart surfboards"—boasted features like electronic steering, built-in iPods and cell phone connections, and in-board displays showing wave shapes and recording rides. Judges from companies like Quiksilver were impressed by the on-campus demos. But then the waves beckoned, so they all went off to Manhattan Beach to hang 10s...oops, make that, digital, 1010s. //







## 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 35,000 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 e-mail forwarding, networking and attending annual events, such as Homecoming and the Viterbi Awards.

## Stay Connected

We rely on your accurate mailing and e-mailing 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.

## Viterbi Alumnus Named President of Korean University

INTERNATIONALLY KNOWN FOR HIS BRIDGE DECKS,  
SUNG WOO LEE TAKES HELM AT TOP UNIVERSITY IN SEOUL



Sung Woo Lee and Viterbi School's Jim Anderson celebrate with their wives.

Sung Woo Lee, a 1987 graduate of the Viterbi School, has been named president of Kookmin University, a major university and leader in information technology in South Korea.

Lee becomes the ninth president of Kookmin University, a 62-year-old institution with approximately 22,000 students and 400-plus faculty members in Seoul, South Korea. An international leader in composite bridge decks, Lee earned his B.S. degree in civil engineering from Seoul National University.

Following five years of service as an officer in the Korean Navy, Lee and his family came to USC, where he earned his master's degree and Ph.D. in civil engineering under the direction of James Anderson, professor of civil engineering in the Sonny

Astani Department of Civil and Environmental Engineering.

"Sung Woo was an outstanding student with a penchant for computers," said Anderson, who was invited to participate in Woo's inaugural ceremony in Seoul. "I regarded him as one of my best students, hardworking and determined to excel in his field."

After finishing his academic studies at USC, Lee accepted a position as professor at Kookmin University and later served as the dean of engineering prior to his election to the presidency from among 12 outstanding candidates.

Anderson said he was thrilled to give one of the inaugural speeches and to visit afterward with Lee. Following the ceremony, Anderson and his wife spent two days with Lee and his wife, visiting several historical sites in Seoul.





Others who knew Lee at USC, such as Farzad Naeim, vice president and general counsel at John A. Martin & Associates, Inc., were equally delighted to hear of his appointment.

"We do not often see one of our own advance to the rank of a major university president," said Naeim, who knew Lee in the mid-1980s when he was working on his doctorate. Lee went to work part-time for John A. Martin & Associate's research and development division, which was under Naeim's supervision. The team was involved in developing a new series of structural-design software systems that revolutionized the day-to-day practice of structural engineering in the office.

"Sung Woo was a breath of fresh air," Naeim said. "He was hardworking and dedicated, with a great sense of humor. I had no doubt then that he would become a successful engineer and a leader. The seeds of greatness were there already. //

## VITERBI ONLINE EDUCATION

### 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 [www.den.usc.edu](http://www.den.usc.edu) to see how to get started this spring semester.

# Engineering Me



**MY NAME:** Raymond Lowe

**HOME:** Culver City, California

**DEGREE:** 1984 BSEE, 1993 BSEMT

**JOB TITLE:** Director, Kaiser Permanente Information Technology

**LIFELONG DREAM:** To make a difference by helping other people

**FAVORITE VITERBI PROF:**  
Petros Iannou

**BOOK I'M READING:** *The Alexandria Link* by Steve Berry

**ON MY IPOD:** Kayne West's *Stronger*

**WORDS TO LIVE BY:** "It's not what or how you say it, it's about how you make people feel."

**ENGINEERING HERO:** Provost Max Nikias

**NEXT TRIP:** NYC and Caribbean Cruise

**BEST TIME OF DAY:** Morning

**FAVORITE GADGET:** Blackberry

**BEST USC MEMORY:** USC Football, E-Week and the Chariot Races

**TOUGHEST ENGINEERING CLASS:** Linear Algebra with Dr. Solomon Golomb

**NUMBER ONE URL:** [www.yahoo.com](http://www.yahoo.com)

**NUMBER OF TROJANS IN MY LIFE:** Hundreds

**PROUDEST MOMENT:** Becoming a dad (twice) Rachael '91, Jacquie '93

**BIGGEST CHALLENGE:** Work-life balance—having a successful career and a happy family

**INSPIRATION:** "Success is not the key to happiness. Happiness is the key to success. If you love what you are doing, you will be successful." —Albert Schweitzer

## Me...Engineered



## Philip Hammond's Rare Career

A TROJAN ENGINEER'S LIFETIME OF WORK IN NUCLEAR POWER RESONATES IN TODAY'S GLOBAL ENERGY CRISIS



Hammond as a young man.

Philip Hammond's interest in rare earth metals led to a rare career. Now, global shortages of food, water and electric power make his work timelier than ever.

"I was a grad student at the University of Chicago and worked with Enrico Fermi on the Manhattan Project," says Hammond. "I helped grind the uranium for the first atomic pile."

But before he got to Chicago and the Manhattan Project, Hammond was a Trojan who received his B.S. in chemical engineering in 1938. He worked for Dean Robert E. Vivian, who came to USC as acting dean in 1937, when Hammond was a junior.

"His arrival was like the sun coming up. He outshone them all because he had industry experience," Hammond said about Vivian, who would become a life-long friend. Hammond worked for Vivian as a student assistant and stayed in touch with him after he had graduated.

"I needed money to live on and my first job at USC was teaching a laboratory class," he says, laughing. "I had an old lab

coat with acid stains on it from high school. It was a mantle of authority. Some of the students called me 'Dr. Hammond,' even though I was a freshman."

After graduation, he became chief chemist for Lindsay Chemical Company in West Chicago, where he continued to work while studying nights at the University of Chicago. Hammond investigated rare earth metals—a group of 17 elements clustered together in the periodic table that have many common properties—to see if any might exhibit properties similar to uranium. He received his Ph.D. in physical chemistry in 1947 and went to work at Los Alamos Laboratory.

Initially, he worked on nuclear weapons, specifically making lanthanum 140, a highly radioactive isotope formed by radioactive decay of barium 140, doing chemistry by remote control.

"Very remote," he emphasizes.

But Hammond's interest quickly turned to peaceful uses of nuclear power. His crew built and operated four experimental reactors using different kinds of fuel. They learned by doing since no one had ever built a reactor before.

"We were trying to design a nuclear power plant to compete with coal," he said. "The utilities wanted a 350 megawatt

plant, but when I studied the economics of scale I saw that it would have to be larger, 450 megawatts or 500 megawatts."

Hammond remains a firm believer in nuclear power, seeing it as an economical clean source of energy that won't damage the climate. He believes that efforts to remove all risk from the plants resulted in over-designed and overly expensive plants.

"There's really not much to it. You have a tank of uranium and a cooling system," he says. "You can develop a containment shield that will withstand a complete meltdown of the fuel. Spent fuel should be reprocessed, made back into metal rods and used again. The rest of the world is doing that. After two years, a reactor only uses 4 percent of the power available from the uranium, but we consider it nuclear waste."

In 1960, Hammond went to Oak Ridge National Laboratory, where he became director of the nuclear desalinization program with 250 engineers working for him. Coupling power production with desalinization is attractive, but also presented new technical challenges. Seawater is corrosive and forms a scale of calcium sulfate and calcium carbonate on metal pipes when it evaporates. Power requires high-temperature steam, while low-temperature steam reduces scaling during desalinization.

"You heat the seawater in a vacuum," he says. "We also found out that aluminum alloys scaled a lot less."

Hammond represented the United States at a series of international conferences discussing peaceful uses of nuclear energy. A trip to India convinced him that nuclear plants integrated to produce both power and fresh water could help expand agriculture, provide electricity and new jobs in impoverished arid coastal zones of the world, such as India, Mexico or the Middle East.



Hammond at home in Laguna Hills.





After retiring, he led an international team at the Metropolitan Water District to develop a breakthrough efficient system for distilling fresh water from the sea. The plan was to build a planted power by natural gas but in the end, the district decided to increase water imports.

"With our achievements in desalinization, efficient agriculture and nuclear power, it is now clear that the food-producing ability of the earth is not limited by technology," he concludes. "Over a billion people live in hopeless poverty; and without hope, terrorism is an easy choice. Yet small investments by the rich countries in energy supply and clean water will create self-supporting communities with purchasing power. The war on terror is really a war on poverty."

Hammond, now 92 years old, is the author of more than 100 technical articles and the holder of 42 patents. He lives in Laguna Hills. //

## VITERBI CAREER SERVICES

If you're interested in becoming involved in hiring current Viterbi engineers, or would like to know where to start for Alumni Career Services, please visit: [viterbi.usc.edu/students/undergrad/careers/alumni/](http://viterbi.usc.edu/students/undergrad/careers/alumni/).

Or visit the Career Services Office

3710 S. McClintock Avenue  
Ronald Tutor Hall (RTH) 218  
Los Angeles, CA 90089-2900  
Phone (213) 740-9677  
Fax (213) 740-9586  
[viterbi.careers@usc.edu](mailto:viterbi.careers@usc.edu)

# Engineering Me



**MY NAME:** Devon Shay

**HOME:** Orange County, California

**DEGREE:** B.S. Mechanical Engineering (Petroleum Engineering), 1997, M.S. Petroleum Engineering, 2003

**JOB TITLE:** Reservoir engineer & CPA

**LIFELONG DREAM:** To see the world

**FAVORITE VITERBI PROF:** Dr. Elmer Dougherty

**BOOK I'M READING:** *The Princes of Ireland—The Dublin Saga*

**ON MY IPOD:** Lyle Lovett & Frank Sinatra

**WORDS TO LIVE BY:** "Always give your best, never get discouraged, never be petty; always remember, others may hate you, but those who hate you don't win unless you hate them, and then you destroy yourself." — Richard Nixon, 1974

**ENGINEERING HERO:** My grandfather, a USC Petroleum Engineering Grad and member of the 1942 NCAA National Championship Hockey Team

**NEXT TRIP:** Nuremberg to Vienna via boat

**BEST TIME OF DAY:** Early morning

**FAVORITE GADGET:** Our automatic Jura Espresso machine

**BEST USC MEMORY:** There are so many great memories, but the No. 1 moment would be my undergraduate graduation ceremony—seeing everyone excited about what the future holds for them

**TOUGHEST ENGINEERING CLASS:** Physics I & II

**NUMBER ONE URL:** [www.lonelyplanet.com](http://www.lonelyplanet.com)

**NUMBER OF TROJANS IN MY LIFE:** Too many to count—husband, mom, sister, friends, businesses associates, clients

**PROUDEST MOMENT:** Graduating with my master's alongside my sister

**BIGGEST CHALLENGE:** Obtaining appointment to the Air Force Academy and then attending USC instead

**INSPIRATION:** My family

## Me...Engineered



## V Needs U

### PREVIEW DAY

Help us out! The Master's and Professional Programs office is hosting its annual Preview Day for prospective Master's students. Alumni are needed to join us in our efforts to recruit top engineering students across the country. If you're interested in being a guest speaker or meeting students one-on-one at this event, please contact Camillia Lee, director of Graduate Recruitment and Marketing, at [camillil@usc.edu](mailto:camillil@usc.edu). Or learn more about volunteer opportunities at [viterbi.usc.edu/mapp/getinvolved](http://viterbi.usc.edu/mapp/getinvolved).

### VITERBI INTERNATIONAL REPRESENTATIVES

The Viterbi School is going global. In addition to searching for Viterbi Alumni worldwide, we are looking for international alumni leaders in major cities to represent the Viterbi School in various regions. Help us engage and connect Viterbi Alumni, plan events and programs in your area and keep the connection with the Viterbi School.

If you are interested in participating or would like to recommend someone who would make a great international representative, please contact the VSoE Alumni Office: [viterbi.alumni@usc.edu](mailto:viterbi.alumni@usc.edu) or (213) 821-2424.

### VITERBI SCHOOL CLASS CORRESPONDENTS

The Viterbi School is looking for special "Class Correspondents" (one from each graduating year) to act as the key liaison between fellow alumni graduates and the Viterbi School. These representatives will work closely with the Viterbi School alumni office on involving their class with signature events and programs and will help our office keep the connection with alumni by alerting us to classmates' career paths, marriages, births and other exciting life news!

If you're looking to be more connected to the Viterbi School and your fellow alumni, this is the job for you! For more information on how to become a "Class Correspondent," please contact the VSoE Alumni Office: [viterbi.alumni@usc.edu](mailto:viterbi.alumni@usc.edu) or (213) 821-2424.

### Women in Engineering Office (WIE)

The Women in Engineering Office offers professional, academic and social services to the women of the Viterbi School. The goal of the Viterbi WIE Office is to recognize the unique challenges that face female engineering students, provide resources and overall support that will address these challenges, and allow our female students to find personal and professional success during their Viterbi career and beyond. Visit the WIE website to learn more: [viterbi.usc.edu/wie](http://viterbi.usc.edu/wie).

### VITERBI WOMAN OF THE WEEK

Viterbi's Woman of the Week series highlights one outstanding female engineer—student, faculty member or alumna—each week to the entire Viterbi community. We encourage all alumnae to nominate a current undergraduate student, fellow alumna, or yourself! To nominate a Viterbi Woman of the Week, click the "vWow" link on our Web site at [viterbi.usc.edu/wie](http://viterbi.usc.edu/wie).

### VITERBI ALUMNI EVENING IN TAIPEI

On March 17, 2008, the USC Viterbi School of Engineering hosted a Viterbi Alumni Evening in Taipei at the Taipei World Trade Center Club. Attended by more than 75 alumni and guests, the dinner was hosted by **Dean Yannis C. Yortsos** and featured special guest and parent **Stan Shih**, Acer founder and chairman of iD SoftCapital Group.







## Viterbi Career Services

### UNDERGRADUATE CAREER CONFERENCE Saturday, September 27, 2008

The Engineering Career Conference is offered each fall to undergraduate engineers. This one-day event, coordinated by Viterbi Career Services and the Center for Engineering Diversity, brings alumni and industry representatives on campus to present workshops on various career-related topics, conduct mock interviews and provide resume critiques. The Conference provides students with valuable skills and strategies, which they can then apply to the job search process, and is entirely dependent on corporate sponsorship and volunteers.

If you're interested in becoming involved with the Career Conference, or would like further information on becoming an event sponsor, please contact Viterbi Career Services at (213) 740-9677 or [viterbi.careers@usc.edu](mailto:viterbi.careers@usc.edu).

### FALL 2008 ENGINEERING CAREER FAIR Thursday, October 9, 2008

The Engineering Career Fair provides an excellent opportunity to increase your company's visibility among our top engineering students. The Engineering Career Fair is attended by 100-plus top engineering employers and approximately 1,700 to 2,200 of our students.

Register at [viterbi.usc.edu/careers!](http://viterbi.usc.edu/careers!)

## Engineering Me



**MY NAME:** Apoorva M. Bhatt

**HOME:** Bangalore, India

**DEGREE:** M.S., Computer Science, 1996

**JOB TITLE:** Vice President & Managing Director, Arada Systems

**LIFELONG DREAM:** Encourage, promote and pursue innovation

**FAVORITE VITERBI PROF:** Professor Horowitz

**BOOK I'M READING:** *Lucy—The Beginnings of Humankind*

**ON MY IPOD:** Nirvana

**WORDS TO LIVE BY:** Be the change you want to bring

**ENGINEERING HEROES:** The Wright Brothers

**NEXT TRIP:** Europe

**BEST TIME OF DAY:** Before office hours (Zero Hours):  
I get a lot done!

**FAVORITE GADGET:** iPhone

**BEST USC MEMORY:** Working at Waite Phillips Hall's user room

**TOUGHEST ENGINEERING CLASS:** Control Systems

**NUMBER ONE URL:** [www.economist.com](http://www.economist.com)

**NUMBER OF TROJANS IN MY LIFE:** 15

**PROUDEST MOMENT:** The day when I launched Arada Systems!

**BIGGEST CHALLENGE:** Spiritual and intellectual motivation  
in what I believe

**INSPIRATION:** Common man

## Me...Engineered

Visit our website today  
to update your information:  
[viterbi.usc.edu/alumni](http://viterbi.usc.edu/alumni)



## School Honors Industry Leaders at Viterbi Awards

BANQUET SALUTES RAMO, SOON-SHIONG AND CROTHALL



USC President Steven B. Sample and Viterbi School Dean Yanniss C. Yortsos present Ramo with the Lifetime Achievement Award.

The Viterbi School celebrated a legend in the field of microwave communications—**Simon Ramo**—and outstanding professionals from industry and USC at its 30th annual Viterbi Awards Banquet, held in May at the Beverly Wilshire Hotel.

Viterbi School Dean Yanniss C. Yortsos presided over the dinner, which began with a toast to the guests for success and good fortune. Yortsos and USC President Steven B. Sample later presented Ramo, co-founder of TRW, with a Lifetime Achievement Award for his many contributions to defense electronics.

**Ramo's** career spans 70 years and several areas of endeavor. As a scientist and engineer, he obtained the Ph.D. degree magna cum laude from the California Institute of Technology at age 23, then joined General Electric as a research scientist. He achieved world recognition as a pioneer in microwaves, which are extremely high radio frequencies fundamental to radar and advanced communications, and developed GE's electron microscope. Before age 30, he had accumulated 25 patents, was made a fellow of the American Physical Society and several other major professional societies, and



Dean Yortsos and Patrick Soon-Shiong.

was voted one of America's "most outstanding young electrical engineers."

Ramo became one of the nation's top experts in guided missiles, first as the director of the Falcon guided missile program for air defense and later as the chief scientist for the nation's Intercontinental Ballistic Missile Program. As the leading civilian contributor to this "largest single program in the country's history," he was awarded a special citation of honor by the Air Force.

Celebrating his 95th birthday, Ramo was presented with a large birthday cake after dinner. Others sitting near enough to watch him blow out the candle included Andrew J. Viterbi and his wife, Erna; USC Provost C. L. Max Nikias, and his wife, Niki; Jay Kear, a member of the Viterbi School Board of Councilors (BOC); Dwight J. "Jim" Baum, chair of the BOC; USC Trustee Flora Thornton; and Anthony Lazzaro, former senior vice president of business affairs at USC.





A surprise birthday cake for Ramo and his wife.



Dean Yortsos and Katherine Crothall (BSEE '71, PhDEE '76).

**Patrick Soon-Shiong, M.D.**, founder, chairman and CEO of Abraxis Bioscience, LLC, was awarded the Daniel J. Epstein Management Award for his industry leadership and exemplary professional accomplishments and contributions to the field of engineering management.

Soon-Shiong is a noted scientist, physician and surgeon, and has devoted his career to developing next-generation technology to enhance the medical care of patients with life-threatening diseases, including cancer, diabetes and heart disease.

He performed the world's first encapsulated islet transplant in a diabetic patient and developed the nanoparticle-delivery technology upon which the cremophor-free form of paclitaxel compound, known as ABRAXANE, is based. The FDA approved ABRAXANE in January 2005 for treatment of advanced stage metastatic breast cancer, and it is being developed for lung and melanoma cancers.

**Katherine Crothall** (BSEE '71, PhDEE '76), a principal of Liberty

Venture Partners, was awarded the Mark A. Stevens Distinguished Alumni Award. The award, established in 1978 in tandem with the USC Viterbi School of Engineering Awards, is presented to a Viterbi alumnus and industry leader in recognition of her/his exemplary professional accomplishments and contributions to the field of engineering.

Prior to joining Liberty Venture Partners, a venture fund focused primarily on health care, Crothall was founder, president and chief executive officer of

Animas Corporation, a leading manufacturer of insulin infusion pumps. Before that, she was founder and CEO of two other successful medical technology companies.

Crothall holds more than 20 patents and has been the recipient of several professional awards, including Greater Philadelphia Ernst & Young Entrepreneur of the Year Award (in 2003) and the Raymond Rafferty Entrepreneurial Excellence Award (in 2004). //

## THE VITERBI SOCIETY

Trojan engineers have a long and proud history of supporting the school and future classes of engineering students. You can continue this important legacy by joining the Viterbi Society, the premier academic support organization for the Viterbi School.

As a Viterbi Society member, you'll have many opportunities to enjoy your lifelong connection to the Trojan Family. You'll also enjoy the member privileges and courtesies reserved exclusively for Viterbi Society members. Most importantly, you will be investing in the future of the Viterbi School, while surrounding yourself with alumni and friends who, like you, care deeply about engineering excellence and innovation at USC.

For more information and a list of membership benefits, contact us at **(213) 740-2502** or **viterbi.giving@usc.edu**.



## Class Notes

Viterbi Class Notes are a great way to catch up with your former classmates. If you want to share your news and photos with the USC Viterbi community, visit [viterbi.usc.edu/alumni/classnotes](http://viterbi.usc.edu/alumni/classnotes) and fill us in.



Gerard DeLong '63

Henry '86 and  
Shirley '86 Chen

Derek Yeung '93

**56** *William Blaine Goeckler* (MSEE) writes: "After graduation in 1956, I went on active duty in the Air Force. After 18 months, I took an early out offer and continued the same work as a civilian employee. In 1963, I transferred to NASA at the Manned Spacecraft Center, now the Johnson Spacecraft Center. I spent the remainder of my career there, working on crew-training equipment development and flight-planning staff work on the Apollo and Space Shuttle programs. I retired at the end of 1987. My wife, Mary, and I live in Seabrook, Texas, in the same house for the past 44 years. We have a daughter and a son and three grandchildren. We enjoy traveling, including Elderhostels, as well as sailing and bridge. We recently retired a motor home in which we had spent more than 800 nights. We stay busy with volunteer, church and social activities."

**63** *Gerard DeLong* (MSAE) writes: "Following graduation, I spent 12 years in aerospace engineering, then changed course and became an investment

broker and financial planner. I now own Las Cruces Investment Center in beautiful Las Cruces, N.M., and enjoy helping people meet their financial goals. I'm a Registered Principal with LPL Financial and recently earned the Registered Financial Consultant (RFC) designation. I guess education will always be an important part of my life. I'm married and have three sons (plus many grandchildren) still in the Southern California area. I'm an avid USC sports fan and plan to make it to a homecoming game soon!"

**79** *David Padgett* (MSSM) joined Alion Science & Technology as Sr. Logistics Analyst in January 2008, as an Army contractor for the Logistics Modernization Program (LMP), with primary duties at Crane Army Ammunition Activity, Crane, Ind. He lives with his wife, Deborah, in Bloomington, Ind.

**86** *Henry Chang* (BSME and MSMTE), and *Shirley Chen Chang* (BSBA) are happy to announce the birth of their son, Matthew Enrique, on December 14, 2007. The family lives in Montebello, Calif.

**93** *Derek Yeung* (MSEE) writes: "I always take pride to be a part of this big Trojan family. Since my graduation, I've worked as an engineer in various positions at a number of companies. I'm involved

in various projects, ranging from chip design to large system architecture. After 13 years of practicing electrical engineering, I shifted my interest to the practice of law, in particular, patent law. It all began with a patent seminar I attended as an engineer. Instead of creating intellectual property, I grew more interested in learning ways to help others protect theirs. After enduring four years of evening law school while working full time as an engineer, here I am, a USC-trained engineer taking on a new role as a patent attorney."

**98** In 2007, *Sanjay Krishnan* (MSEE) moved to the Bay Area to manage a product line at Maxim Integrated Products. He's also enrolled in the M.B.A. program at the Haas School of Business, University of California, Berkeley. He's currently interested in the future of the semiconductor industry.

**01** *Garrett Pendergraft* (BSCSCI) writes: "After graduating from USC in 2001, I spent three years working in visual effects with Rhythm & Hues Studios. I then decided to pursue a career change, and have been in graduate school for philosophy ever since. I am currently getting my Ph.D. at the University of California, Riverside, and hope to be out in the job market in the fall of 2009 or 2010. I was married to Amy (Congo) in 2002, and we have two children: our daughter Sage, born in September 2005, and our son Curran, born in January 2008."





## 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/](http://viterbi.usc.edu/viterbistore/) to purchase your Viterbi items today!

**02** *Julie Hjorth* (BSCECS) and Chris Hjorth (BSCHE, MSCHE) had a daughter on December 27, 2007. She'll be attending Viterbi Engineering in 2026. No word yet on whether she'll attend as a computer engineer or a chemical engineer.

**07** *Ralph Basilio* (MSAE, PhDAE) of the Jet Propulsion Laboratory, California Institute of Technology, is the deputy project manager of the Ocean Surface Topography Mission (OSTM) and of the Orbiting Carbon Observatory (OCO). The OSTM/Jason-2 spacecraft launched June 15, 2008, from Vandenberg Air Force Base (VAFB), Calif. The mission will serve to extend the global sea surface data record first established by the TOPEX/Poseidon spacecraft more than a decade and a half ago. The OCO spacecraft launch is scheduled for December 15, 2008, also from VAFB, and will provide the first global view of regional scale sources and sinks of carbon dioxide—a major anthropogenic gas. //

## INTERNATIONAL ALUMNI

Where in the world are our international alumni? Can you help us find these fellow engineers? You can email us names, spread the word to your friends and family and update your information online. To help, please contact us: VSoE Office of Alumni Relations at (213) 821-2424 or online [viterbi.usc.edu/alumni](http://viterbi.usc.edu/alumni).

# Calendar of Events

## VITERBI EVENTS

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

### Engineering Career Conference\*

Saturday, September 27, 2008  
USC Campus

### Fall Engineering Career Fair\*

Thursday, October 9, 2008  
USC Campus

### USC Homecoming 2008— Annual Viterbi Reunion Picnic

November 1, 2008  
USC Campus

### Viterbi Bay Area Alumni Reception

November 14, 2008  
Silicon Valley, California

### Regional Networking Events

Ongoing  
Los Angeles, Orange County,  
San Diego, San Francisco

\*These student events have an alumni component—see volunteer section on page 52 for more information.

## USC EVENTS

### Fall Semester Classes Begin

August 25, 2008

### Home Football USC vs. Ohio State

September 13, 2008

### Home Football USC vs. Oregon

October 4, 2008

### Trojan Parents Weekend

October 10-12, 2008

### Home Football USC vs. Arizona State

October 11, 2008

### Home Football USC vs. Washington

November 1, 2008

### Home Football USC vs. California

November 8, 2008

### Home Football USC vs. Notre Dame

November 29, 2008

### Spring Semester Classes Begin

January 12, 2009

### Commencement

May 15, 2009

Visit our website for  
the latest information:  
[viterbi.usc.edu/alumni](http://viterbi.usc.edu/alumni)



## In Memoriam



**Roy G. Johnston**, (BSCE '35), a structural engineer who helped to shape the Los Angeles skyline and to develop the seismic requirements in building codes, died recently at the age of 88.

A founding partner of the structural and civil engineering firm, Brandow & Johnston, Inc., he practiced the profession he loved for 67 years before retiring in 2002.

Johnston attended USC during the Depression on an alumni scholarship. In 1945, he joined forces with George E. Brandow, a fellow Trojan, to found a firm that went on to design the infrastructure of more than 20,000 building projects throughout Southern California. The firm's work included high-rise office buildings, hospitals, convention centers, universities, airports, schools and industrial facilities. Most notable in the 1940s was the Los Angeles County Courthouse and Administration Building; and in the 1950s, the Los Angeles Sports Arena, the California Bank—which was the first building to surpass a 12-story height limit—and the Superior Oil building, which was the first all-welded structural steel building in Los Angeles.

In the 1960s, Brandow & Johnston designed the TransAmerica Tower, the University of California, Irvine campus, the Lockheed L-1011 Palmdale facility and much of the modern USC campus, with work continuing up to the present.

Johnston was dedicated to the advancement of structural engineering, especially the seismic design of buildings in support of earthquake safety. Among his many professional accomplishments and affiliations, he was a member of the National Academy of Engineering (NAE) and a consultant to the National Science Foundation (NSF); president of the Structural Engineers of Southern California (SESC) in the early 1960s and, subsequently, president of the statewide chapter; a director of the Earthquake Engineering Research Institute (EERI) from 1979 to 1981; and part of the U.S. EERI delegation that went to mainland China in 1980 as a guest of the Chinese government.

Throughout his life, Johnston served as a "mentor, inspiration and role model for many engineers," and in 1982,

won the USC Engineering Alumnus Award for Outstanding Achievement. In 1985, he was named the Institute for the Advancement of Engineering's Southern California Engineer of the Year, and the Structural Engineering Association of Southern California's Engineer of the Year in 1990. In 2000, the Institute for the Advancement of Engineering presented Johnston with its Lifetime Achievement Award, the only time this award has been given. //



**Ahmed M. Abdel-Ghaffar**, an internationally known civil engineering professor at the Viterbi School of Engineering, died recently after a long illness.

Abdel-Ghaffar specialized in the design and monitoring of long-span flexible bridges, which led to the development of more structurally sound and reliable designs.

His 1974 investigation of the Vincent Thomas Bridge in Los Angeles, conducted while he was studying at Caltech, led to new standards on how to collect, analyze and interpret structural dynamic measurements from complex, three-dimensional, extended structures. Abdel-Ghaffar's investigation involved streaming data from monitors placed along key parts of a bridge and measuring low-level vibrations coming from forces, such as wind and traffic, to determine the stability of a structure.

His data-measurement techniques led to the development of high-fidelity computational tools that were used to design more reliable structures able to resist action from earthquake ground motion. The California Department of Transportation (Caltrans) used Abdel-Ghaffar's computer program when it embarked on a major retrofit of the Vincent Thomas Bridge; Abdel-Ghaffar served as a consultant on the project to determine the damping characteristics of the bridge.

"Professor Abdel-Ghaffar's excellence and innovation in the area of long-span bridges was known internationally and he was much beloved by his students," says Yannis C. Yortsos, dean of the Viterbi School. "He will be greatly missed by all of his colleagues here and around the world."





"Building tall bridges that would span vast geographic divides and withstand great earthquakes was Ahmed Abdel-Ghaffar's passion," says Jean-Pierre Bardet, chair of the USC Sonny Astani Department of Civil and Environmental Engineering, where Abdel-Ghaffar was on the faculty. "Ahmed was a gentleman engineer and a dedicated educator."

Abdel-Ghaffar also made major contributions to understanding and analyzing the behavior of structures when they interact with soil during an earthquake. He was among the pioneers who conducted forced-vibration experiments on the Santa Felicia Earth Dam and interpreted its recorded seismic and dynamic response.

A native of Egypt, Abdel-Ghaffar came to Caltech from Cairo in 1972, earning his master's degree in civil engineering in 1973 and Ph.D. with an emphasis on structural dynamics and earthquake engineering in 1976. His reputation at Cairo University as one of the most intelligent and attentive young lecturers led other aspiring Egyptian researchers to follow him to the United States. //



**Sarah Condiotti** (MSCSCI '90) passed away on April 13, 2008, two days after her 41st birthday, after a yearlong battle with cancer.

After graduation, she worked for Bellcore (now Telcordia) in New Jersey, obtained an M.B.A., and consulted for EDS, the Sydney Futures Exchange and Westpac Bank in Australia, before starting her own training company.

Most recently, she consulted for G. X. Clarke & Co., a bond dealer in Jersey City. She leaves a husband, James Mannix, of Matawan, N.J. //



**Naseeb M. Saliba**, co-founder with USC Trustee Ronald N. Tutor of Tutor-Saliba Co., died of a heart ailment on May 22, 2008, at Encino-Tarzana Regional Medical Center in Encino. He was 93.

Saliba, who ran his own successful construction company until 1956, came out of retirement to found Tutor-Saliba in 1971 with Tutor. The pair built a construction company that later moved into the top 400 U.S. general contractors.

"Everyone assumed because I was 30 years younger that I was the risk-taker and he was the calming influence. It was the opposite," said Tutor, president and chief executive officer of Tutor-Saliba. "He was a very kind, very good man who feared nothing in the business world. He was always ready to take on risks, no matter what the magnitude."

Tutor-Saliba, based in Sylmar, Calif., has built major infrastructure projects and public buildings, including a large portion of the Alameda Corridor, the Los Angeles Metro Rail system, the San Diego Convention Center and the International Terminal at San Francisco International Airport.

Saliba is survived by two daughters, Janet Saliba and Debra Leeper; a brother, Leon; three grandchildren and two great-grandchildren. //

*Visit our website for the latest Viterbi news:*

**viterbi.usc.edu**

## Q&A with Kate Baxter

*Kate Baxter is director of Student Support Programs and the Women in Engineering program office at the USC Viterbi School.*

### **The Viterbi School** boasts a 25% female undergraduate population compared to the 17% national average. What more does the Women in Engineering Office (WIE) need to do?

We must support our current students and encourage younger girls interested in engineering to apply and be successful at Viterbi. WIE is geared towards helping female students navigate their academics, their leadership and social commitments and have a successful undergraduate experience. As an underrepresented group, women benefit from this additional support and future female engineers see the WIE Office as a comforting resource. Not every woman is meant to be an engineer, but I'll be happy when every woman who wants to be an engineer finds it a viable career opportunity.

### **What does the WIE program offer?**

WIE supports our current undergraduate women, and introduces younger girls to the concept of engineering. WIE Connect is an outreach program held at USC where our undergraduate women lead high school girls in a range of activities, such as Engineering 101 and Engineering Adventures. These high school girls start understanding what engineering is and our undergraduate women build their leadership and mentoring skills. WIE also connects undergraduate women with Viterbi alumnae and industry contacts for networking opportunities. This past year, WIE implemented the "Viterbi Woman of the Week," where a female student, faculty or alumna is showcased for her unique talents and contributions to the community. When women come to Viterbi or other engineering schools, they find fewer female classmates, fewer female faculty and fewer female role models. WIE provides a place to connect them to other women in similar situations, creating a cohesive, supportive community.

### **Are today's students different than students in the past?**

They're extremely bright and looking for a holistic college experience—football, minors in music or art, service and leadership opportunities. Viterbi is working to match their interests with exciting programs such as SHOWCASE, an art exhibit highlighting our students' creative talents. We need to provide these high quality students with dynamic, innovative educational programs.

### **Why do many engineering programs have difficulty retaining students?**

Freshmen often choose engineering without fully understanding what it entails. Engineering is rigorous and, typically, the first year is heavy with math and physics requirements. Students expect much more interactive and "fun" activities. At USC, the Freshman Academies include this component. Last year, students built trebuchets, walked on water and held an Engineering Olympics. Many of the introductory courses now include hands-on projects. We also invite accomplished engineers to speak and share their experiences so students see the real world applications of what they learn in the classroom.

### **What accounts for the 83% to 92% climb in engineering freshman return rates over the past three years?**

With the First Year Excellence Program, we now have a comprehensive communication loop to monitor student progress from orientation through their first year. All freshmen are advised through the Viterbi student affairs office and enroll in the Freshman Academy, a course taught by senior faculty with two "academy coaches"—upper division student mentors. We also work closely with the academic advisors in each of the departments in monitoring student progress after the first year. The Viterbi Academic Resource Center provides free peer tutoring, supplemental instruction and a study lounge. We study the patterns then design programs to best serve our students.

### **Are there other factors?**

Yes, definitely. Ronald Tutor Hall has become a central hub for student life, which has helped build an even stronger community feel for our undergraduates. Career Services and targeted programming within the Center for Engineering Diversity, the Women in Engineering Office and the Klein Institute for Undergraduate Engineering Life (KIUEL) program have also created many unique and interesting programs for students. These areas provide opportunities ranging from leadership development, networking, mentoring and service-learning projects. We have a broad array of activities going on throughout the year to help students make friends and find a sense of community at Viterbi. //





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