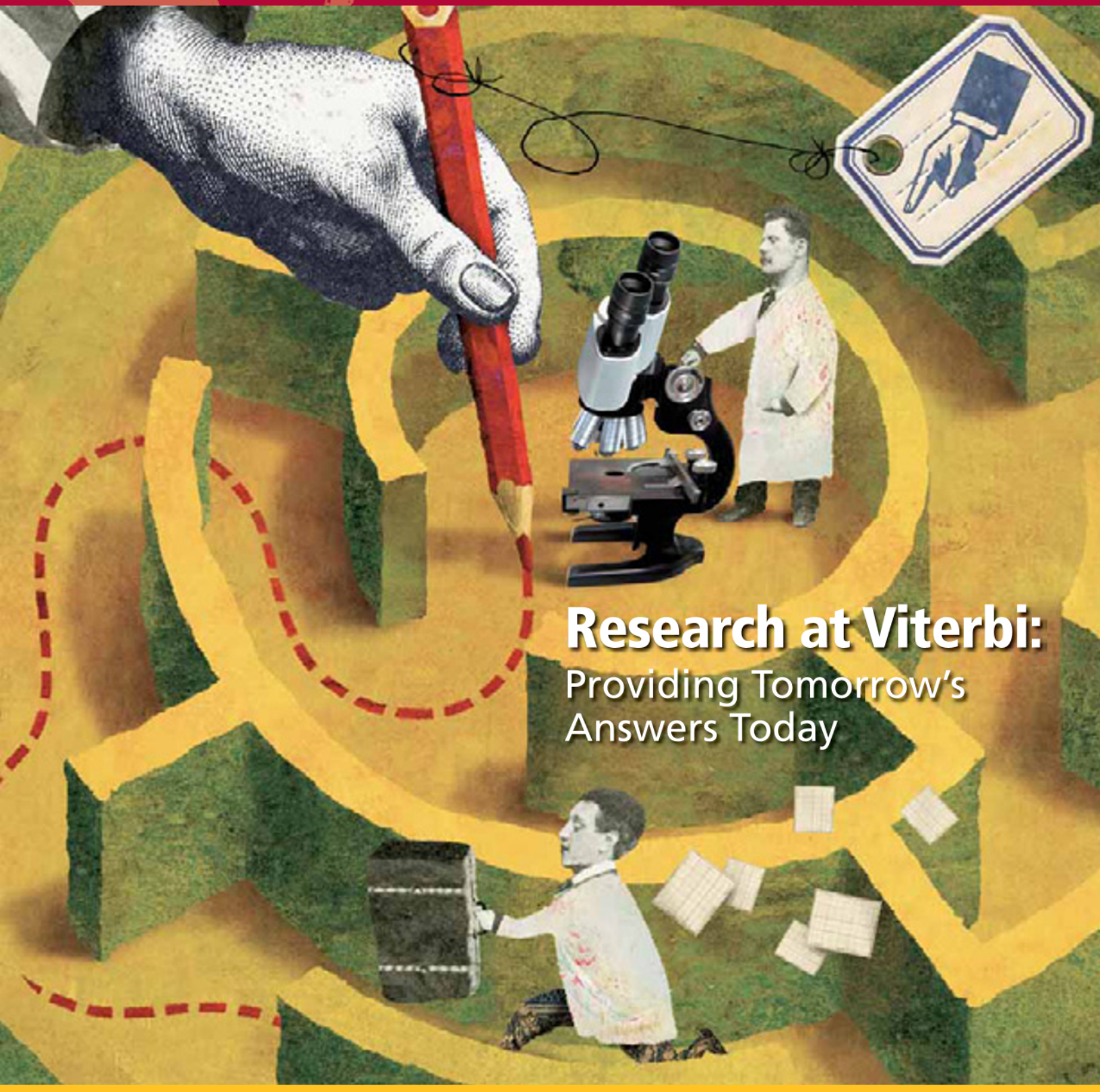
University of Southern California • Fall 2007

USC Viterbi // Engineer



Research at Viterbi:
Providing Tomorrow's Answers Today

REACHING FOR THE STARS // TORRENTS OF DATA // NATIONAL RESEARCH CENTERS

The Viterbi Society:

Celebrating a Proud Past, Ensuring a Brilliant Future.

The Viterbi Society is the premiere academic support group for the USC Viterbi School of Engineering.

Your membership in the Society helps to secure our place among the elite schools of engineering in the nation and supports the continuing legacy of excellence and innovation in engineering education and research at USC.

Participation in the Viterbi Society offers an impressive list of membership courtesies, and the satisfaction that comes from providing vital resources for:

- programs and services for outstanding engineering students
- recruitment and research assistance for world-class faculty
- technology improvements for classrooms and labs
- development of innovative curriculum

Call or email to learn more about this important giving opportunity.

Call Matt Bates at 213.821.2730 or visit viterbi.usc.edu/giving

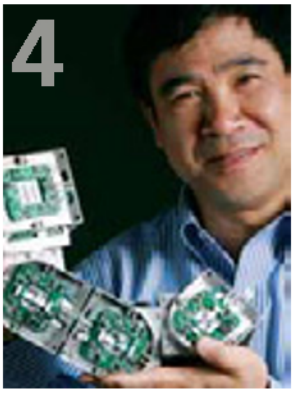
USC UNIVERSITY OF SOUTHERN CALIFORNIA

USC Viterbi School of Engineering

USC Viterbi // Engineer

FALL 2007

IN THIS ISSUE



FEATURES

PHOTO ESSAY

DEPARTMENTS

BOARD OF COUNCILORS

USC **Viterbi**
School of Engineering

Yannis C. Yortsos
Dean

Christopher J. Stoy
Chief Executive Officer,
External Relations

USC **Viterbi** // Engineer

Kirstin Strickland
Executive Director of
Alumni Relations, Editor

Bob Calverley
Executive Director of Communications
and Public Relations, Section Editor,
Contributing Writer

Diane Ainsworth
Public Communications Manager,
Section Editor, Contributing Writer

Eric Mankin
Public Communications Manager,
Contributing Writer

John Cohoon
Public Communications Manager,
Contributing Writer

Kathleen Concialdi
Production Director

Linda Davis
Contributing Writer

Teresa Hagen
Contributing Writer

Lime Twig Group
Art Direction and Graphic Design

Phil Channing, Steve Cohn,
Irene Fertik, John Livzey
Photography

Volume 6, Issue 1
USC Viterbi Engineer is published
twice a year for the alumni and friends of
the Viterbi School of Engineering at the
University of Southern California.

Letters to the editor and comments are
welcome. Please send them to:

USC Viterbi Engineer
Olin Hall 500
Los Angeles, California 90089-1451

Or email them to:
viterbi.communications@usc.edu.

viterbi.usc.edu

Research and Scholarship at Viterbi

Strengths in research and scholarship have always been the defining marks of the USC Viterbi School of Engineering. With only a medium-sized engineering faculty, the school is ranked consistently among the top five in the nation in total research volume and in the amount of funded research per faculty member. It also accounts for about a third of all of USC's research. The reasons are simple:

- Excellence in scholarship.
- Mission driven by interdisciplinary research and societal relevance.

The school is one of only three in the nation to boast two concurrent National Science Foundation Engineering Research Centers:

- The Integrated Media Systems Center (IMSC);
- The Biomimetic MicroElectronic Systems (BMES) center.

Working across the disciplines is the hallmark of both centers: Researchers from USC's Annenberg School for Communication and the School of Cinematic Arts are our main partners in IMSC. BMES lies at the intersection between engineering and medicine, namely, our school and the Keck School of Medicine at USC. The excellence in scholarship was evident in the awards of the centers: The IMSC proposal finished first among 117, the proposal for BMES was first among 79 other competing proposals.

> "**Technology** will relentlessly drive innovation and the solution of complex global problems."

Interdisciplinary research and societal relevance is at the core of an important third national center: The Center for Risk and Economic Analysis of Terrorism Events (CREATE), the U.S. Department of Homeland Security's (DHS) very first university Center of Excellence. DHS reviewed more than 70 proposals before choosing USC's. CREATE combines our strengths with those of the USC School of Policy, Planning and Development. The close collaboration between the two schools is evident in yet another center, the U.S. Department of Transportation center METRANS, which focuses on metropolitan transportation problems.

The evolving research landscape is prompting new forms of collaboration: major university-industry research partnerships. The Viterbi School has been at the forefront of this wave, through its Center for Interactive Smart Oilfield Technologies (CiSoft), a partnership with Chevron. The center promotes the integration of information technology with the management of oilfield operations.

Our success in research is fueled by the close interaction with dedicated research institutes: A particularly bright light is the USC Information Sciences Institute (ISI) in Marina del Rey. ISI is engaged in the broad area of information technology and provides the technological lubrication needed to solve a number of societally important problems. With a brilliant history—it is one of the birthplaces of the Internet—ISI is a research powerhouse that addresses timely societal problems.

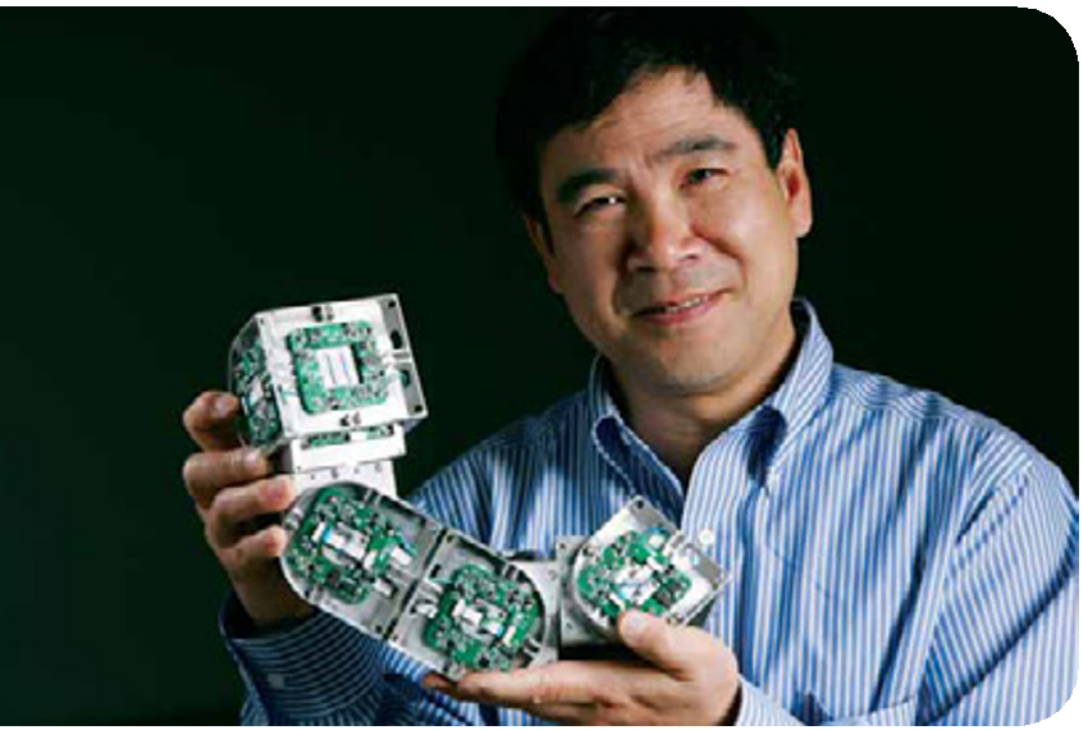
Advancing research and scholarship at today's breathtaking technological pace cannot be sustained without a robust Ph.D. program. The school is aspiring to support all its first-year Ph.D. students with unrestricted scholarships—and to graduate each year as many Ph.D. students as it has tenure-track faculty. Today, more than 100 unrestricted fellowships are available for first-year Ph.D. students, while the last two Ph.D. graduate classes have averaged close to 85 percent of the number of tenure-track faculty.

Technology will relentlessly drive innovation and the solution of complex global problems. Scholarship will be increasingly defined by the ability to work across the fields. The Viterbi School, at the forefront of this emerging paradigm shift, is committed to being a leader. The present issue of *Viterbi Engineer* gives a brief glimpse of this commitment.

Yannis C. Yortsos
Dean
USC Viterbi School of Engineering

Super Bots

THEY WALK, THEY WIGGLE, THEY SLITHER AND ROLL



Wei-Min Shen holds up one of his slithering bots.

They walk. They roll. They slither. And they wiggle. Wei-Min Shen's "Super Bots" can even climb ropes.

Shen, a research professor of computer science in the Viterbi School's Information Sciences Institute (ISI), has been developing his modular robots for six years, but has recently made significant progress. The robots consist of a series of small identical units that plug into each other in different configurations to form larger robots capable of a variety of tasks.

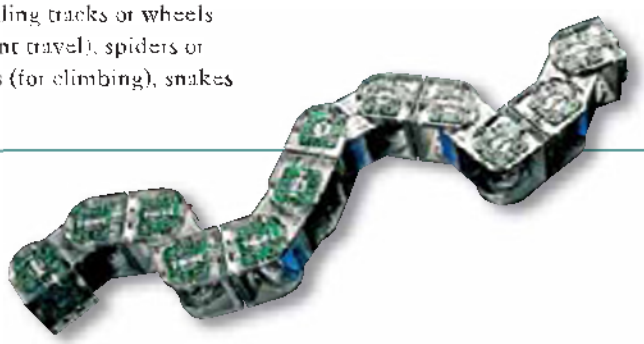
"Each module is a complete robotic system and has a power supply, micro-controllers, sensors, communication, three degrees of freedom and six connecting faces (front, back, left, right, up and down) to dynamically connect to other modules," says Shen. "Examples of configurable systems include rolling tracks or wheels (for efficient travel), spiders or centipedes (for climbing), snakes (for burrowing in the ground), long arms (for inspection and repair in space), and devices that can fly in a micro-gravity environment.

Shen says his design allows for flexible bending, docking and continuous rotation. Each module can move forward or backward, left or right, flip over and rotate like a wheel. Modules communicate with each other for totally distributed control and can support arbitrary module reshuffling during their operation.

"They have both internal and external sensors for monitoring self-status and environmental parameters," he continues. "The robots can form arbitrary configurations and can control these configurations for different functionality, such as locomotion, manipulation and self-repair."

The Super Bot team includes computer scientists Mark Moll and Behnam Salemi; Ph.D. students Harris Chiu, Jacob Everest, Feili Hou, Nadeesha Ranasinghe and Mike Rubenstein; and M.S. students Nick Kiswanto and Peter Shin.

In addition to his research faculty appointment, Shen is also director of the Polymorphic Robotics Laboratory at USC's Information Sciences Institute in Marina Del Rey, Calif. //



The best way to understand the unique value and multifunctional potential of Shen's Super Bots is to look at videos of them in action on the USC Viterbi School website. The Super Bot videos can be found at:

www.isi.edu/robots/superbot/movies/Feb2007/

Doctoral Students Get A Boost

ANNENBERG CENTER REINVESTMENT WILL BOLSTER VITERBI SCHOOL SUPPORT FOR FIRST-YEAR PH.D. STUDENTS

A reinvestment of funding in the USC Annenberg Center for Communication to support the rapid growth of cross-disciplinary graduate research and education programs in digital communications and multimedia technologies will help the Viterbi School of Engineering realize its goal of fully supporting all first-year Ph.D. students.

The Annenberg Center, established in 1993 with a historic $120 million gift from the Annenberg Foundation, was designed to foster collaboration among three of the university's communications-related schools: the Annenberg School for Communication, the School of Cinematic Arts and the Viterbi School of Engineering. This year, funding was shifted to create 100 new graduate fellowships, to be shared among the three schools and supported by at least $4 million per year.

"These are among the premier fellowships at USC," says Viterbi School Dean Yannis C. Yortsos. "With those fellowships and further increased funding from the USC provost, we can now guarantee the support of more than 100 first-year Ph.D. students."

The Viterbi School has awarded close to 150 Ph.D.s in the last two consecutive May commencement ceremonies in 2006 and 2007. The university considers support for doctoral students a top priority and recently announced its commitment to triple Ph.D. fellowship funding, raising its annual graduate fellowship funding levels to an unprecedented $15 million. The funds are used to recruit the most promising graduate students nationwide and to develop cutting-edge graduate programs in a broad range of communications-related, digital media and gaming disciplines.

> "...we can now guarantee the unrestricted support of more than 100 first-year Ph.D. students."

"Along with recruiting new faculty and building the school's endowment, attracting the best possible Ph.D. students is the best recipe for moving us to a higher level of excellence," Yortsos says.

The campus-like setting on West Adams Boulevard that has been home to the USC Annenberg Center for Communication will continue to be available for the three schools' research programs and for Annenberg Ph.D. fellowship students, called Annenberg Fellows. The schools will be able to use this space for conferences, seminars, visiting scholars and interdisciplinary research projects, including many such activities that have already been established with financial support from the center. In order to preserve and enhance these programs, each of the three schools will continue to receive $600,000 annually from the center's endowment.

"Given that we have made the creation of new Ph.D. student fellowships a top priority, this change will help spur the further transformation of graduate research and education at USC," says USC Provost C.L. Max Nikias. "These funds are now available for the recruitment of the most talented graduate students—women and men who will advance our research mission and who constitute the next generation of academic professional leaders. Few universities—if any—in the United States can match this level of commitment." //

INTELLIGENT AGENTS

Five newly minted computer science Ph.D.s became part of an exciting new subfield of artificial intelligence, called 'intelligent agents,' this year. 'Agents' are robots, or software bots on the Web, and intelligent characters in video games. The students' dissertation work was focused on multi-agent systems, in which these intelligent agents interacted with each other or with people. Left to right: **Emma Bowring**, **Nathan Schurr**, **Jonathan Pearce**, **Praveen Paruchuri** and **Pradeep Varakantham**. **Professor Milind Tambe** is in the center in the black robe. //

It's A Done Deal

VITERBI SCHOOL ESTABLISHES NEW PARTNERSHIP WITH TSINGHUA, CHINA'S TOP TECHNICAL UNIVERSITY

Viterbi School Dean Yannis C. Yortsos and 17 faculty members recently conducted a two-day workshop with Chinese colleagues in information science and technology at China's prestigious Tsinghua University in Beijing. The focus was to build bridges of collaboration between Tsinghua and USC faculty, to establish a strategic partnership for future collaboration in research and education, and to facilitate student and faculty exchanges.

The Tsinghua computer science and electrical engineering faculty affiliated with the multidisciplinary Future Internet Technologies (FIT) Research Center hosted the workshop.

During the visit, Tsinghua and Viterbi faculty showcased their relative strengths through briefings by individual faculty members. Viterbi faculty met Tsinghua students interested in graduate studies at a reception held the second day.

"We learned first-hand that Tsinghua students are enthusiastic to study abroad," says Yortsos. "Many of them have very positive views of doing so at USC, and we are looking forward to leveraging many sources of support to make this happen."

The workshop was organized by Cauligi "Raghu" Raghavendra, professor of electrical engineering and senior associate dean of special projects, and Jun Li, executive vice dean at Tsinghua.

Jiguang Sun, dean of Tsinghua's School of Information Sciences and Technology, and USC Viterbi School Dean Yannis C. Yortsos shake hands after signing the MOU.

Jiguang Sun, dean of Tsinghua's School of Information Sciences and Technology, and Yortsos signed a Memorandum of Understanding (MOU) calling for future exchanges of students and faculty, as well as for collaboration on research and education topics of mutual interest. They agreed that the partnership would be mutually beneficial, and expressed optimism and excitement over the opportunities for future cooperation.

The Tsinghua–USC partnership was initiated by Feng Deng (MSCE '93), a highly respected engineer, entrepreneur and venture capitalist who is an alumnus of both USC and Tsinghua. Deng worked in Silicon Valley at Intel and Juniper Networks before co-founding Netscreen Technologies with two friends. He received the 2002 Ernst & Young Entrepreneur of the Year Award for the Northern California region and is listed in their Entrepreneur's Hall of Fame.

Deng returned to China to co-found Northern Light Venture Capital with three other successful Chinese entrepreneurs. The company has quickly become one of China's top venture capital companies, and Deng maintains close ties to the electronics industry in Silicon Valley.

"Tsinghua produces the very best undergraduate engineering students in China, while USC produces some of the very best graduate engineers in the world," Deng said at the MOU signing. "I owe so much of my success to the combination of these two opportunities that I want to expand this possibility to many other Tsinghua graduates, while also developing faculty cooperation. I am so happy to see this partnership come together." //

HONORING MING HSIEH

At the exclusive Jonathan Club in downtown Los Angeles, Trojan dignitaries gathered to recognize Ming Hsieh, BSEE '83, MSEE '84, for his generous gift to the Department of Electrical Engineering. Pictured left to right are USC President **Steven B. Sample**, **Kathryn Sample**, **Fong Liu**, **Ming Hsieh**, **Sheryl Yortsos** and Viterbi School Dean **Yannis C. Yortsos**. //

New Faculty at Viterbi

SIX NEW FACES WILL BRING THEIR EXPERTISE TO THE SCHOOL THIS FALL

Six new faculty joined the Viterbi School of Engineering this fall: **Francisco Valero-Cuevas** of Cornell University's Mechanical and Aerospace Engineering Department; **Joe Qin** of the Department of Chemical Engineering at the University of Texas at Austin; **Andrea Hodge** of the Lawrence Livermore National Laboratory; **Dongxiao Zhang** of the Mewbourne School of Petroleum and Geological Engineering at the University of Oklahoma; **Murali Annavaram** of Intel Corp., Austin, Texas; and **Noah Malmstadt** from the Department of Bioengineering at UCLA.

Associate professor **Francisco Valero-Cuevas** specializes in the neurophysiological and mechanical functioning of human hands and improving current treatments for hand injuries. He joins the Viterbi School's Biomedical Engineering Department and the Biokinesiology Department of the School of Dentistry.

Valero-Cuevas received a Ph.D. in mechanical engineering from Stanford University in 1997. Shortly thereafter, he joined the Biomechanical Engineering Division at Stanford University before going to Cornell University.

Professor **Joe Qin** accepted joint appointments in the USC Mork Family Department of Chemical Engineering and Materials Science, the Ming Hsieh Department of Electrical Engineering and the Daniel Epstein Department of Industrial and Systems Engineering.

Qin specializes in process systems engineering. He received his Ph.D. in chemical engineering from the University of Maryland and joined the University of Texas at Austin faculty in 1995, where he was associate chair and holder of the Paul D. and Betty Robertson Meek and American Petrofina Foundation Centennial Professorship in Chemical Engineering.

Assistant professor **Andrea Hodge** has been a research scientist at Lawrence Livermore National Laboratory, Calif., since earning her Ph.D. in 2002 in materials science and engineering from Northwestern University.

Her interests lie in nanomechanics, nanocrystalline materials processing, high-temperature mechanics, thin and thick film coatings, biomaterials mechanics and foam processing.

Assistant professor **Murali Annavaram** will join the Viterbi School's Ming Hsieh Department of Electrical Engineering from the Nokia Research Center in Palo Alto, California. Prior to his work at Nokia, Annavaram was a senior researcher at the Intel Microarchitecture Research Lab in Austin, Texas.

He did his graduate work at the University of Michigan, where he earned his Ph.D. and worked with professor Ed Davidson on prefetching techniques for databases.

Professor **Dongxiao Zhang** has an appointment at the Department of Civil and Environmental Engineering and the USC Mork Family Department of Chemical Engineering and Material Sciences.

Prior to joining USC, he was the Miller Chair professor at the Mewbourne School of Petroleum and Geological Engineering of the University of Oklahoma from 2004 to 2007. From 1996 to 2004, he was a senior scientist and team leader at Los Alamos National Laboratory.

Zhang has also served as a ChangJiang Chair professor at Nanjing University and is the founding associate dean at the College of Engineering of Peking University in China. He received his M.S. and Ph.D. degrees, both in hydrology, from the University of Arizona, in 1992 and 1993, respectively.

Francisco Valero-Cuevas

Andrea Hodge

Joe Qin

Murali Annavaram

Dongxiao Zhang

Noah Malmstadt

Assistant professor **Noah Malmstadt** has joined the Viterbi School's Mork Family Department of Chemical Engineering and Material Sciences. Previously, he was a postdoctoral fellow in the Biohybrid Microsystems Laboratory in UCLA's Department of Bioengineering.

Malmstadt's research focuses on the temporal and spatial control of self-assembly processes. He did his undergraduate work at the California Institute of Technology, and received his Ph.D. in bioengineering in 2003 from the University of Washington, Seattle. //

Seeds of a New Partnership

VITERBI SCHOOL AND KOREAN AEROSPACE UNIVERSITY PLANT A TREE TO MARK NEW MEMORANDUM OF UNDERSTANDING

President Junku Yuh, left foreground, Dean Yannis Yortsos, second from left, and other KAU representatives plant a commemorative tree outside the new KAU Administration Building to symbolize future growth of the KAU-USC academic partnership.

Viterbi School Dean Yannis C. Yortsos and Junku Yuh, president of Korea Aerospace University (KAU), recently marked the signing of a Memorandum of Understanding (MOU) by planting a commemorative tree outside KAU's new administration building in Seoul. The MOU outlines a commitment by the two schools for joint academic activities.

Yuh and Yortsos said the new tree represents the potential for increased cooperation in the shared interests of computer science, electrical engineering, robotics, aerospace engineering and materials science.

Yuh is no stranger to American universities, having served on the staff of the National Science Foundation immediately prior to his appointment to lead KAU. He knows some of the Viterbi School faculty quite well, including Senior Associate Dean for Research Maja Mataric and Professor Gaurav Sukahtme, both globally renowned robotics experts with whom he has worked in the past. USC's robotics expertise was a strong motivation for the partnership.

KAU, founded 55 years ago as Hankuk Aviation University, was recently renamed. (Hankuk is the Korean language name for Korea.) In addition to its College of Engineering, College of Aviation and Management, and Department of English, the school boasts its own runway, a fleet of training aircraft and an aerospace museum.

As part of his introduction to KAU, Yortsos traveled to Jeju Island and toured the Flight Training Center. He readily admitted that "Jeju is a beautiful place, but I had the most fun that day flying the Cessna Citation flight simulator."

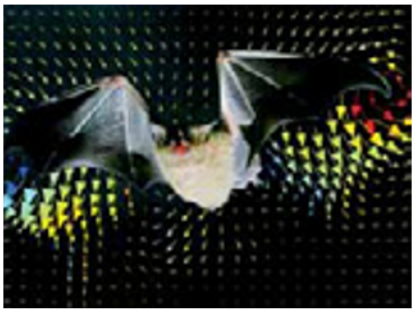
Yortsos and Yuh look forward to the growth of the KAU-USC partnership. The two schools are already collaborating under a joint research institute in conjunction with the European aerospace company Airbus and Korean Air. The two leaders envision other productive ventures as the commemorative tree they planted in 2007 continues to grow. //

The Magic of Bat Flight

A TEAM OF RESEARCHERS DISCOVERS UNIQUE AERODYNAMIC PATTERNS IN A BAT'S WING BEAT

Bats generate a measurably distinct aerodynamic footprint to achieve lift and maneuverability, quite unlike birds and contrary to many of the assumptions that aerodynamicists have used to model animal flight, according to aerospace engineer Professor Geoffrey Spedding.

Spedding, together with a multi-institutional team of scientists, found that bat flight is quite different from bird flight, particularly at very small scales. The team based its findings on new measurements of aerodynamic performance in the wing beats of a small species of bat, published in a May 2007 issue of *Science* magazine.



Colored arrows show airflow created by bat flight.

"Bats with a body mass of 10 to 30 grams—or about the weight of one or two teaspoons of sugar—and tip-to-tip wing spans of 25 to 30 centimeters—about the length of a human hand—generate very different wakes," he reported. "The telltale tracks in the airflow caused by the wing beat have a very different pattern for bats, and this difference can be traced to the peculiar upstroke. That, in turn, is likely caused by the collapsible membrane of the bat's wing, which needs to maintain some degree of tension."

Geoff Spedding in his flight experiment lab.

Spedding and his colleagues think that a bat's unique aerodynamic wake signatures are caused by different mechanical operations in the upstroke of the wing beat. Whereas birds can open their feathers like a Venetian blind, bats do something different: They have developed a twisting wing path that increases lift during the upstroke.

That's good to know, Spedding says, because with micro-flight just around the corner, aerodynamicists want to make tiny robot airplanes fly just as masterfully as bats.

"Bats are agile hunters, capable of plotting and executing complex maneuvers through cluttered environments," Spedding says. "These are the traits we'd like our unmanned air vehicles to have, because there are so many complex rural and urban environments in which we could use them." //

Honoring An Industry Pioneer

A NEW FULLY ENDOWED CHAIR WILL PAY TRIBUTE TO KOREAN AIRLINES FOUNDER

USC Viterbi School Dean Yannis C. Yortsos announced the establishment of a new endowed chair in the Department of Aerospace and Mechanical Engineering, which will honor the founder of Korean Airlines.

The new chair will be called the Choong Hoon Cho Chair of Aerospace and Mechanical Engineering. The Boeing Company contributed $1 million toward this endowed chair. Other funding brings the Cho Chair endowment to a total of $2 million.

In 1969, Choong Hoon Cho took over a bankrupt airline that had been run by the Korean government and, by initially concentrating on transportation of cargo, built it into one of the world's premier airlines. In addition to worldwide passenger service, the airline today has the world's largest air-cargo operation.

Cho, who died in 2002 at the age of 82, is the father of Yang Ho "Y.H." Cho, a member of the USC Board of Trustees, the USC Viterbi School Board of Councilors and the current chairman of Korean Airlines. //

Viterbi School Keynote Lectures

THIS YEAR, THE SCHOOL LAUNCHED A NEW SERIES OF ENDOWED GUEST LECTURES HOSTED BY EACH DEPARTMENT

The Viterbi School ushered in its second century with a new set of endowed annual keynote lectures. Each of the school's academic departments now offers a special scholarly presentation each year that is named for an individual who was connected to USC and who influenced the discipline.

In its first year, the keynote lectures covered a broad range of engineering topics, drawing on eminent scholars in the world of engineering. The series continues this fall, but has already included a number of experts and scholars:

Visit our website

for up-to-date series information:

viterbi.usc.edu/news/events/keynote

- **THE WILLIAM G. SPITZER LECTURE**, sponsored by the Viterbi School Department of Chemical Engineering and Materials Science, which featured nanosystems biology expert James Heath, the Gilloon Professor of Chemistry at Caltech.
- **THE ANDREW J. VITERBI LECTURE**, sponsored by the Ming Hsieh Department of Electrical Engineering, which featured Robert J. McEliece, renowned information theorist who is the Allen E. Puckett Professor of Electrical Engineering at Caltech and the 2004 Shannon Lecturer of the IEEE. McEliece presented a talk and video on "Learning to Teach the Viterbi Algorithm."
- **THE GEORGE A. BEKEY LECTURE**, sponsored by the Computer Science Department, featured Ed Lazowska, the Bill and Melinda Gates Chair of Computer Science and Engineering at the University of Washington, who chronicled the past, present and future of computer science.
- **THE JACK MUNUSHIAN LECTURE**, sponsored by the Ming Hsieh Department of Electrical Engineering, featured Steven Chu, Nobel Laureate in physics and director of the Lawrence Berkeley National Laboratory, who addressed "The World's Energy Problem and What We Can Do About It."
- **THE JANOS LAUFER LECTURE**, sponsored by the Aerospace and Mechanical Engineering Department, which featured Anatol Roshko, the Theodore von Karman professor emeritus of aeronautics at Caltech, who discussed "Reflections of the Turbulence Problem."
- **THE FRED S. GRODINS LECTURE**, sponsored by the Biomedical Engineering Department, which will feature Douglas Lauffenburger of MIT, the Uncas and Helen Whitaker Professor of Bioengineering and director of MIT's Biological Engineering Division, who will address "Bioengineering and Systems Biology: A Promising Intersection for Bioscience and Biotechnology."
- **THE EBERHARDT RECHTIN LECTURE**, sponsored by the Daniel J. Epstein Department of Industrial and Systems Engineering, will feature Louis Martin Vega, dean of the College of Engineering at North Carolina State University and president-elect of the Institute of Industrial Engineers. Professor Vega will address manufacturing, logistics, distribution, operations management, and production and service systems.
- **THE ALBERT DORMAN LECTURE**, sponsored by the Civil and Environmental Engineering Department, will be announced later this fall.
- **THE HSIEN K. CHENG LECTURE**, sponsored by the Astronautics and Space Technology Division, will also be announced later this fall. //

Movers & Shakers LOCAL ENGIN

Photo credit: John Livzey

DEN's New Chief

BINH TRAN HAS BECOME THE NEW DIRECTOR OF VITERBI SCHOOL'S PREMIER DISTANCE EDUCATION PROGRAM

Binh Tran, formerly instructional technology director for the Viterbi School's Distance Education Network (DEN), has become DEN's new executive director, succeeding Kelly Goulis, who has become associate dean for the school's Master's and Professional Programs.

Tran's promotion was part of a reorganization announced in September 2006 by Dean Yannis C. Yortsos to create a new office of Master's and Professional Programs (MAPP), of which DEN is now a part. The new office assumed the responsibility of recruitment and student services for all master's students, e-learning operations, and the management and development of all lifelong and continuing education programs.

Tran, who supervised all DEN operations and faculty support responsibilities for the online courses, has more than 10 years of experience in implementing and supporting instructional technology services.

He has been instrumental in developing DEN's online delivery system and played a major role in providing consulting and training services for USC's recently launched Technology Enhanced Learning Initiative.

Tran received his M.S. in instructional technology at the USC Rossier School of Education. He has also supported complex computing environments and taught various multimedia courses in the Information Technology Program at the Viterbi School. //

EERS MEET TRANSPORTATION SECRETARY MARY PETERS.

The Los Angeles area chapter of WTS—formerly Women's Transportation Seminar—hosted a dinner for U.S. Department of Transportation Secretary Mary Peters earlier this year at the Millennium Biltmore Hotel in downtown Los Angeles. The audience of more than 300 guests included numerous Southern California transportation agency executives, city council members, county supervisors, mayors and transportation commissioners. Forty USC students from the USC Viterbi School of Engineering, the USC School of Policy, Planning and Development, and California State University, Long Beach also attended, sponsored by global transportation consulting firms DMJM Harris, DMJM H&N, Metcalf & Eddy, and parent company AECOM Technology Corporation.

Pictured here, left to right: **Kim Chan**, transportation planner at Parsons Brinckerhoff and WTS-Los Angeles Scholarship Chair; **James Moore II**, chair of the USC Epstein Department of Industrial and Systems Engineering; U.S. Transportation Secretary **Mary Peters**; and **Stephanie Taylor**, MSCE transportation engineering student. //

Pomp and Pageantry: Commencement Day 2007

1,762 BEAMING VITERBI SCHOOL GRADUATES SEIZE THE DAY

Clockwise, from top left: Andrea Cheung, BSCE '07; the procession, with faculty member Jim Moore leading, followed by Professors Dan Dapkus and Alexander Sawchuk; Mohammed Al Kayyalibrahim, MSEE, and a future Trojan; Selassie Daniel Ahorlu (center), MSEE '07, with his parents.

The Viterbi School conferred 1,762 undergraduate and graduate degrees this year, celebrating the event with pomp and pageantry in the Engineering Quad on May 11, 2007.

The school handed out 28 more engineering degrees than last year and a record number of Distance Education Network master's degrees—272—for a 30 percent increase over 2006.

The school also graduated 142 Ph.D. students, making the day memorable not just for the graduates, but for parents, families and friends, who crowded into the E Quad to watch the ceremonies.

Graduation Statistics	
Undergraduates	480
Masters Degrees	1,140
Ph.D.s	142
TOTAL	1,762

Honoring Excellence

DEAN YORTSOS RECOGNIZES INDIVIDUALS FOR EXCEPTIONAL SERVICE AT THE 29TH ANNUAL ENGINEERING AWARDS LUNCHEON

Those receiving Viterbi alumni awards this year included, left to right, Sonny H. Astani, Steven DenBaars, Carol Bartz and Karl Weiss. Dean Yannis C. Yortsos is on right.

The USC Viterbi School of Engineering presented its engineering awards to four engineers and scientists at the 29th annual Engineering Awards Luncheon, held April 24, 2007, in USC's Town & Gown conference center.

Viterbi School Dean Yannis C. Yortsos presided over the ceremonies, which included a keynote address by **Carol Bartz**, executive chair of the board of Autodesk, Inc. Bartz received the Daniel J. Epstein Engineering Management Award for leading a company that grew in revenues during her 14-year tenure from $285 million in 1992 to $1.52 billion in 2006.

Recently named one of the 50 most powerful women in business by *Fortune* magazine, Bartz serves on President George W. Bush's Council of Advisors on Science and Technology, as well as on the board of directors of Cisco Systems, Network Appliance, and the Foundation for the National Medals of Science and Technology. She holds an honors degree in computer science from the University of Wisconsin, an honorary Doctor of Humane Letters degree from the New Jersey Institute of Technology, an honorary Doctor of Science degree from Worcester Polytechnic Institute, and an honorary Doctor of Letters degree from William Woods University.

Karl Weiss, chairman of the board of USC's Integrated Media Systems Center, received the Distinguished Service Award for his role in helping guide the center through 11 years of spectacular success. Weiss is a founding director of the Massachusetts Technology Park Corp. and served as chair of the board from 1992 to 1995. A professor emeritus at Northeastern University, Weiss has also been associated with that university for nearly 40 years. Prior to his academic career, he had industrial experience with Color Research Corp. in New York City.

Steven DenBaars, holder of the Mitsubishi Chemical Professor in Solid State Lighting and Displays and co-director of that center at UC Santa Barbara, received the Distinguished Alumni Award in Academia. DenBaars is an IEEE Fellow and has 18 patents in the field of optoelectronic materials and devices. He earned his advanced degrees in electrical engineering at USC, receiving a M.S. degree in 1986 and a Ph.D. in 1988.

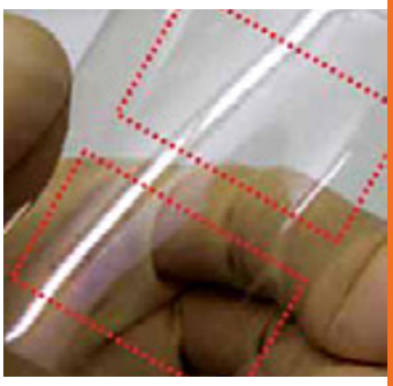
Sonny H. Astani, chair and founder of Astani Enterprises, received the Mark A. Stevens Distinguished Alumni Award. With more than 25 years of industry experience, Astani's real estate assets span more than $500 million in properties, including nearly 5,000 apartment units, with an additional 1,800 apartments and condominiums in development in downtown Los Angeles. A native of Iran, Astani immigrated to the United States nearly 30 years ago, where he began his studies at USC, leading up to his M.S. degree in industrial and systems engineering in 1978. //

Visit our website for the latest Viterbi news:

viterbi.usc.edu

Transparent Transistors

FIRST EVER SEE-THROUGH NANO TRANSISTOR COULD BRING US SOME NIFTY NEW PRODUCTS, LIKE E-PAPER AND POP-UP WINDSHIELD DISPLAYS



The red dots indicate transistor array regions.

In a specialized nanotech lab tucked safely in the basement of Tutor Hall, Chongwu Zhou has created the first prototype of a transparent transistor. These are tiny devices that will one day give your automobile windshields and computer displays transparent pop-up screens, bring us "e paper," and clear the way for embedded information that will make our credit cards smarter.

Zhou, an associate professor in the Ming Hsieh Department of Electrical Engineering and in the USC College Department of Chemistry, fabricated the prototype nanowire transistors from designs that were co-created by his colleagues: David Janes of the Purdue University School of Electrical Engineering and Computer Engineering, and Tobin J. Marks, holder of the Vladimir N. Ipatieff chair of chemistry at Northwestern University. Results of the research first appeared in the June issue of *Nature Nanotechnology*, and were later presented at an international nanotechnology conference.

While some semiconductors are transparent, they've needed metal wires—which are not—for connection. The new nanowire designs are made of metal oxides, including two oxides of indium (InO and In2O3), tin oxide (SnO2), zinc oxide (ZnO), and cadmium oxide (CdO), and don't require metallic connectors.

Zhou created the nanowires using a process he helped develop. The process uses laser beams to blast metal atoms off targets made of indium and other metal alloys. The process condenses the high temperature (700 degrees C) vapors on a nest of nanoscale gold particles, where they self-assemble (or morph) into nanowires.

"Purdue had the nanowire idea," Zhou explains. "We provided and optimized the material, and then they assembled it into a device."

But it's a little bit like magic, because the nanowires are transparent. "The contacts we put on then are transparent," says Janes, "and the glass or plastic substrate is transparent."

Marks says the research opens the door to entirely new technologies for high-performance transparent flexible displays. The tiny circuits could produce displays that enable drivers to see information without looking down at the dashboard. They could project information onto a person's visor without obstructing his or her view. And someday, they could revolutionize sports goggles by displaying player stats in real time during the big game. Just think of that! //

Changing of the Guard

FUJI XEROX LAB CEO JAMES BAKER TAKES THE HELM AT IMSC

James Baker, chairman and chief executive officer of Fuji Xerox's Palo Alto Laboratory (FXPAL), became director of USC's Integrated Media Systems Center (IMSC) on June 1. He succeeded Adam Clayton Powell III, who was named USC vice provost for globalization.

Baker is founding president of FXPAL. He became chief executive officer in 1997 and chairman of the company in 2005. During that time, FXPAL evolved into a leading center of multimedia research, with achievements in video capture, storage and retrieval, authoring and surveillance.

Prior to joining FXPAL, Baker was the director in charge of the three information and computing sciences research laboratories at Lockheed Martin. Before that, he was director of computer sciences research at Schlumberger in Ridgefield, Conn., and head of its computer-based engineering center in Austin, Texas.

Baker, who has a Ph.D. in mathematics, was formerly chairman of IMSC's Industrial Advisory Board and has served on various other university boards throughout his career. //

One Liners

GEN X-CELLENCE SCORES BIG

The buzz at Viterbi never stops. As the quality of our undergraduates continues to climb, that "Gen X-cellence" is showing up at awards time. Take a look at what some of these students have done:

Miles Killingsworth, a senior majoring in astronautical engineering, has won the highly competitive 2007 Luce Scholarship, which will allow him to live and work in Asia for a year.

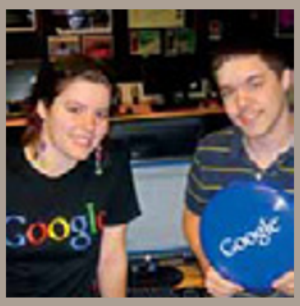
Kimberly Pacheco, a junior majoring in structural engineering, won this year's top student award from the Structural Engineers Association of Southern California.

Pacheco won the Margaret Narver Memorial Scholarship in a competition with students from 11 engineering schools in Southern California.

Reed Doucette, a mechanical engineering major with a 3.978 GPA, won the 2007 James Zumberge Award for the highest GPA on USC's basketball team.

The Trojans, a smart and entertaining team, reached the Sweet 16 round of this year's NCAA championships, higher than most predicted, and their best finish since 2002.

In the academic arena, **the Mork Family Department of Chemical Engineering and Materials Sciences' student chapter of the Society of Petroleum Engineers (SPE)** was named national Chapter of the Month for May, the national SPE office announced earlier this year. The USC chapter organized a successful fund-raising program and handled the arrangements for the annual Western Region SPE paper contest.



Engineering undergraduates **Pamela Fox**, left, and **Ryan Brown**, right, were congratulated for creating the most useful and the most addictive **Google Gadgets** in this year's national collegiate competition.

Computational Kudos

A GROUP OF TALENTED MINORITY STUDENTS GATHER AT USC TO BUILD A PARALLEL COMPUTER

USC is home to the second most powerful supercomputer system on any university campus nationwide. It is also the host of the annual Computational Science Workshop, which brings 12 to 15 of the country's brightest undergraduate minority engineering students to campus each year for an intensive workshop on parallel and grid computing.

This year was particularly special: Supercomputing expert Cray Henry, director of the U.S. Department of Defense's High Performance Computing Modernization Program, visited USC's Center for High-Performance Computing and Communications and congratulated 24 budding young computer science students for their Herculean efforts to build a parallel computer.

The students and their faculty mentors were primarily from historically black colleges and universities, as well as Hispanic-serving institutions. At the end of the workshop, all students received a new computer to take back to school and use for their studies in computational science and engineering.

Viterbi School Dean Yannis C. Yortsos joined Henry for an awards dinner, as did the directors of USC's Collaboratory for Advanced Computing and Simulations (CACS): Professors Rajiv K. Kalia, Aiichiro Nakano and Priya Vashishta. All three have joint faculty appointments in the Viterbi School and the USC College of Letters, Arts and Sciences.

"I am a firm believer in the power of technology to the economy and the well-being of this nation," Yortsos told the students. "I also believe the 21st century will be the century of the engineer: Engineers and scientists will increasingly shape this future, not only in technology, but also in the other sciences, in medicine and in the arts. You [students] can lead this transformation, which is becoming a reality in front of our very eyes." //

Pinkston @ NSF

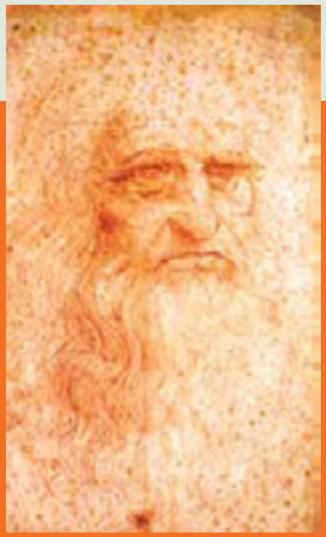
ON TEMPORARY LOAN TO THE FUNDING AGENCY, A COMPUTER SYSTEMS ENGINEER WILL HAVE SOME COMPELLING NEWS ABOUT RESEARCH DIRECTIONS WHEN HE RETURNS

He's been on loan to the National Science Foundation for 18 months, influencing national policy and funding decisions in computer science and engineering. When he returns to USC's Ming Hsieh Department of Electrical Engineering in 2008, Timothy M. Pinkston will have some important new insights to share with his USC colleagues about compelling research directions in the field of computer systems architecture.

"This is a terrific opportunity to identify major challenges and set a national research and education agenda that will keep our nation on the cutting edge of computational needs for society," says Pinkston. "This is a critical time for computer system architecture research. Many experts agree that we're approaching the end of the prolific 'Moore's Law' era in computing. In order to continue the greater than 40 percent per year computational performance growth rates we've come to expect, a paradigm shift must occur toward highly parallel —yet low power consumption—computer systems."

Although Pinkston's research group and other groups at USC are addressing that issue in their own individual research projects, he's "delighted to be in a position to impact research efforts more broadly, on a national stage, to advance the state of computing during my tenure here at NSF."

The National Science Foundation plays a major role in sponsoring research activities in the United States, providing more than 85 percent of the federal funding directed toward basic research in the computer sciences at U.S. academic institutions. Pinkston serves as a program director in the Division of Computing and Communication Foundations (CCF), one of three divisions in the Computer and Information Science & Engineering Directorate, which has a fiscal year 2007 budget of $526.69 million. He also has served as the lead program director for CCF's Foundations of Computing Processes and Artifacts cluster. //



Leonardo da Vinci: The Engineer

Leonardo da Vinci touched many lives in 15th-century Italy, not just with his paintings of the "Mona Lisa" and "The Last Supper," but with his scientific investigations of the human body and his many engineering inventions. Da Vinci etched out blueprints for a bridge across the Golden Horn at Istanbul and a much simpler version of the steam engine than James Watt's invention. It's all in Illumin, written and published on the Web by USC Viterbi School undergraduates. Illumin is dedicated to exploring the science and technology behind the inventions we take for granted in everyday life.

http://illumin.usc.edu

Faculty Accolades

THE LOW-DOWN ON ALL THOSE PROFESSORIAL AWARDS AND ACHIEVEMENTS

Herbert Schorr, the executive director of the USC Information Sciences Institute (ISI) and senior associate dean of the Viterbi School, led a parade of recent faculty honors. His leadership at ISI and his many contributions to the school earned Schorr USC's highest honor, the Presidential Medallion.

Schorr's award was presented at the USC Honors Convocation for 2007, where two other members of the Viterbi faculty also played leading roles. **Alexander "Sandy" Sawchuk** and **Bart Kosko** were awarded, respectively, the USC Associates Award for Excellence in Teaching and the Phi Kappa Phi Faculty Recognition Award, for Kosko's recent book *Noise*, an original and fascinating perspective on noise and its pervasive presence. Both are members of the Ming Hsieh Department of Electrical Engineering; Sawchuk is the department's Systems chair.


Herbert Schorr


Alexander Sawchuk


Bart Kosko


Sami Masri


Eva Kanso


Gerard Medioni


Terence Langdon

Sami Masri, professor of civil engineering, is the 2007 recipient of the Newmark Medal of the American Society of Civil Engineers (ASCE), awarded to those ASCE members whose contributions to structural mechanics have substantially strengthened the scientific base of structural engineering. The prize recognizes Masri's seminal work leading to the emergence of structural health monitoring as a vital area of research.

Eva Kanso, assistant professor of mechanical engineering in the Department of Aerospace and Mechanical Engineering, was awarded a Faculty Early Career Development award from the National Science Foundation for her work in dynamical systems, fluid-structure interactions and aquatic locomotion. The grant provides $400,000 over five years to support continued research in the field.

While Kanso's award is of quite recent vintage, other work done by Viterbi faculty has seen years of rising stature. A prime example is the classic paper, "Using Computer Vision in Real Applications: Two Success Stories," presented by **Gerard Medioni**, former chair of the Computer Science Department, at the Machine Vision Applications (MVA) international conference in 1996. That paper, which outlined Medioni's work in computer vision leading to internationally used techniques for seamlessly inserting stored images into live broadcasts, has now won the MVA's "Most Influential Paper of the Decade" award.

Terence Langdon, the William E. Leonhard Professor in Engineering, who is a professor of aerospace and mechanical engineering, materials science and earth sciences at USC, earned yet another award recently. He received the Albert Sauveur Achievement Award for 2007 from AMS (formerly the American Society for Metals) International, the Materials Information Society.

George Chilingar, professor of civil engineering and of petroleum engineering, received the USC Academic Senate's Distinguished Faculty Service Award for his "55 years of exemplary and dedicated service to USC."

Michael Gruntman, chair of the Viterbi School's Astronautics Division, has received the Luigi Napolitano Award of the International Academy of Astronautics for his book on the history of rocketry.

Sanjit Mitra, the Varra Professor in the Hsieh Department, known for his work in signal and image processing, recently achieved dual distinctions: He has been named a Foreign Fellow of both the National Academy of Sciences, India, and a Foreign Fellow of the Indian National


George Chilingar


Michael Gruntman


Sanjit Mitra


Tomlinson Holman


Melvin A. Breuer


Urbashi Mitra


Antonio Ortega


William Steier


Robert A. Scholtz


Shrikanth Narayanan


Constantinos Sioutas


Elaine Chew


John Hsiai


Ramesh Govindan


Aiichiro Nakano


Milind Tambe


Najmedin Meshkati


Eun Sok Kim

Academy of Engineering. Honors are nothing new to Mitra, who is also a member of the U.S. National Academy of Engineering.

A quick Jeopardy quiz: He's the only person who has won both an Academy Award (an Oscar) and the IEEE's Masaru Ibuka Award. Answer: Who is **Tomlinson Holman**?

Holman is a professor of electrical engineering and cinema, and a member of the Integrated Media Systems Center (IMSC), one of our two National Science Foundation Engineering Research Centers. He earned the 2007 Ibuka Award for his contribution — the fabled THX sound system — to the development of advanced audio and cinema multi-channel playback systems.

A special IEEE half-day conference event last year celebrated the work and influence of **Melvin A. Breuer**, the Viterbi School's Powell Professor of Electrical Engineering and Computer Science. More than 70 of Mel Breuer's colleagues, former students and friends gathered in Santa Clara for the invitation-only program that was sponsored by the IEEE Computer Society, its Test Technology Technical Council, Syntest, Intel and Mentor Graphs.

Urbashi Mitra and **Antonio Ortega**, both of the Ming Hsieh Department of Electrical Engineering, have been elected Fellows of the Institute of Electrical and Electronics Engineers (IEEE).

William Steier, the Hogue Professor of Electrical Engineering, has been named a Fellow of the American Association for the Advancement of Science for his revolutionary work in high-speed opto-electronics and complex optical circuitry.

Robert A. Scholtz of the Hsieh Department of Electrical Engineering received the 2006 IEEE Eric E. Sumner Award "for pioneering contributions to ultra-wide band communications science and technology" at a ceremony in San Francisco.

Other standout performances by Viterbi faculty members have earned them important internal recognition. Dean Yannis C. Yortsos announced that the stellar work being done by two younger faculty members — **Shrikanth Narayanan** and **Constantinos Sioutas** — earned them appointments to two new professorships.

Narayanan, a member of the Hsieh Department of Electrical Engineering, is now the holder of the new Andrew J. Viterbi professorship; Sioutas, a member of the Department of Civil and Environmental Engineering, was named to the new Fred Champion professorship.

Alexander "Sandy" Sawchuk, systems chair of the Hsieh Department of Electrical Engineering, has become holder of the newly established Leonard Silverman chair, while **Chongwu Zhou** was named to the Munushian Early Career chair.

Dean Yortsos also announced numerous promotions, including **Elaine Chew** of the Epstein Department and **John Hsiai** of the Biomedical Engineering Department, who became associate professors.

Five faculty members were promoted from associate to full professor, including three in the Department of Computer Science: **Ramesh Govindan**, **Aiichiro Nakano** and **Milind Tambe**. **Najmedin Meshkati** of the Department of Civil and Environmental Engineering and **Eun Sok Kim** of the Hsieh Department of Electrical Engineering also joined the ranks of full professor. //

IEEE Award Winner

NANOCARBON SPECIALIST CHONGWU ZHOU WINS IEEE'S NEW EARLY CAREER AWARD

Chongwu Zhou of the Ming Hsieh Department of Electrical Engineering, whose work on carbon nanotube self-assembly has attracted international attention, won a new IEEE honor. He is the first recipient of the IEEE's new Nanotechnology Council's Early Career Award.

Zhou was chosen for his pioneering work in nanotube and nanowire electronics. He also won the Viterbi School's Junior Faculty Research Award in 2004 and is a National Science Foundation Career awardee.

The young scientist began his career in China, receiving a B.S. from China's University of Science and Technology, and continued his education in the United States, earning his Ph.D. in electrical engineering in 1999 from Yale University.

He worked as a postdoctoral research fellow at Stanford University before joining the USC faculty in 2000. //

Zero G

NOT MORE THAN ABOUT 170 UNDERGRADUATE STUDENTS across the country have a chance to fly aboard NASA's microgravity aircraft each year. This spring, five students from the Viterbi School earned the opportunity. Taking a roller coaster ride through the sky, they flew parabolas high over the Gulf of Mexico while testing their flame ball experiment outside the bounds of gravity. "It wasn't like anything I had imagined," says **Emily Hedges**, a junior aerospace major. "If anything, it was like spinning." Adds **Daniel Calvo**, "If you make the slightest movement, you'll float away." After a few unsuccessful attempts to begin their experiment, the students finally got down to the business of observing how rapidly fire burns at zero g in different atmospheres, such as in an oxygen-carbon dioxide diluted atmosphere and an oxygen-helium diluted atmosphere. The experiment was designed to help the students determine whether the CO2-based fire extinguishers currently used aboard the space station and space shuttle are really the safest for use in space. The USC flight team also included **Adriel Carreno**, a junior majoring in mechanical engineering; **John Duncan**, a junior majoring in aerospace engineering; **Quinn Freyermuth**, a junior majoring in mechanical engineering; and **Mikeala Blackler**, a junior majoring in industrial systems engineering. **Eugene Bickers**, a physics professor and associate vice provost for undergraduate programs, and former astronaut **Paul Ronney**, a professor of aerospace and mechanical engineering, served as advisers for the experiment. //


AEROSPACE
ENGINEERING
UNIVERSITY OF
SOUTHERN CALIFORNIA

Can Designer Immune Cells Stop AIDS?

CHEMICAL ENGINEER PIN WANG EXPLORES A NEW APPROACH TO GENE THERAPY TO COMBAT ACQUIRED IMMUNODEFICIENCY SYNDROME

Twenty years after its introduction, gene therapy still holds great promise as a way to harness the insidious power of viruses, such as the human immunodeficiency virus (HIV). But scientists have yet to solve a vexing problem: developing an efficient transport system that is capable of delivering therapeutic payloads to specific cells.

As challenging as the problem has been, researchers may be turning a corner. With support from a $13.9 million grant from the Bill and Melinda Gates Foundation, a multi-institutional team of scientists, including Pin Wang of the USC Mork Family Department of Chemical Engineering and Materials Science, is exploring a completely new way of manipulating the body's natural defense system.

Alex Lei, a chemical engineering major, is part of the USC HIV vaccine project.

"Rather than focusing on conventional vaccines that boost the immune system, we are experimenting with a way to help the immune system produce antibodies that can neutralize the virus," says Wang. "If we can design a modified virus that will deliver these antibodies to chosen cells, we will be able to insert DNA that will help rather than harm cells."

Viruses are efficient carriers or transport vehicles in the body because they are naturally able to penetrate cells, inserting the genetic material they contain into their new host. By itself, a virus cannot reproduce; it must infect a cell and take control of the host's machinery to make copies.

HIV possesses an unusual structure and a keen ability to hide from antibodies with a sugar-coated shield. The shield has very few open spaces on its surface, Wang says, which makes it virtually impossible to puncture. But because the virus also has an uncanny ability to hide, HIV often goes virtually unnoticed by neutralizing antibodies that are roaming the body in search of disease.

Faced with such a clever adversary, Wang wants to synthetically alter the HIV viral invaders and use their hollow shells as delivery vehicles to insert DNA that will counteract the infection.

The "Cadillac" of this gene delivery system is an HIV-based "lentiviral vector," a type of retrovirus that uses the backbone of a virus to infect both dividing and nondividing cells. Wang says lentiviral vectors are very efficient delivery vehicles for human cells.

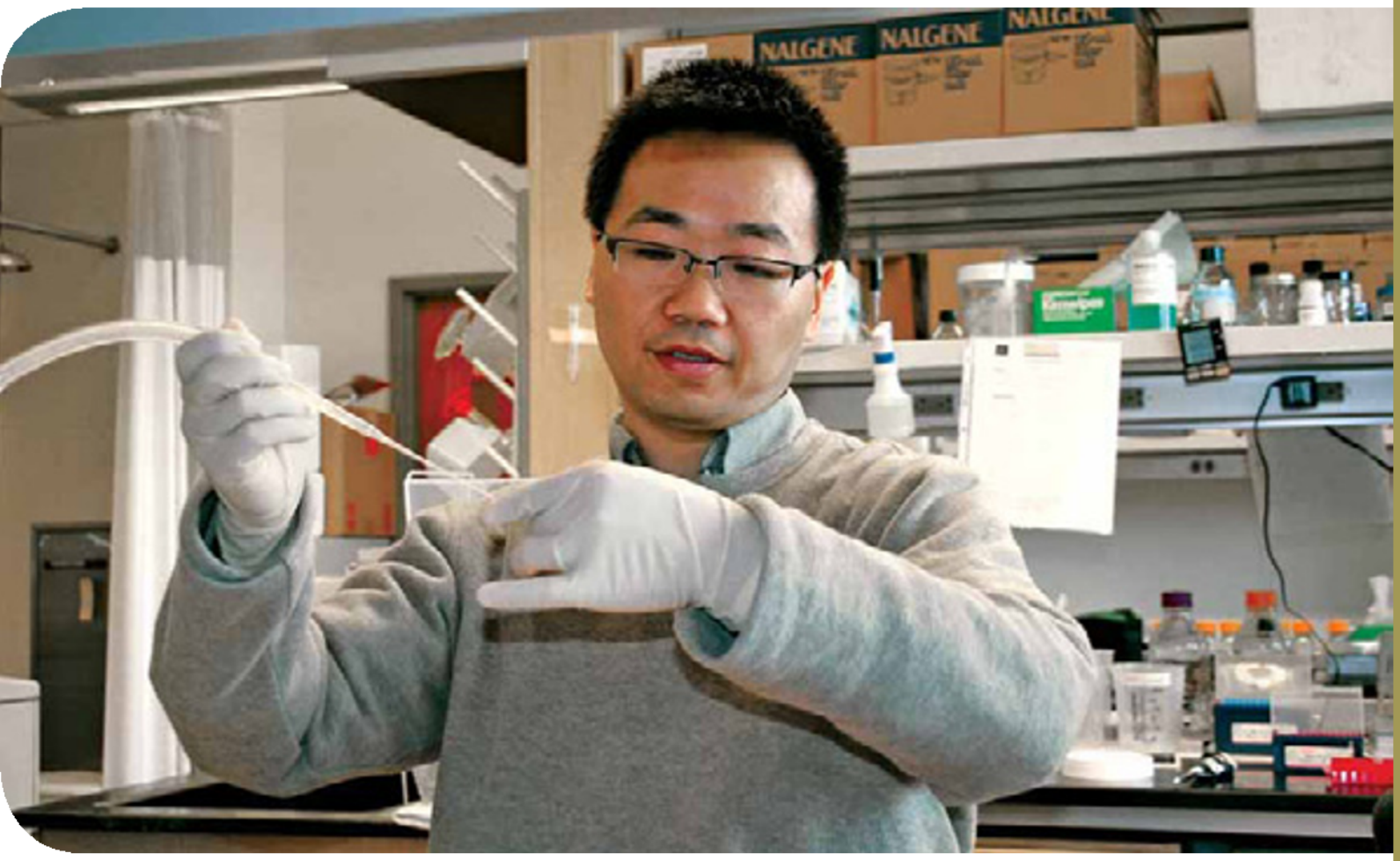
Collaborators on his project are targeting hematopoietic stem cells—the bone marrow cells that form blood cells—to create B lymphocytes. The researchers want to reprogram these bone marrow cells by adding genes that will instruct the cells to produce rare antibodies such as B12, 4E10, 2G12 and 2F5. Wang says these antibodies are known to neutralize the virus.

"In laboratory tests, we remove harmful genes coding for the HIV virus and engineer the backbone, or spine, of the virus so that it is no longer replicable " he says. "Once manufactured recombinantly, this modified virus—the lentiviral vector—becomes a natural delivery system that can transport useful genes into cells without causing illness."

Although the gene delivery technique looks promising, researchers are still working on ways to manipulate these elusive bone marrow cells and get them to generate "designer immune cells." Another problem seems to be making sure lentiviral vectors target only hematopoietic stem cells, and not other types of cells, to achieve the desired targeted delivery.

With a group of USC chemical engineering students and Caltech biologists, Wang is experimenting with CD20 as a target antigen for human B cells. His strategy, published in *Proceedings of the National Academy of Sciences*, targets the human B cells only. After two years of experimentation,

"Rather than focusing on conventional vaccines that boost the immune system, we are experimenting with a way to help the immune system produce antibodies that can neutralize the virus."



Pin Wang modifies viral cells to neutralize HIV-infected cells.

the team has been able to demonstrate that it can specifically target human B cells in mice.

"Possibly the most important implication of the work is that gene therapy could now be carried out as an inexpensive procedure, able to be considered even in the less-developed world," Wang and his co-authors wrote.

That's good news for the World AIDS Foundation, which announced on World AIDS Day last year (Dec. 1, 2006) that the disease is on the rise again. More than 39 million people around the world are now infected with HIV, the foundation reported.

"I think we are finally on the right track," Wang says. "If scientists can find a way to genetically engineer immune cells to neutralize HIV, we may be able to develop immunotherapy for HIV-infected people, as well as find ways to prevent it all together."

Wang's research is part of the Gates Foundation's Grand Challenges in Global Health initiative, which was launched in 2003 to create "deliverable health tools" that were "not only effective, but also inexpensive to produce, easy to distribute and simple to use in developing countries."

Collaborators on the five-year project, titled "Engineering Immunity Against HIV and Other Dangerous Pathogens," include, in addition to Wang, principal investigator David Baltimore of Caltech and co-principal investigator Pamela Bjorkman of Caltech. The USC student researchers working on the project are Leslie Bailey, Taehoon Cho, Haiguang Yang and Alex Lei. All four are third-year Viterbi School graduate students majoring in chemical engineering. //

Taming Torrents of Data

THE VITERBI SCHOOL'S INFORMATION SCIENCES INSTITUTE LEADS SEARCH FOR SCALEABLE KNOWLEDGE DISCOVERY THROUGH GRID WORKFLOWS

A growing number of scientific fields suffer from a stifling embarrassment of riches. Data pile up faster than researchers can analyze them. At the Viterbi School's Information Sciences Institute, computer scientists are addressing that problem by building the prototype of a system that will automate scientific workflows.

Yolanda Gil leads the newly funded $13.8 million Windward Project, aimed at "Scaleable Knowledge Discovery through Grid Workflows."

Gil says that in fields like climatology, high-energy physics and seismic modeling, "our ability to gather data is surpassing our ability to analyze it. Our data warehouses are becoming data graveyards."

In a sense, Windward will bring to analysis of scientific problems an approach that is similar to that of industrial engineering, where engineers create optimal workflows, so that raw material and machinery combine in the most efficient fashion to create products. But in today's world of scientific research, the product is not a physical item like an automobile or computer; rather, it is more often a model or an understanding. Efficient workflows to create it are equally critical, and because the raw material is information instead of matter, it is much easier to automate.

Gil and ISI collaborator Ewa Deelman co-chaired a National Science Foundation workshop on the subject in May 2006.

"Significant scientific advances today are achieved through complex distributed scientific computations," their overview for this workshop noted. "These computations, often represented as workflows of executable jobs and their associated dataflow, may be composed of thousands of steps that integrate diverse models and data sources."

The workshop held out the possibility that computer science would be able to channel this waterfall of data into orchestrated workflows, leading to recommendations for "basic work in computer science to create a science of workflows." The workshop suggested that scientists proactively

ISI's Yolanda Gil leads the $13.8 million Windward Project.

build workflow architecture into their research plans.

"Workflow representations that capture scientific analysis at all levels should become the norm when complex distributed scientific computations are carried out," concluded the overview.

Windward is an effort by Gil, who is principal investigator and project leader of the ISI Interactive Knowledge Capture research group, Deelman, and two fellow ISI project leaders, Paul Cohen and Carl Kesselman. They believe they can accomplish this ambitious task by integrating two longtime ISI specialties, artificial intelligence (AI) and grid computing.

AI tries to give computers power to respond accurately and appropriately to changing and novel circumstances, bringing multiple concerns to bear on the problem of making the right choice from a number of alternatives.

Cohen will build on his work at the ISI Center for Research in Unexpected Events, which has focused on AI systems for complex data analysis. He has been working specifically in the area of AI analysis of scientific data for years, publishing papers on "Intelligent Assistance for Computational Scientists: Integrated Modeling, Experimentation, and Analysis" 10 years ago, with work on planning systems going even farther back.

Cohen has also studied the history of science in certain fields to try to see patterns in the process of discovery. It is work that underlies the researchers' approach.

In order for AI systems to automate processes and provide assistance to scientists in defining workflows of complex computations, they need to have the world carefully structured and described.

Gil has long been active in developing the semantic web, which creates a digital universe that AI can explore and understand, and which will be a building block of the Windward system.

Previous AI systems have been much smaller than the regional, national and even intercontinental data structures needed to do workflow science.

This is where grid computing and Deelman and Kesselman come in. Since 1996, Kesselman has been perfecting the Globus software that allows multiple users in multiple locations secure, easy and transparent access, not just to raw data, but also to resources (computers) to process the data.

Linking to grid computing software, Deelman and her collaborators have developed a workflow management system, called Pegasus, that maps large numbers of computations to distributed resources while optimizing the overall performance of the application.

Deelman will continue to evolve Pegasus, which has already been successfully used in applications in the fields of astronomy, earthquake science, gravitational-wave physics and others.

> "...our ability to gather data is surpassing our ability to analyze it. Our data warehouses are becoming data graveyards."

The AI and grid computing groups at ISI have been collaborating in the area of scientific workflows for several years now, with notable results in earthquake science, in joint work with the Southern California Earthquake Center.

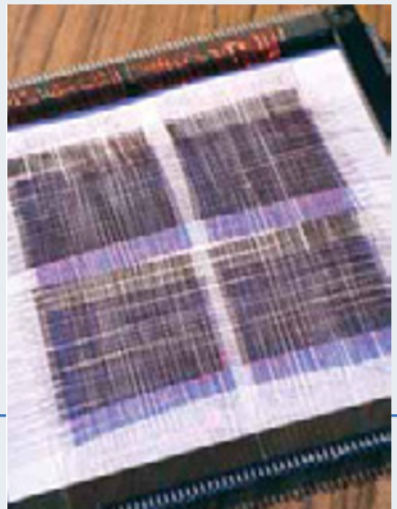
In the Windward project, they will develop new workflow techniques to represent complex algorithms and their subtle differences, so that they can be automatically selected and configured to satisfy the stated application requirements.

They will also investigate mechanisms to support autonomous and robust execution of concurrent workflows over continuously changing data.

In addition, they will develop learning techniques to improve the performance of the workflow system by exploiting an episodic memory of prior workflow executions.

Gil, with David DeRoure and Jim Hendler, co-edited a January 2004 special issue of IEEE Intelligent Systems journal on "E- Science," putting forth many of the ideas Windward will develop.

Funding for the project comes from the Air Force Research Laboratory. //



Computer science is helping researchers manage massive data flows.

Uncanny Swimmers

WHAT PROPELS DOLPHINS, TUNAS, WHALES, AND SEALS THROUGH ROUGH WATERS?

Eva Kanso is investigating the secrets of hydrodynamic acceleration.

The most energy-efficient swimmers on Earth—dolphins, tuna, whales and seals—will burst through choppy waves, playing tag as they torpedo across the ocean's surface on a gusty day. Diving, darting, streaking through the immensity of the ocean, these majestic predators can follow ships cruising at up to 40 nautical miles per hour (knots), or about 46 miles per hour, using their vertical tail movements to accelerate and maneuver beyond any naval architect's wildest dreams.

What propels these swift marine creatures so effortlessly through turbulent waves, ocean winds and strong currents?

That's what Eva Kanso, a mechanical engineer who specializes in dynamical systems, wants to know. If she can unlock some of the hydrodynamic secrets to a marine mammal's uncanny swimming ability, that could lead to the development of a new generation of biologically inspired robots capable of exploring the depths of the ocean or environments that are too hazardous for human intervention.

"Fish and cetaceans move in water with great agility and efficiency, through rhythmic shape changes, which generate an unsteady flow around the animal's body and typically create a vortical flow past the body," says Kanso, an assistant professor of mechanical engineering in the Viterbi School's Department of Aerospace and Mechanical Engineering. "There is a widespread belief that fish exploit the unsteadiness in that flow and use it to their advantage, which makes them capable of achieving very impressive hydrodynamic efficiencies. But we don't fully understand the dynamics yet."

Fish use their cleverly streamlined bodies to exploit fluid-mechanical principles in ways that nautical science and technology can only marvel at today. It's taken 500 million years for fish to evolve from armored, jawless bottom suckers to extraordinary engines of propulsion efficiency, acceleration and maneuverability. It's probably going to take a while to figure out their hydrodynamic secrets.

Aquatic locomotion and the study of solid-fluid interactions is the centerpiece of Kanso's dynamical systems research. It is based upon the physical conservation laws of mass, momentum and energy. On large scales, the mathematical statements of these laws have been applied to deep-sea submersible vehicles capable of reaching depths that were never possible before. But the forces that govern the motion of fish involve shape changes and the specialized flows that an undulating body creates as it moves through the water. For example, finless fish create vortices (whirling currents) as they shimmy through the water, and researchers want to quantify the momentum and acceleration.

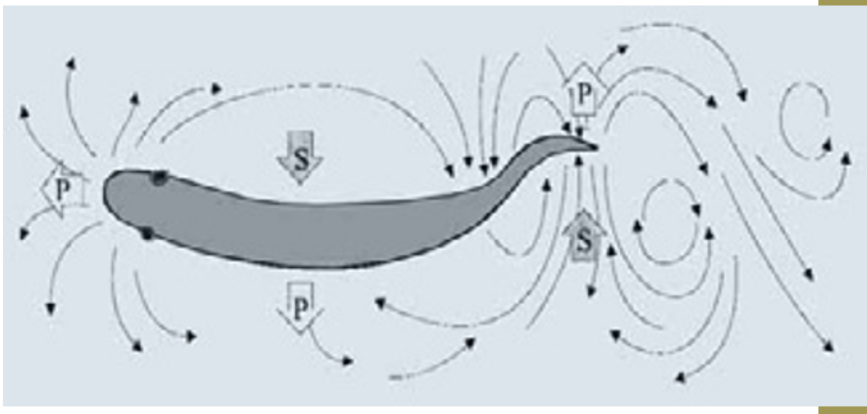
"Understanding the laws of aquatic locomotion will help us design biologically inspired robotic vehicles, big and small, to use in the exploration of our oceans," Kanso says. "That's very important because we still have much more to learn about the ocean and aquatic life."

As a student of dynamical systems, Kanso brings a different perspective to the field of aquatic locomotion. "My work is theoretical in the sense that I am thinking of the simplest mathematical equations that describe solid-fluid interactions," she says. "I then work on analyzing the behavior of these equations, which govern the physics of a solid body in fluid. For this analysis, I use tools from dynamical systems theory, which is the study of any phenomenon that changes with time."

Phenomena that change over time can include fish swimming in water but they can be many other things as well. In nature, dynamical systems characterize animate and inanimate objects. They can be chaotic or linear. They can be airfoils or lava flows.

> "**Understanding** the laws of aquatic locomotion will help us design biologically inspired robotic vehicles, big and small, to use in the exploration of our oceans."

A handful of specialized hydro- and aerodynamics groups—at USC, Stanford, UC Berkeley, MIT, Cornell and Carnegie Mellon—are studying the same mathematical expressions of these dynamical solid-fluid systems in the hopes of developing new high-tech robot vehicles. Some of Kanso's colleagues at USC include Professor Tony Maxworthy, who holds the Smith International Chair in Mechanical Engineering, and his associate, Professor Geoff Spedding, a zoologist by training who studies airfoils and bat flight.



Undulating body of a whale creates vortices (whirling currents) to propel it forward.

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

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

Similar principles may apply to swimming fish, an area that Kanso began investigating as a postdoctoral researcher at Caltech. During that time, she modeled the fish as a deformable body made of articulated rigid links, and showed that it could propel and steer itself in potential flow solely by changing its shape.

Her work is highly regarded and, earlier this year, won for her a Faculty Early Career Development Award from the National Science Foundation to pursue theoretical and computational modeling.

With the $400,000 grant awarded over five years, Kanso may be able to help nautical science and technology advance to a new understanding of underwater locomotion. And when a naval architect wants to know how a yellow fin tuna can overcome its prey with a few bursts of acceleration, she may be able to explain it. //

Clearing the Air

OVERALL, L.A.'S AIR QUALITY HAS IMPROVED, BUT SOME OF THAT INVISIBLE STUFF HAS BECOME MORE TOXIC

Despite obvious improvements in air quality over the past few decades, Los Angeles Basin remains the most polluted region in the nation. Much of the pollution is invisible—ultrafine particulate matter (PM), volatile organic compounds and other gaseous combustion by-products, such as sulfur dioxide and nitrogen oxides—and much of it is spewed from tailpipes.

The smaller range of PM, known as ultrafine particles, is not only increasing, but becoming more toxic, says Constantinos Sioutas, holder of the Fred Champion Professorship in Civil and Environmental Engineering at USC and co-director of the Southern California Particle Center and Supersite (SCPCS).

"Over the past seven years, the emission rates of these particles from vehicles has increased considerably," says Sioutas. "Along and nearby L.A.'s busy freeways, each cubic centimeter of air can contain up to a million or more of these ultrafine particles."

Ultrafine particles are typically defined as less than 0.1 micrometer in diameter, but these tiny specks can carry large amounts of absorbed or condensed toxic air pollutants. Nationwide, PM has been linked to roughly 60,000 smog-related deaths each year, and according to epidemiological studies, an increase in daily PM concentrations of as little as 10 micrograms per cubic meter (10 $\mu g/m^3$) has resulted in a 1 percent increase in the nation's daily mortality rate.

Sioutas checks his PM monitor before starting data collection.

Constantinos Sioutas, who holds the Fred Champion Professorship in Civil

"These microscopic specks of dust and soot are far more toxic in the human body than larger, coarser particles," Sioutas says. "When they are inhaled, they aren't trapped by the nose and trachea, but travel all the way down to the tiniest branches of the lungs and enter the bloodstream through the alveoli, which are very thin-walled sacs of spongy tissue at the ends of the bronchioles. That means they are rapidly absorbed into the bloodstream and remain embedded in the body for long periods of time. That sometimes leads to systemic health problems, in addition to the more intuitively obvious respiratory problems, such as asthma and bronchitis."

Not much was known about ultrafine particles until Sioutas and John Froines, co-director of SCPCS, founded the center six years ago and began to investigate the physical, chemical and toxicological characteristics of this microscopic material. The data is collected via a SCPCS network of monitors, located throughout the Los Angeles

and Environmental Engineering, sets up a roadside monitor.

Basin, which is able to identify pollutants in discrete size groups. The groups are: ultrafine particles of less than 0.1 micrometers, such as those generated by combustion; accumulation mode particles, ranging in diameter from 0.1-2.5 micrometers, such as ammonium sulfate and nitrate compounds; and coarse, dusty particles larger than 2.5 microns that contain mostly road and soil dust, and sea-salt elements.

"These pollutants are complex, persistent and unique," Sioutas says. "They are spewed from millions of motor vehicles and nearly 300,000 diesel trucks. We have high concentrations of PM around Los Angeles Harbor, the busiest harbor in the country, and at LAX, the fifth busiest airport in the world. These pollutants turn the basin, which is shaped like a big bowl, into an incubator for secondary aerosol formation, which lingers in the atmosphere long after the PM from primary combustion sources has disappeared."

Sioutas, who is interested in the impact of PM on health, says new data from the SCPCS has found that children living near major interstate highways are at high risk of developing asthma and other respiratory ailments due to the toxicity of airborne particulate matter.

But solving the problem isn't easy or obvious, he says. And whatever improvements have been made in cleaning up the air—by reducing the PM emission rates of individual vehicles and trucks —have been outperformed by the increase in population, as well as the increase in commuters' average drive times to and from work each day.

"We're really at a plateau right now in our ability to reduce air pollution, so we have to start looking at something entirely different," says Sioutas, who is a member of the Air Quality Advisory Committee on PM for the state of California. "The public will have to start using hybrid vehicles and, more importantly, the city will have to seriously look at improving our system of public transportation. We have models of larger cities, such as New York City, London, Tokyo, Moscow and Paris, where people do much less driving, and this, in turn, has drastically reduced vehicle-induced pollution and increased the quality of life."

In September 2006, the Environmental Protection Agency (EPA) instituted revisions to the National Ambient Air Quality Standards Board for particulate matter, based on undeniable evidence of its link not just to respiratory disease but also to cardiovascular disease. This year, the state and the federal government, as well as the EPA, are considering the promulgation of an ultrafine particle standard, yet to be defined. Sioutas says it's a step in the right direction. "In my view, spending two to three hours each day commuting and being exposed to air pollutants on the freeway that are 10 times higher than what you're exposed to off the freeway is not an acceptable situation for anyone," Sioutas says. "But it is especially undesirable for susceptible groups of our population, such as children or people with pre-existing health conditions." He adds, "In California, we are rising up to the challenge and working to find ways of keeping everyone's air safe, but other states have to follow suit. After all, human lungs are the same, whether you're in California, New York or any other place in the United States." //

"**In my view** spending two or three hours each day commuting and being exposed to air pollutants on the freeway that are 10 times higher than what you're exposed to off the freeway is not an acceptable situation for anyone."

Resea

Providing Tomorrow's Answers Today

rch at Viterbi:

Research at Viterbi is interdisciplinary, with a focus on the solution of societal problems and a goal to lead in innovation, creativity and timeliness.

No better is this synergy manifested than in national centers of research excellence. These highly competitive awards provide the stability needed to launch long-range programs, and are the catalysts for the recruitment and nurturing of new scholars whose ideas and solutions will change the future. No less is their impact on engineering education, including undergraduate education, and on the cross-pollination of ideas between different fields.

The Viterbi school is fortunate to count a good number of such research jewels: Two National Science Foundation (NSF) Engineering Research Centers (ERC), the graduating Integrated Media Systems Center (IMSC), and the Biomimetic MicroElectronic Systems center; the first ever Department of Homeland Security university Center of Excellence, CREATE; the METRANS Transportation Center of the U.S. Department of Transportation; and the Center for Embedded Network Sensing, an NSF Science and Technology Center, with our sister institution UCLA as the lead.

IMSC is graduating after 11 continuous years of NSF support—the maximum an ERC can receive. The rest have been renewed and actively pursue their brilliant research agendas. In the next few pages, you will have a chance to review some of the accomplishments of the three Viterbi centers—and how they provide tomorrow's answers today.

You'll also find feature stories on faculty, undergraduate student and alumni research projects. Members of the faculty conduct research with their graduate students, but the Viterbi School has a long tradition of allowing talented undergraduates to work on research projects. And when they graduate to become alumni, they take that Viterbi spark of research creativity with them.

BMES:
An NSF Engineering Research Center That Learns from Nature

The goal of the Biomimetic Micro-Electronic Systems center (BMES) is uncompromisingly ambitious: Biomedical engineers creating electronic devices that cure—not just palliate—intractable conditions like blindness, paralysis, epilepsy and stroke.

BMES is the Viterbi School's newest (2003) National Science Foundation-funded Engineering Research Center (ERC). Its researchers are boldly using biology as a model, as they build systems that will allow the blind to see, the paralyzed to walk, and dementia patients to remember.


MARK HUMAYUN

"This is disruptive, not incremental advancement in technology," says BMES Director **Mark Humayun**, who is on the faculty of the Viterbi School's Department of Biomedical Engineering and the Keck School of Medicine at USC. "Our ERC vision is realized first by identifying the unmet medical needs in three test beds of blindness, paralysis and central nervous system impairments."

The natural ways the body performs these functions are broken down into a set of engineering problems. Then, engineers create systems to solve the problems. Some of the problems are specific to the three test beds. Others (electronic design, a way to power the devices, integrating silicon into cells) are common.

Here's a brief breakdown of where BMES is—and where it hopes to go.

THE RETINA: THE BLIND SEE

This is Humayun's own domain. His overall design has a tiny video camera transmitting images to an implanted signaler connected to the optic nerve through a high bandwidth (1,000-electrode) connection. Working with a start-up company, Second Sight, significant progress has been made: the creation of a prototype 1,000-channel electrode array design.

"We have invented a closed-loop power control system, and a 1,000-channel stimulator chip has been designed," says Humayun. "We have begun to study the response of retinal cells to electrical stimulation.These studies will establish safe limits for electrical stimulation in the retina. Finally, we have begun to study the mechanical properties of the retina and other eye tissues."

Humayun acknowledges that experience with chronic implantation suggests that mechanical damage to the retina is a significant concern for long-term implants. A Viterbi team including Ellis Meng, assistant professor of biomedical engineering, is at work on this problem.

Humayun is working with a large team including Keck school ophthalmologist J. D. Weiland and researchers from a large number of other universities and research centers. A half dozen formerly blind patients have received low-resolution implants allowing them to see light and shapes. The researchers' plan is to continue improving the technology, so that eventually patients will be able to recognize faces and read print.

THE BION: REVITALIZING PARALYZED LIMBS— AND BUILDING NEW ONES

Gerald Loeb, a physician who is a professor of biomedical engineering at the Viterbi School, has created the Bion, a chip that can patch a damaged nerve line, allowing a patient to regain control of muscle. But what if the limb that the nerve served is no longer there? Loeb's team is working on artificial limbs that the Bion can control.

Rahman Davoodi, research assistant professor of biomedical engineering, and Mehdi Khachani, programmer in the Alfred E. Mann Institute, are working to model the forces of arms and legs. For full natural control, the signals must be two-way - that is, the Bion must not only transmit information to the limb, but that limb must also create appropriate feedback and transmit it back to the Bion. The next generation of the Bion, the BION™2, which is now in intensified development, will do this.

BRAIN CHIPS FOR VICTIMS OF STROKE, EPILEPSY AND DEMENTIA

Ted Berger, professor of biomedical engineering and holder of the David Packard Chair in Engineering, is closing in on a 30-year dream of duplicating the way the hippocampus functions. With theoretical help from fellow Viterbi Professor of Biomedical Engineering **Vasillis Marmarelis**, and painstaking 'wet' research, he has "cracked" the spatiotemporal code that the hippocampus uses to process incoming information into memories and learned behavior. **Armand Tanguay**, professor in the Ming Hsieh Department of Electrical Engineering, provided early

TED BERGER

insights into creating silicon analogs. Chip expert **John Granacki** from the school's Information Sciences Institute has recently created a chip that perfectly mimics a 100-cell section of hippocampus. The potential payoff would be a cure for epilepsy, stroke and dementia victims.

ENERGY, IMPLANTABILITY AND DATA PROCESSING

Implanted devices of all kinds share common needs: power to operate them, the ability to integrate physically with biological systems, and the ability to process data. For power, **Florian Mansfeld**, a professor in the Mork Family Department of Chemical Engineering and Materials Science, is working with the BMES Power and Data Management Technology Thrust to develop tiny implantable fuel cells that can use in-body sources to generate power. Researchers are creating ways to transmit outside power to run devices, creating interfaces that will stand up to conditions found inside the body without damaging tissues and expanding work on multipurpose multifunctional biomimetic chips.

In addition to performing research in connection with a very wide range of sister universities and government laboratories, BMES also partners with relevant industry, is developing an education curriculum to teach the techniques it is learning and has a robust community outreach program. //

IMSC:

The NSF Engineering Research Center with a Bonfire of Research

May 23, 1996, was Oscar night for engineering. After months of grueling comparisons of no less than 117 candidate schools, the National Science Foundation (NSF) was ready to announce the winning institution that would house an Engineering Research Center in the field of multimedia. In the envelope was the name of USC's School of Engineering and its newly formed Integrated Media Systems Center (IMSC).

USC President **Steven B. Sample** was exultant—and prophetic. "I see the NSF grant as a match on a little gasoline," he said. "It will start a bonfire of research and innovation."

Aggressive and unapologetic partnership with industry was a cornerstone of IMSC, setting a pattern now widely imitated at USC. But the bottom line and touchstone of IMSC was, and remains, a remarkable record in fostering exceptional cross-disciplinary and collaborative engineering research.

Many IMSC researchers, as their efforts gained momentum, acquired new funding to establish their own new labs, making room for more IMSC start-up efforts that, in their turn, branched out.

The following is just a brief sampling of a few of the research achievements at IMSC.

ULTRAWIDEBAND RADIO

Most utilizations of radio involve modulating very specific radio frequencies to carry messages, or for radar. At IMSC, **Robert Scholtz**, professor in the Ming Hsieh Department of Electrical Engineering, provided a foundation for a new technology that has the opposite strategy. Scholtz and his students developed techniques for generating, receiving and using extremely weak pulses of radio waves spread across an enormously wide stretch of the spectrum. The pulses are so weak that devices won't interfere with each other unless they are very close. And they don't interfere with other users of the radio frequencies at all. Ultrawideband is coming into use for Bluetooth and WiFi operations, with Scholtz recognized as father of the technology.

IMMERSIDATA AND VIRTUAL REALITY EDUCATION/TESTING

Working at IMSC, **Albert 'Skip' Rizzo**, a psychologist who is now a research scientist at the USC Institute for Creative Technologies, and **Cyrus Shahabi**, associate professor of computer science, created unique new training tools and systems that monitor users' interactions with computers to both teach students and assess skills. An influential example is Virtual Classroom, a prize winning system for diagnosing attention deficit hyperactivity disorder (ADHD) in children. The recorded 'immersidata," reveals sharply distinct patterns for children with ADHD, and the system is being commercialized as a diagnostic tool.

HAPTICS

Margaret McLaughlin, a professor in the USC Annenberg School, developed devices at IMSC that allow users to 'feel' shapes and textures that exist only as digital information in computer interfaces. One application is a system to help rehabilitate stroke victims, by "challenging them to grasp, pinch, squeeze, throw and push their

way to recovery, as described in a report in *Virtual Medical Worlds*. "It lets them interact with virtual worlds by feel," Other work developed desktop devices for museums, to allow visitors to 'touch' works of art on display, without endangering the art.

IMMERSIVE AUDIO

IMSC investigators **Chris Kyriakakis**, associate professor in the Ming Hsieh Department of Electrical Engineering, and **Tomlinson Holman**, a professor in the USC School of Cinematic Arts, who is also a professor of electrical engineering and the "TH" in the THX sound system, have revolutionized the field of sound reproduction. Their work is rippling through the industry, accelerated by an IMSC-linked start-up, Audyssey Laboratories Inc. "To show off his work, Kyriakakis plays a recording of the Hallelujah Chorus from Handel's "Messiah," reported *Time Magazine*. "Then, via digital filtering, he drills down to specific instruments, as if microphones had been placed next to them. A digitized timpani track is stunningly realistic and intimate." The IMSC-created immersive sound system ingeniously widens the 'sweet spot' of conventional sound systems, so that every seat receives perfect sound. In the view of many listeners, the reproduced sound is indistinguishable from actually being present. IMSC pioneered technology to send the immersive sound experience over the Internet, allowing performers on opposite sides of the continent to play together with a pianist in Miami sounding as close and real as the vocalist in Los Angeles she accompanied.

IMMERSIVE ENVIRONMENTS

Ulrich Neumann, associate professor of computer science who served for several years as director of IMSC, created visual tools more vivid and useful than any in existence. The efforts included new forms of display, ways to integrate views from overlapping camera views that allow an individual to take a virtual walk through an area. A collaboration with Cyrus Shahabi produced GeoDec, which allows computer operators to do the same trick with world geographical information.

Combining visual advances with the immersive audio and haptics research is the continuing challenge for IMSC, which has the audacious goal to bring all these elements together to produce a grand digital representation that is indistinguishable from reality.

TOMLINSON HOLMAN & CHRIS KYRIAKAKIS

ELAINE CHEW

ENGINEERING MUSIC

At IMSC, **Elaine Chew**, associate professor in the Daniel J. Epstein Department of Industrial and Systems Engineering and a winner of the Presidential Early Career Award for Scientists and Engineers, found a place to combine her two life interests, music and engineering. In her classroom, students apply engineering techniques to analyze musical expression. In her own laboratory, she has put the techniques to work in an intriguing series of inventions and devices, including one that enables a non-musician to 'drive' a performance of a piano piece, changing volume and tempo through an automobile-like interface.

SYNTHESIZING AND UNDERSTANDING SPEECH

Shri Narayanan, the Viterbi Professor of Engineering in the Ming Hsieh Department and a professor of computer science, linguistics and psychology, attracted international attention two years ago with an automated system that was able to detect anger in the voice of callers. Another line of that research synthesized lifelike laughter. Still another was a pioneering effort to have computers recognize the distinctive speech of children, who could then interact without using the conventional mouse and keyboard. Perhaps Narayanan's most ambitious research was a module that enabled a doctor to ask questions in English, have his words come out of the machine in understandable Farsi (Persian) for a patient to hear. Then the same machine translated the patients' spoken Persian responses into English for the doctor.

This listing is only a part of the "bonfire of research and development" foreseen by President Sample. As IMSC continues through its second decade under the directorship of James Baker, its new chairman and the chief executive officer of Fuji Xerox's Palo Alto Laboratory, it appears the fire will continue to burn brightly. //

CREATE:

The First DHS Center of Excellence Studies Risky Business

In November 2003, USC scored a major coup when the Department of Homeland Security (DHS) selected it for the very first university "Center of Excellence," headquartered in the Ronald Tutor Hall.

Four years later, the Center for Risk and Economic Analysis of Terrorism Events, or CREATE, exerts national influence, with its research and products affecting policy and helping responders manage risk. The center is a collaboration between the Viterbi School and the USC School for Policy, Planning, and Development (SPPD), with New York University and the University of Wisconsin acting as partner.

DETLOF VON WINTERFELDT

CREATE director **Detlof Von Winterfeldt** is a professor in the Daniel J. Epstein Department of Industrial and Systems Engineering at the Viterbi School, with a joint appointment in SPPD. He has literally rewritten the book on the concept of risk, developing rigorous and subtle ways to quantify adverse possibilities in a manner designed to help decision-makers.

Many of his ideas began during his tenure as director of USC's Institute for Safety and Systems Management, which has the distinction of having granted graduate degrees to more currently serving Air Force generals—29—than any other school in the country. Von Winterfeldt succeeded Randy Hall, Vice Provost for Research Advancement, who co-directed CREATE prior to his new appointment.

CREATE's seven sister DHS Centers of Excellence are all developing information on specific threats and ways to combat them. For example, the second DHS center (in which the Viterbi School also participates) is the Center for Foreign Animal and Zoonotic Disease Defense (FAZD), aimed at developing tests, cures, models and other basic research for possible outbreaks of foot-and-mouth disease, avian flu, and rift fever.

But to develop policy, to decide what to do, DHS calls on CREATE, which is becoming the glue binding all of the others together. CREATE work includes a range of studies to develop a variety of tools, as described below.

RISK ANALYSIS

A study that Von Winterfeldt completed about the danger posed by small, shoulder-fired anti-aircraft rockets with the potential to bring down passenger airliners illustrates the way CREATE works. Von Winterfeldt tracked consequences using "decision trees" of alternate possibilities to evaluate costs and benefits.

The analysis was widely admired and **Michael Orosz**, a project leader at the school's Information Sciences Institute (ISI), working with ISI colleagues **Tatiana Kichkaylo** and **Robert Neches**, have made Von Winterfeldt's approach accessible to risk analysts all over the nation with the Risk Analysis Workbench, or RAW.

RISK MANAGEMENT AND EMERGENCY RESPONSE

CREATE is also developing tools that can guide and speed response to disasters. CREATE teams are analyzing new tools for three specific disasters or threats.

Sami Masri, professor of civil and environmental engineering, and **Jean Paul Caffrey**, research assistant professor of civil and environmental engineering, are working on an open system that can analyze explosion threats against specific buildings and pre-configure responses.

Computer scientist **Ke-Thia Yao** of ISI completed a project for a system to orchestrate response by the civilian air system to attacks or threats of attacks on airports or individual planes. Professor **Maged Dessouky** and **Fernando Ordonez**, assistant professor of industrial and systems engineering, are working on a way to optimize pre-placement of medical resources, such as vaccines, for best response to emergencies.

SPECIFIC PLACE PLANNING

Emergency preparations need to be custom-tailored to individual places. CREATE has done substantial work using economic analysis tools to estimate impacts of various interruptions in the Southern California megalopolis. **James Moore**, professor and chair of the Daniel J. Epstein Department of Industrial and Systems Engineering, who is also a civil engineer, and **Peter Gordon** and **H.W. Richardson** from SPPD are adapting their complex existing economic model, both for local use and as a prototype.

Ordonez and **Milind Tambe**, associate professor of computer science, are working with USC's Department of Public Safety on improved flexible response, using GPS tools.

MILIND TAMBE

TRAINING TOOLS

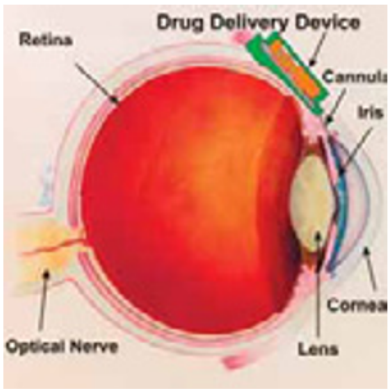
One of the most striking and innovative CREATE products has been DEFACTO, an application of artificial intelligence technology for training emergency responders. Tambe and **Nathan Schurr** (Ph.D. CS '07), who was Tambe's graduate student, worked directly with the Los Angeles County Fire Department. CREATE is also working with the GamePipe Laboratory to build another fire-training game, called Firescope. //

Out of Sight Implants for the Eye

A new microfluidic device, designed by bioengineer Ellis Meng and an interdisciplinary team of researchers, could be a gift to the vision-impaired.

Out with the old and in with the new. In a few short years, microfluidic devices may replace eye drops, gooey ointments and intraocular injections for those suffering from glaucoma and other vision-threatening diseases.

Assistant Professor Ellis Meng is a microelectromechanical systems (MEMS) fabrication specialist in the Viterbi School's Department of Biomedical Engineering and the winner of a National Science Foundation Faculty Early Career Development Award. With a team of interdisciplinary scientists from the Keck School of Medicine at USC and Caltech, she has developed a new generation of intraocular devices that promise to alleviate some of the more invasive and often painful interventions associated with the management of glaucoma and age-related macular degeneration , two of the leading causes of blindness in the world.



Schematic of the human eye shows where an intraocular device is placed.

Glaucoma is an incurable disease characterized by gradual loss of peripheral vision. An estimated 3 million to 6 million people in the United States, including 4 percent to 7 percent of the population over age 40, have elevated eye pressure. The disease occurs when the optic nerve is damaged by increased pressure inside the eye. As it worsens, the field of vision gradually narrows and eventually leads to blindness.

Age-related macular degeneration (AMD) is the leading cause of blindness in people 55 and older, and primarily affects the macular photoreceptors that serve the central vision of the eye. The condition impacts a person's ability to read, recognize faces and drive, making them legally blind. Estimates indicate that there are about 1.75 million Americans with AMD; by 2020, that number is expected to climb to nearly 3 million, and at the same time, an additional 8 million people will have clinical signs of AMD and be at high risk of progression to late-stage vision loss.

"There are physiologic barriers to treatment, because the medication has to be delivered to the interior and usually the back wall of the eye, where the macula is located, and that's a difficult place to reach," Meng says. "It requires monthly injections into the eye with a needle. That introduces the possibility of side effects, such as infection and bleeding, not to mention the associated pain and discomfort of the injections."

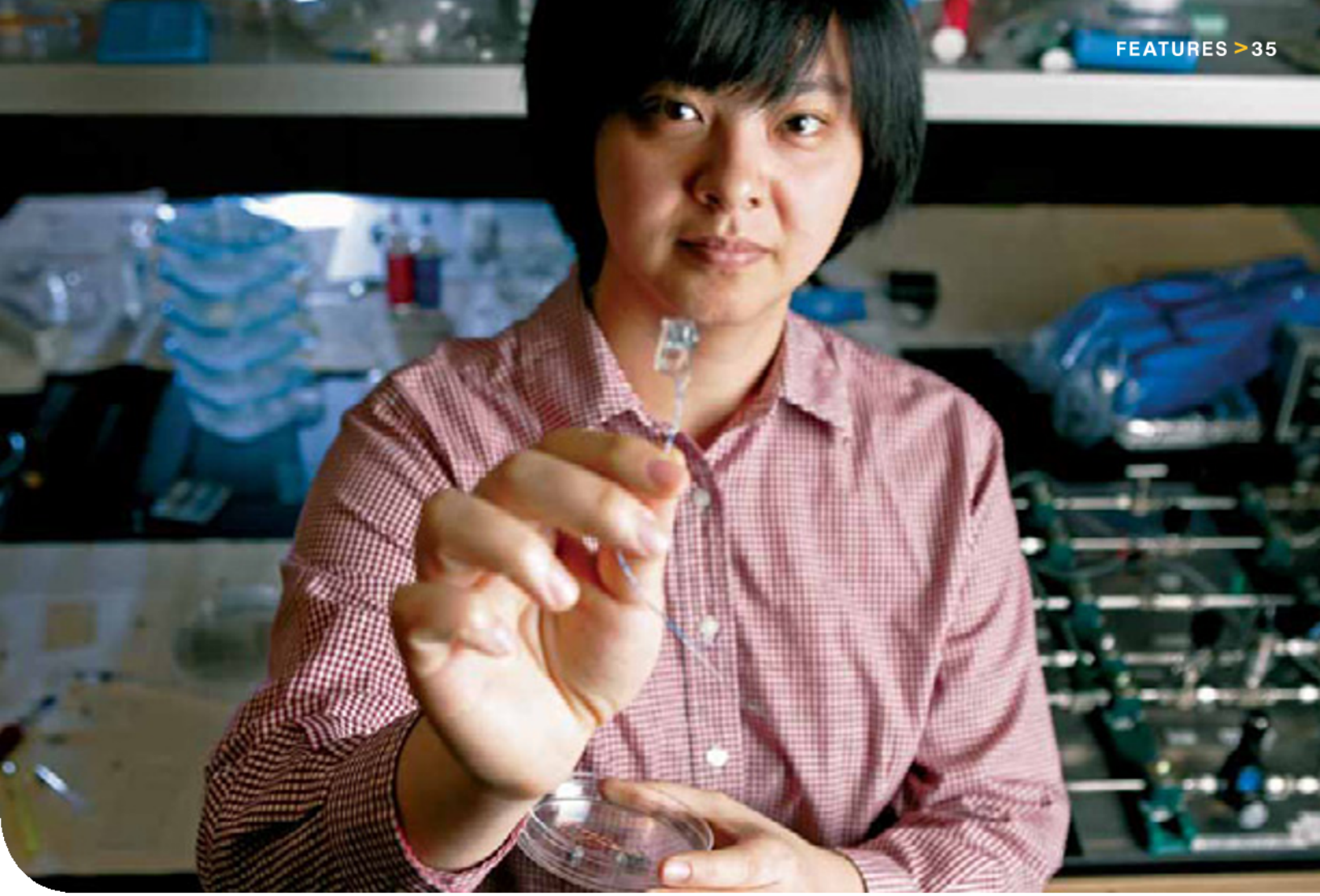
Microfluidic devices, which are based on MEMS technology, offer several advantages over traditional approaches to glaucoma therapy: They can be implanted permanently in the eye and can be refilled.

"We are about two years away from commercializing the first implantable intraocular delivery system for AMD, as well as glaucoma management, and for the treatment of other eye diseases," says Meng, holding up an implant about the size of a wristwatch battery. "I think this is really going to improve our ability to slow the progression of chronic, degenerative conditions."

Meng has spent several years experimenting with microfluidic devices. Her current devices measure about 5 to 7 millimeters in diameter and act like a tiny chemistry lab to deliver minuscule volumes of medication to the eye. The device is more like a tiny reservoir of fluid attached to an even tinier tube—called a "cannula"—which is threaded through the interior of the eye and fastened to its anterior wall.

Unlike current intraocular devices, Meng's is refillable. Operated either manually or electrically, it only has to be implanted once, which is an appealing feature for anyone who has repeatedly undergone more invasive procedures. Of course, the more bells and whistles that are added, the more bioengineering smarts it takes to design these microdevices. But that isn't a problem.

Meng is developing her implant with help from one of the nation's leaders in retinal prosthetics, Mark S. Humayun, a physician and biomedical engineer who is associate director of ophthalmology research at Doheny Eye Institute, Keck



Ellis Meng holds up one of her new eye implants, which is about the size of a wristwatch battery.

School of Medicine at USC. Humayun is on the faculty for both the Keck and the Viterbi Schools and directs the Biomimetic Microelectronic Systems (BMES) Engineering Research Center, a collaboration between the Viterbi and Keck Schools that is developing novel implants to treat disabilities such as blindness, paralysis and memory loss.

Humayun is a surgeon with a Ph.D. in biomedical engineering. He has spent the last 20 years developing an implantable artificial retina that can stimulate the remaining photoreceptor cells in the retinas of people who are suffering from retinitis pigmentosa. This degenerative disease causes blindness as the rods and cones in the eye lose their ability to function.

Humayun sees intraocular implants as a promising technology for treating and slowing down the progression of degenerative eye diseases. The microfluidic device that Meng's group has fabricated shows potential: It has done well in early pre-clinical implantation studies and, in early tests, appears to be working as expected.

The device is made of micro-machined silicon and biocompatible polymers. The drug reservoir is attached to a tiny electrolysis-actuated pump that will turn the mechanism on like a faucet.

The implant is surgically embedded in the eye wall just behind the cornea, the transparent, dome-shaped window covering the front of the eye. Meng says the tiny tube is inserted through the eye wall and can be threaded to the front or back part of the eye. Each time the electrolysis pump is activated, a controlled dosage of medication will be injected.

In preliminary experiments, Meng and her co-investigators used dye to visualize initial delivery in porcine (pig) eyes, then later used phenylephrine, a drug used to dilate the pupil, in rabbit eyes to obtain physiological evidence of the drug's effect in vivo. The reservoirs were repeatedly dispensed and refilled, and the researchers recorded notable effects on pupil dilation after dispensation of the drug.

"We didn't have any functional damage from repeated refilling of the device," Meng reports. "We observed pupil dilation with repeated dispensation, which means the medication reached its destination."

Her results were presented in various professional meetings and were well- received, signaling a successful conclusion to Phase 1 testing. Now it's time to take the next step. //

Reaching for the Stars

Two enthusiastic groups of Viterbi School students are chasing their dreams of space, with a little help from Viterbi faculty. One group launched its handmade rocket three times in the Southern California desert, while the other wants nothing less than to land on the moon.

How do you get to the moon? Well, you can leapfrog. The Viterbi School's Lunar Entry and Approach Platform for Research on Ground—known as LEAPFROG—is the latest and greatest USC lunar landing vehicle to accomplish just that.

Professor Mike Gruntman, chair of the Astronautics and Space Technology Division and David Barnhart, the director of the Aerospace Technology and Systems Center at the school's Information Sciences Institute, have been supervising 14 astronautical students, as well as graduate and undergraduate students from other engineering departments, in their quest to build a small, autonomously controlled hovercraft that can simulate landing on the moon. The project began in 2006 and showed off its hardware late that year at the second Space Exploration Conference in Houston.

According to Barnhart, the design was inspired by a real machine used to train Apollo astronauts, the Lunar Lander Research Vehicle (LLRV). That flyer simulated, by means of a special, additional jet engine, the reduced gravity that the Lunar Module would encounter. The students' LEAPFROG is smaller, being a little more than three feet in diameter, and much cheaper, about $12,000, compared with several million dollars for the LLRV.

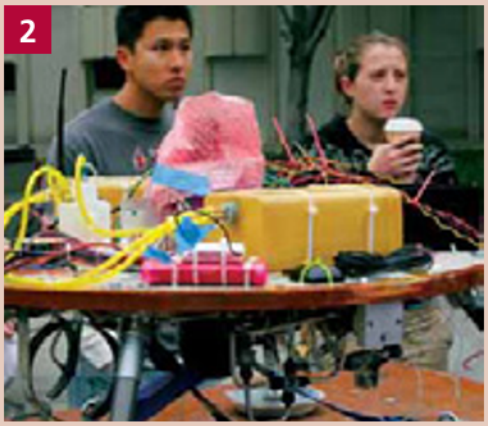
Barnhart says the project goal was "hardware, not paper," with a focus on rapid fabrication, integration and testing.

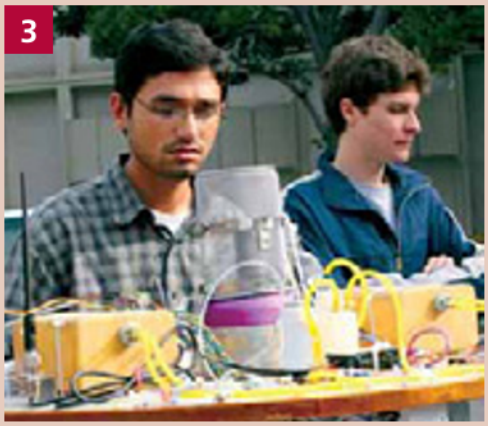
"Build a little, test a little, fly a little," he explains.

LEAPFROG provides "an actual flight platform … to test early prototypes of key landing subsystems," Barnhart says, "through a similar profile, and in similar dust and lighting conditions experienced on the moon."

The students were successful enough to attract the attention of the aerospace community and NASA.


1


2


3

1. Paul Giuliano; 2. Jason Cheng and Kristina Rojdev; 3. Omair Rahman and Michael Rudolph;
4. Omair Rahman; 5. Nicole Jordan, Kristina Rojdev and Jason Cheng; 6. Jason Cheng;
7. The LEAPFROG student team in the back from the left are Allen Eramya, Omair Rahman, Kristina Rojdev, Nicole Jordan, Omer Faghfoor, Michael Rudolph, Paul Giuliano, Alvin Garcia, Morgan Henry, Del Causon (staff). In front are David Barnhart of ISI, Cassandra Raskin and Savith Chuahan

Yes,

"I am amazed at the progress and scope the student team has achieved in such a short time," says Alan Weston, from Ames Research Center, who attended the Critical Design and Integration Review, which the team held only a few weeks after coming together.

The student participation was not just to assemble an existing idea. Rather, the effort involved everything from designing from scratch, using off-the-shelf components, to assembling and integrating a complete flight system. The design team followed traditional spacecraft subsystem roles giving individual Viterbi students responsibility for overseeing specific areas. Student supervisors were Kristina Rojdev (Engineering); Morgan Hendry (Guidance Navigation and Control), Michael Rudolph and Allen Eramya (Structures), Jason Cheng (Jet Engine), Lucy Hoag (Power and Harness), Omer Faghfoor (Communications), Nicole Jordan (Ground and Flight Systems), and Alvin Garcia, Jose Martinez and Savith Chauhan (Attitude Control).

Barnhart says standout successes have included design and fabrication of the attitude control thrusters by Savith Chauhan within six weeks, a process normally taking three months; architecting, purchasing and running the Rabbit microcontroller software and PLC hardware to control the jet engine and the ACS thrusters by Omair Rahman and Cassandra Raskin; and successful test firing and characterization of the jet engine by Jason Cheng and Daniel Frolich on campus, within one week of training.

Meanwhile, last April, another student research group fired 45 pounds of carbon fiber, Kevlar and solid rocket propellant 18,461 feet into the clear, blue sky high above California's Mojave Desert before their rocket plummeted safely back to the ground by parachute. It was the third successful launch in two years for the rocket, affectionately known as Del Carbon.

USC Viterbi astronautics students in the Rocket Propulsion Lab (RPL) built this demonstration flight vehicle from scratch under the direction of Professor Daniel Erwin.

Del Carbon, named for its carbon-fiber construction as well as the students' favorite fast-food restaurant, was baked in an oven big enough for a "really big pizza," according to sophomore David Reese. It first flew in May 2006. After the success of that test flight, Del Carbon, with its hand-polished aluminum nose cone, received a more powerful engine and was launched again in October. That time, it reached an altitude of more than 21,000 feet.

Reese, a rocket hobbyist since age 8, eagerly responded when Erwin asked his astronautics students about their interest in forming a student-run research organization to design, build and test composite airframes. Many of the more than 20 others who responded are still part of the core group that includes budding rocket scientists ranging from freshmen to grad students. Ian Whittinghill, a senior with years of rocket building experience, has led the group since its beginning.

The April flight tested two new systems. The CanSat payload (small enough to fit in a soda can) carried a GPS avionics system to record position information and log it into flash memory. For this third flight, the RPL students replaced the nose cone aluminum with lightweight Kevlar to allow penetration by the GPS signals.

The telemetry downlink was successful and corroborated the integrated accelerometer data that showed apogee at 17,900 feet.

The flight also tested a dual-stage parachute system. The purpose of the two stages is to speed up the rocket's descent and make it less vulnerable to drifting in the strong desert winds.

Reese and sophomore Sarah Thomas used words like "unbelievable" and "amazing" to describe the launch, but Reese says words can't really capture the experience. "It's like nothing else in the world. You're getting hands-on experience with what you learned in class, and pushing the limits of what can be done," he says.

Thomas, who manages the lab, enjoys the chance to work with other engineering students. "It's fun to travel with the group, and the hands-on experience is great. And the skills we learned should help us get future jobs." (Both she and Reese got summer jobs at NASA's nearby Jet Propulsion Laboratory.)

Del Carbon is being retired after three successful flights. Thomas is coordinating RPL's move to a new lab space, where the group plans to develop a hybrid propulsion rocket with the goal of reaching an altitude of 100 kilometers (62 miles), which is the Kármán line, the boundary between the Earth's atmosphere and outer space.

Video of Del Carbon's launches and of the students' treks to the desert, as well as a blog can be found at RPL's website at www.uscrpl.com. //

Freelancer Linda Davis contributed to this article.


4


5


6


7

rocket science can be a lot of fun.

Going with the Flow

By Teresa Hagen

Brian Marcotte (PTE '71) deals in the most precious substance known to man. No, it's not diamonds but black gold—oil, a vital fuel for both our vehicles and world economies that is fast becoming an endangered commodity. While many engineers focus on their quest to discover alternative energies, Marcotte keeps his eyes fixed squarely on the problem at hand: Where can we find enough oil to supply our global demands until new fuels become widely available?

"As an industry, on a global average, we only produce about 35 percent of the discovered oil, leaving 65 percent unrecoverable with current technology. This is just unacceptable," says Marcotte, CEO of Titan Oil Recovery, Inc., home to a process known as biological oil stimulation, or the Titan Process®. As oil becomes more difficult to find, business is good for Titan. Titan deals with oil that has already been discovered, but where production is declining. "If we could help turn around that decline and recover additional reserves, it would have potentially a huge impact."

Marcotte is no stranger to the oil industry. For 34 years, he worked for the Unocal Corporation, starting his relationship with the company while earning his bachelor's degree in petroleum engineering, moving up through the ranks and developing expertise in all aspects of oil and gas exploration, as well as development and production, and finally taking the helm as president of Unocal subsidiaries in the Netherlands, Thailand and Indonesia.

"I was in Indonesia at a fascinating time, just after the fall of President Suharto and the subsequent transition to a democracy," Marcotte recalls. "They've gone through such changes. Now from a purely oil perspective, they are going through yet another transition. Indonesia has been a member of OPEC for 45 years, but its oil production is beginning to decline quite rapidly.

"With declining production, Indonesia is at a point where it's actually beginning to import oil, and so its status as an OPEC member is very questionable," he continues. "About 30 percent to 40 percent of the gross national product comes from the oil industry, so as oil production declines, the whole economy sits on a knife's edge."

Indonesia's plight is exactly why Marcotte left retirement to join forces with Titan. "When Titan came along, I was very intrigued, as I have felt for a long time that the next huge breakthrough in the oil industry might well be enhanced oil recovery."

Titan's technology started with Australians Noel, Bob and Bill Carroll, and Alan Sheehy, Ph.D. In the late 1980s, the Carrolls helped finance research on a microbial enhanced oil-recovery technology with the Commonwealth Scientific and Industrial Research Organization, Australia's largest government-funded research organization.

In the past, Australians have puzzled over how their koalas are able to survive on a diet of eucalyptus leaves, since the leaves are very oily and most animals don't eat them.

"So they wanted to do a study to find out why is it that a koala is able to eat, digest and get nutrients from eucalyptus," says Marcotte. "And they found that it was because of the naturally occurring microbes in the gut of the koala that allow the oil to be broken down into a usable form. Well, from that study, the rest is history."

He admits that the concept of using microbes in oil recovery has been around for decades, but says most of the past processes were designed to do different things, such as cleaning up well-bore paraffin deposits, remediating oil contaminated soils or trying to change the chemistry of the oil. "Most, if not all, of these processes attempted to culture microbes at the surface and pump them into the oil reservoir," says Marcotte. "These processes utilized oxygen-using microbes, and when the microbes were pumped into the oxygen-free oil reservoir, they could not adapt to the oxygen-free environment, the salinity or, perhaps, the temperature of the reservoir, and died."

So, how does the Titan's technology work? Oil exists in the microscopic pore spaces surrounding small grains of sand or limestone in porous rock formations. Physical forces govern the ability of that oil to flow from the reservoir to the producing well. After some amount of production, a significant fraction of the oil originally in place is left "trapped" in the reservoir-- unable to be moved or forced out by conventional methods. Titan samples and utilizes naturally occurring microbes already existing in the underground oil reservoirs, and by feeding a field-specific mixture of nutrients, stimulates the microbes to change the flow characteristics of this remaining oil. This allows for more production from the existing field.

It isn't successful everywhere, such as pools with very heavy tar-like oil, or areas where there is very high salinity in the associated water or very hot geothermal temperatures. But with more than 40,000 oil fields globally, the market is practically unlimited.

"Solving this recovery issue will be an amazing benefit to the oil industry, and we do it with environmentally benign nutrients," Marcotte emphasizes. "We do not require that oil companies expand their environmental footprint to increase production."

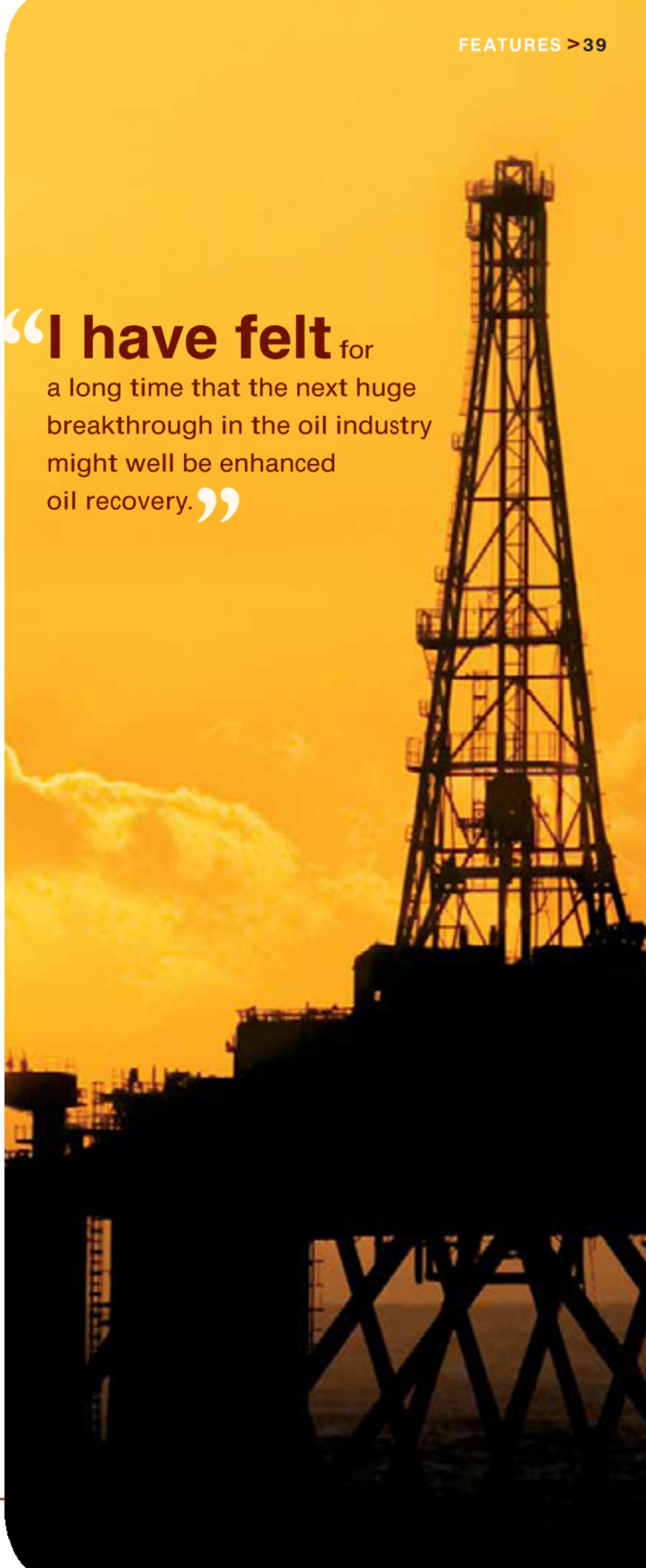
According to Titan laboratory results, the company's process can recover up to 24 percent of the oil currently trapped.

"In natural reservoirs, we will not be able to duplicate this performance," Marcotte says, "but we anticipate being able to recover from 3 percent to 10 percent of the oil originally contained in the reservoir."

"If all existing fields in the world could recover 10 percent or more of the oil that was already discovered, there would be enough additional oil to meet the current global demand for another 20 years."

And in a world where demand for oil continues to rise while supplies appear to be declining, Marcotte sees a huge challenge, and a huge opportunity.

"The melding of microbiology and the oil industry is a unique solution to our energy supply needs," he says. "Whenever science and technology come together in new ways, the results can be extraordinary." //



"I have felt for a long time that the next huge breakthrough in the oil industry might well be enhanced oil recovery."

ALUMNI NEWS

VITERBI ALUMNI RELATIONS

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

You are part of a distinguished group of more than 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 email forwarding, networking and attending annual events such as Homecoming and the Viterbi Awards.

Visit our website today and update your information: viterbi.usc.edu/alumni

Ray Lowe (BSEE '84, MSEMT '93) and his cousin Jeff Lee show their Trojan pride at the USC vs. Arizona men's basketball game. Before the game, Ray and Jeff took part in a VIP tour of the newly constructed Galen Center.

Spring 2007 Basketball Event

On January 18, the Viterbi School welcomed more than 75 alumni on a special VIP tour of the newly constructed Galen Center. USC's Project Manager for the Office of Capital Projects, Stan Westfall and Director of the Viterbi School's Construction Engineering and Management Program, Hank Koffman led two groups of tours around the Galen Center. Following the tour, alumni were treated to free hot dogs and sodas as they watched the men's basketball team defeat the Arizona Wildcats 80-73.

Brandow and Johnston Room Naming

Vice President Emeritus Tony Lazzaro (BSISE '49) joins Dean Yannis C. Yortsos in thanking Roy Johnston (BSCE '35) and Gregg Brandow (BSCE '67).

The Viterbi School unveiled the new Brandow and Johnston Engineering Seminar Room in Ronald Tutor Hall. The room acknowledges the generosity of Viterbi alumni Gregg Brandow (BSCE '67) and Roy Johnston (BSCE '35). Gregg is the President of Brandow & Johnston Associates, a Los Angeles-based structural engineering consulting firm founded in 1945 by his father, George (BSCE '36), and Roy Johnston. The firm has successfully engineered more than 15,000 building projects throughout the world, including many of the buildings on the USC campus.

Alumnus Robert Gray Elected to NAE

USC alumnus Robert Gray, the Lucent Technologies Professor of Engineering and vice chair of the Electrical Engineering Department at Stanford University, was elected to the National Academy of Engineering on Feb. 8, 2007. He was cited for his "contributions to information theory and data compression." His research has included work on image compression, enhancement and classification, as well as statistical signal processing.

Gray earned bachelor's and master's degrees from MIT in 1966, both in electrical engineering, and a doctorate in the same field from the Viterbi School of Engineering in 1969. That year, he joined Stanford's faculty. From 1984 to 1987, he was director of the Information Systems Laboratory.

Spring 2007 Baseball Event

On March 20, despite the rain clouds over Los Angeles, Viterbi alumni spent the evening at Dedeaux Field watching the Trojan men's baseball team take on the Pepperdine Waves. During the game, alumni enjoyed Taco Tuesdays with $1 tacos from El Cholo. The event gave engineering alumni an opportunity to come back to campus and meet other alumni and their families. While the Trojans couldn't secure a win with a 3-5 score, the Viterbi spirit was alive and well cheering them on the whole way.

Arline, Mary and Richard D'Agostino (BSEE '60) root for the Trojan men's baseball team as they take on the Pepperdine Waves.

Engineering Me

MY NAME: Geraldine Knatz (Viterbi School Board of Councilors Member)

DEGREE: M.S. Environmental Engineering, 1977; Ph.D. Biological Sciences, 1979

JOB TITLE: Executive Director, Port of Los Angeles

LIFELONG DREAM: Be a Philanthropist

FAVORITE VITERBI PROF: Joe DeVinny

BOOK I'M READING: *The Button Box: A Memoir of Mrs. George S. Patton*

ON MY IPOD: Motown

WORDS TO LIVE BY: "Do something that scares you everyday" (Eleanor Roosevelt), but in my case it's more like do something that scares you every hour

ENGINEERING HERO: John Stevens—the engineer who built the Panama Canal

NEXT TRIP: Spain (OK, so they're not a major trading partner)

BEST TIME OF DAY: 6:30 a.m. – 7:30 a.m. (It's quiet in the office)

FAVORITE GADGET: The thing that opens the pickle jars

BEST USC MEMORY: The informal late afternoon engineering student get-togethers we would have, which would allow the full time graduate students the opportunity to meet the students who held full-time jobs. (OK, it was really an opportunity for some of us to find someone to date who had a real job)

TOUGHEST ENGINEERING CLASS: I didn't take that one

NUMBER ONE URL: Ebay.com

NUMBER OF TROJANS IN MY LIFE: There are so many!!! All my students in ENE 502, 60 employees and one community activist

PROUDEST MOMENT: Standing next to Mayor Antonio Villaraigosa when he announced my appointment as the first woman port director of the largest port in the nation

BIGGEST CHALLENGE: In order of difficulty: 1) Raising two 12-year-old boys to be good citizens with a work ethic. 2) Getting a major civil works project approved in Los Angeles!

INSPIRATION: Watching the ships travel up our main channel into port—breathtaking!

Me...Engineered

Engineering Me

Sisters Kristi (Frank) Smaha and Kerri (Frank) Keslow.

MY NAME: Kristi (Frank) Smaha

DEGREE: M.S. Industrial and Systems Engineering, 1994

JOB TITLE: Entrepreneur and mother

LIFELONG DREAM: To make the Forbes Top 10 richest people in the world list

FAVORITE VITERBI PROF: Gerald Fleischer

BOOK I'M READING: *The Very Hungry Caterpillar* (with my son, Tyler, age 2)

ON MY IPOD: Beatles

WORDS TO LIVE BY: "Go confidently in the direction of your dreams. Live the life you have imagined," by Thoreau

ENGINEERING HERO: My sister

NEXT TRIP: Portland, Maine

BEST TIME OF DAY: When I put my son to sleep!

FAVORITE GADGET: Tivo!

BEST USC MEMORY: Any Saturday football game

TOUGHEST ENGINEERING CLASS: Database systems

NUMBER ONE URL: My AOL email

NUMBER OF TROJANS IN MY LIFE: 18

PROUDEST MOMENT: Becoming a mother

BIGGEST CHALLENGE: Balancing motherhood with work

INSPIRATION: Every time I see the sunrise

Me...Engineered

MY NAME: Kerri (Frank) Keslow, M.D.

DEGREE: M.S. Industrial and Systems Engineering, 1994

JOB TITLE: Physician, Family Medicine, UCLA Santa Monica

LIFELONG DREAM: To be an accomplished fiction writer

FAVORITE VITERBI PROF: Austin Weston

BOOK I'M READING: *Random Family* by Adrian Nicole LeBlanc

ON MY IPOD: "Read My Mind" by the Killers

WORDS TO LIVE BY: "Life is either a daring adventure or nothing," by Helen Keller

ENGINEERING HERO: My father and my sister (two industrial engineers)

NEXT TRIP: Hawaii (my honeymoon!)

BEST TIME OF DAY: 6 a.m. with coffee and quiet

FAVORITE GADGET: Sony Cybershot digital camera

BEST USC MEMORY: Taking all my senior year classes with my sister

TOUGHEST ENGINEERING CLASS: Anything in electrical engineering

NUMBER ONE URL: www.youtube.com

NUMBER OF TROJANS IN MY LIFE: Too many to count

PROUDEST MOMENT: Medical school graduation

BIGGEST CHALLENGE: Deciding what to do with the rest of my life

INSPIRATION: My friends and family

Me...Engineered

Five former presidents of the USC Chapter of Chi Epsilon gathered to honor Albert Dorman: Ed Reynolds (1981), Henry Koffman (1961), Dorman, Ryan Anderson (2007), Karthikgeyan Sivakumaran (2006) and Gregg Brandow (1962-63).

Albert Dorman Honored by Students of Chi Epsilon

The students of the USC Chapter of the Chi Epsilon civil engineering honor society recognized Albert Dorman (MSCE '62) as Chapter Honor Member in a reception attended by students, faculty and staff. Mr. Dorman's achievements in the civil engineering profession and his exemplary display of the traits of a Chi Epsilon member warranted this distinction, a rare honor in the long history of the USC Chapter.

Alumna Julie Brown Inducted into New Jersey High Tech Hall of Fame

USC alumna Julie Brown, chief technical officer at Universal Display Corporation, has been inducted into the New Jersey High Tech Hall of Fame, along with seven inductees selected by members of the industry. Brown, who joined Universal Display in 1998, has been a leader in research and advancement of the company's phosphorescent OLED technology, which makes it possible for OLEDs (organic light-emitting devices) to attain up to four times greater efficiency than previously thought.

Brown received an M.S. and Ph.D. in electrical engineering/electrophysics at USC under the advisement of Professor Stephen R. Forrest, a fellow pioneer in the field of OLEDs. Effective this year, she holds the title of Fellow for the Institute of Electrical and Electronics Engineers, Inc. (IEEE), which recognized her for outstanding contributions and leadership in developing and commercializing very high-performance semiconductor and OLED technologies.

THE VITERBI SOCIETY

Trojan engineers have a long and proud history of supporting future classes of engineering students. As a new Viterbi School graduate or friend of the school, you can continue this important legacy by joining the Viterbi Society, the premier academic support group for the USC Viterbi School of Engineering.

As a Viterbi Society member, you will have many opportunities to enjoy your lifelong connection to the Trojan Family. You will 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 **Matt Bates** today at **(213) 821-2730** or via email at **matthew.bates@usc.edu**.

VITERBI STORE

Introducing the Viterbi Store! We have just created a brand new line of Viterbi School products with the USC bookstore. Show your pride with custom-designed Viterbi gear and gift items. Visit the USC Bookstore on campus or shop online at the Viterbi Store at viterbi.usc.edu/viterbistore to purchase your Viterbi items today!

2007 Donor Recognition Luncheon

Civil engineering student Allison Lind and donor Lourita MacNeill at the 2007 Donor Recognition Luncheon.

The Viterbi School hosted its first donor recognition luncheon on March 30. The luncheon gave the Viterbi School the opportunity to thank both individual and corporate donors for supporting students and student programs. More than 50 donors came to the luncheon at the Davidson Center to hear about the impact of their giving. Dean Yannis C. Yortsos spoke of the importance of these donors in attracting and retaining top engineering students. One of those stellar engineering students, Guillermo Garcia, spoke about the role these donors have played in his time at USC. The luncheon was a great success as guests also had the chance to meet the undergraduate students who are benefiting from their support.

Volunteer Opportunities

VITERBI SCHOOL CLASS CORRESPONDENTS

The Viterbi School of Engineering 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 are 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 at **viterbi.alumni@usc.edu** or call **(213) 821-2424**.

VITERBI CAREER SERVICES

If you are 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/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

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 of Engineering 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 at **viterbi.alumni@usc.edu** or **(213) 821-2424**.

CENTER FOR ENGINEERING DIVERSITY (CED)

CED exists to support the recruitment, retention and graduation of African-American, Latino, Native American and female students pursuing engineering degrees. CED provides a supportive environment that prepares students academically, professionally and personally for success as professional and academic engineers.

The Center for Engineering Diversity has launched a new mentoring program between mentors and students. The program requires the commitment of contact via email at least once a month. In addition, CED will coordinate two on-campus events each academic year for mentors and students to interact. Engineering alumni, industry members and graduate students from any engineering background are welcome to join. Mentors from outside of Southern California are encouraged to participate. Undergraduate student participants will be in their third or fourth year.

If you need additional information or are interested in becoming a CED mentor, please email your name to **viterbi.ced@usc.edu**.

WOMEN IN ENGINEERING

The Women in Engineering (WIE) Office invites female alumnae to participate in the "Connections" mentoring program. WIE recognizes the wonderful insight and support alumnae can offer to undergraduate students and wants to connect an alumna, who will serve as a mentor, with a female undergraduate student, who will serve as a protégé. Student participants will be in their third or fourth year at Viterbi. All matching will be done by the WIE Office. The time commitment is up to each individual mentor/protégé and can include emailing, phone conversations, in person meetings, etc.

If you are interested in participating in the Connections program, please contact us at **viterbi.wie@usc.edu** or call **(213) 740-4530**.

PREVIEW DAY: USC GRADUATE ENGINEERING
Friday, September 28, 2007
8:30 a.m.–4:30 p.m.

Alumni are invited to join the Office of Master's and Professional Programs in giving prospective students a preview of what the Viterbi School has to offer. Share your experience with students by participating in our lunchtime alumni panel from 11:30 a.m. – 1 p.m. This is a great chance to reconnect with faculty members and help the Viterbi School in the process!

Please visit **viterbi.usc.edu/mspreview** or contact Camillia Lee at **camillil@usc.edu**.

Visit our website today

UNDERGRADUATE CAREER CONFERENCE
Saturday, September 29, 2007

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 offer 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 are interested in being involved with the Career Conference, or would like further information on becoming an event sponsor, please contact Candace House at **(213) 740-9677** or **housec@usc.edu**.

2007-2008 ENGINEERING CAREER FAIRS
Fall Event: October 11, 2007
Spring Event: February 21, 2008

The Engineering Career Fair provides an excellent opportunity to increase your company's visibility among our top engineering students. We offer two tech-only fairs each year, in October and February. The Engineering Career Fair is attended by 85 to 100 engineering employers and approximately 1,700 to 2,200 of our students.

Register at **viterbi.usc.edu/careers** before September 4 to qualify for early registration!

Engineering Me

MY NAME: Vijayakrishna 'Vijay' Panati

DEGREE: B.S. Computer Science, 2007

JOB TITLE: MIS Manager

LIFELONG DREAM: To make a true difference in people's lives

FAVORITE VITERBI PROF: Too many to list (Richard Vawter, Maja Mataric, Michael Crowley, Jason Lidow, Joseph Greenfield, and the list goes on)

BOOK I'M READING: *Seeing What's Next* by Clayton M. Christensen

ON MY IPOD: eclectic mix of country, classical and oldies

WORDS TO LIVE BY: "You give but little when you give of your possessions, it is when you give of yourself that you truly give." —Khalil Gibran

ENGINEERING HERO: Thomas Alva Edison

NEXT TRIP: Europe and Alaska

BEST TIME OF DAY: Every waking moment

FAVORITE GADGET: Blackberry (my liberating "ball and chain")

BEST USC MEMORY: Seeing my friends at my graduation

TOUGHEST ENGINEERING CLASS: Operating Systems (I used to dream about the solutions to the projects)

NUMBER ONE URL: www.gutenberg.org

NUMBER OF TROJANS IN MY LIFE: Many... one can never have enough Trojans in life, the more the better

PROUDEST MOMENT: The day I finished college after surmounting a mountain of hurdles

BIGGEST CHALLENGE: Balancing career and personal goals

INSPIRATION: Parents

Me...Engineered

to update your information:
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. We have a fun and diverse schedule, so make plans now to join us at one or more of the following:

Undergraduate Career Conference*
September 29, 2007
USC Campus

Fall Engineering Student Career Fair*
October 11, 2007
USC Campus – Viterbi School Engineering Quad

VSoE Asia Alumni and Recruiting Tour
October 2007
Taiwan, China, Korea

USC Global Conference – Viterbi Reception
October 26, 2007
Evening – TBD
Tokyo, Japan

Preview Day: USC Graduate Engineering*
September 28, 2007
USC Campus

USC Homecoming 2007 – Annual Viterbi Reunion Picnic
November 3, 2007
USC Campus

Viterbi Bay Area Alumni Reception
November 9, 2007
Downtown San Francisco – TBD

USC Basketball Viterbi Alumni Night
January 2008
USC Galen Center

Spring Engineering Student Career Fair*
February 21, 2008
USC Campus – Viterbi School Engineering Quad

USC Baseball Viterbi Young Alumni Night
March 2008
USC Baseball Stadium

30th Viterbi Engineering Awards
Evening Gala 2008
TBD

VSoE India Alumni Tour
August 2008
TBD

Regional Networking Events
Ongoing
Los Angeles, Orange County, San Diego, San Francisco

*These student events have an alumni component—see volunteer section on page 44 for more information.

USC EVENTS

Fall Semester Classes Begin
August 25, 2007

Home Football – USC vs. Idaho
September 1, 2007

Home Football – USC vs. Washington State
September 22, 2007

Home Football – USC vs. Stanford
October 6, 2007

Trojan Parents Weekend 2007
Thursday, October 11, 2007
Sunday, October 14, 2007

Home Football – USC vs. Arizona
October 13, 2007

USC Global Conference
October 25-27, 2007
Tokyo, Japan

USC Homecoming Home Football – USC vs. Oregon State
November 3, 2007

Home Football – USC vs. UCLA
December 1, 2007

Spring Semester Classes Begin
January 12, 2008

Commencement
May 15, 2008

INDIA ALUMNI TRIP

Dean Yannis C. Yortsos celebrates Viterbi engineering with alumni in India. He was joined by Associate Deans Cauligi Raghavendra, third from left and Kelly Goulis, second from right.

Class Notes

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

53 *George Nugent* (BSEE) and his wife, Bonnie, were honored at an Escondido celebration for couples who have been married for 50 years or more. The couple has three sons.

67 *Arthur Nussberger* (MSME) recently published three books based on personal experiences: *Manned Space Projects (Apollo to Space Stations)*; *Solar Energy Systems (Heating-Cooling-Electric Power)*; and *Small Town America (Families Along the Chippewa River)*. The books are published through Xlibris Corporation, Philadelphia, Pa.

78 *Robert Miller* (MSSM) received his Ph.D. in Information Systems from Nova Southeastern University, Fort Lauderdale, Florida, in 1996. He now works for the Engility Corporation as a software engineer in the Aeronautical Systems Center, Wright-Patterson Air Force Base, Ohio.

79 *Retired Maj. Gen. Joseph T. Anderson* (MSSM) has been promoted to the position of deputy director for the National Air and Space Museum's Steven F. Udvar-Hazy Center near Washington Dulles International Airport in Northern Virginia. Anderson joined the Smithsonian museum in 2003 as associate director for the newly opened facility in Chantilly, Va. He retired from the U.S. Marine Corps in 2001, after serving as commanding general, First Marine Aircraft Wing, following key positions in the U.S. Marine Corps Headquarters, Naval Air Systems Command and the Office of the Secretary of Defense. Anderson also had commanded the Marine Aircraft Group 13 in Yuma, Ariz. The new deputy director is also a graduate of the U.S. Naval Academy. He was a fighter pilot in the Vietnam War, serving in a number of Marine attack squadrons. Anderson also was a test pilot at Patuxent River, Md., and an AV-8 Harrier systems and engineering officer with Naval Air Systems Command. He holds numerous decorations for his military service.

81 *Al Morelli* (MSISE), was named President of Searchtec Consulting Group. In addition, he is currently an Industry Professor at the USC Industrial and Systems Engineering Department. An international expert in operational improvements, organizational turnaround and restructuring, Morelli is a graduate industrial engineer from USC and Cal Poly-San Luis Obispo. Also, he was Past President of the Institute of Industrial Engineers—Orange County chapter. // In the summer of 2005, *Rick Severinnghaus* (MSISE) was elected Chairman of the Executive Committee of Simulation Interoperability Standards Organization (SISO Inc), an international M&S standards development organization. Severinnghaus works in the domain of command-level decision processes, human performance research and human systems integration. // St. Mary Land & Exploration Company announced that *Julio Quintana* (BSME) has been appointed to serve as a director of the company. Quintana was appointed to the board on July 7, 2006. With his addition, the board will have eight members. Mark Hellerstein, chairman and chief executive officer, comments: "We are pleased to have an individual of Julio's talents and experiences joining St. Mary's board. He brings a very strong background in oil and gas technologies. Julio will enhance the diverse business knowledge brought to St. Mary by its directors." Quintana is president and chief executive officer of TESCO Corporation, an oilfield technology, services and supply company. Prior to his appointment to his current position in September 2005, he served as executive vice president and chief operating officer at TESCO. From 1999 to 2004, Quintana was employed at Schlumberger in various management roles. He began his career at Unocal Corporation, where he spent 20 years working in various engineering and leadership roles.

>>

INTERNATIONAL ALUMNI

The Viterbi School is aggressively working on a Global Alumni Plan. We are hoping to identify the many International Viterbi Engineers who have lost contact. 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 at **viterbi.usc.edu/alumni**.

STAY CONNECTED

We rely on your accurate mailing and emailing addresses to ensure you receive our many publications and invitations to special events. Please update your information online at http://viterbi.usc.edu/alumni or by contacting the VSoE Office of Alumni Relations at (213) 821-2424.

82 WiSpry, Inc. announced the appointment of *Collin Baker* (BSEE) to its executive team. Baker joins WiSpry as vice president of customer engineering. He comes to WiSpry with more than 25 years of semiconductor experience with leading-edge system-on-chip, microprocessor, and mixed-signal chip development companies. Baker has held various engineering, management and project director roles at LSI Logic and Rockwell Semiconductor (Conexant), including director of North American Design Centers, director of Mint Technology Design Services (an LSI Logic subsidiary) and senior director of RapidChip(R) Structured Array platform product development. He has managed the tape out of hundreds of ASIC devices covering the consumer, storage, computation and military market segments, with a total device revenue base in the billions of dollars.

88 *Dannes Hutapea* (BSCHE) writes: "After graduation from USC, I began my career at Mobil Oil Indonesia. As a result of the Mobil Oil & Exxon merger, I am now working for Exxon Mobil Oil Indonesia in User Support Engineering, now in my 16th year.

I married my wife, Manni Pratama, in December 1998, and we now have two boys, Darren and Denzel, 5 and 3, respectively. At ExxonMobil, I am very active in our Community Outreach Program. I was a volunteer on "What's After High School," a workshop for a local high school's students from low-income families, am a regular blood drive participant, and recently volunteered in a "Stop Bullying" one-day national seminar for teachers, parents and junior high school students. Outside of work, I am also active socially. Late last year, with some friends, we held a Painting Exhibition and Auction benefiting local communities. We raised an equivalent of about US $15,000."

92 *ShengFeng Hwang* (MSCSCI) writes: "In 1998, along with friends, I initiated a consulting company that provides strategic business plans, as well as training and development services to corporations. We currently have offices in Taipei, Beijing and Shanghai and serve many international companies like Cisco, Errison, DHL and Microsoft."

97 *Sunil S. Dalal* (MSBME; Ph.D. BME) and his wife, Sonal Pandya-Dalal, are happy to announce the birth of a son, Milan, born March 5, 2007. Milan joins big sister, Naia.

99 *Yen-shuo Peter Liao* (Ph.D. BME) and Pai-jun Mao Liao are happy to announce the birth of their daughter, Anna Yu-An Liao, on January 4, 2007. The family lives in Warsaw, Indiana, and would like to express special thanks to Dr. Bradford L. Bopp (M.D. '91) at the Midwest Fertility Specialists. // *Imran N. Chaudhry* (BSME; MSCAE), at age 29, was selected as one of the youngest recipients of the 2007 "40 under age 40 accomplished leaders" by the San Fernando Valley Business Journal, for his accomplishments in the health-care industry. He is the youngest regional director at Providence Health and Services and is charged with improving the operational and financial performance for the Southern California region. Previously, he was the quality leader for General Electric Infrastructure Western Region from 2002-2004.

00 *Giovanni Jaramillo* (MSCSCI) writes: "Currently I am a programmer/principal analyst at DIRECTV Inc (from 2002 to present). Previously, I was a consultant at the leading biotech firm in the world: AMGEN Inc. And before that (right after I graduated), I was with an Internet start-up company called CheckOut.com.

01 *Sophia Perl (Sounalath)* (BSCSCI) recently got promoted to manager of the database XML development team at IBM and is halfway through MBA school at UC Davis (San Ramon campus). // *Damian Desai* (BSCSCI) writes: "I have been in sales with Intel for the past seven years. A recent promotion has brought us back from New England to California, where I will be calling on Cisco Systems in San Jose. We are stoked to be in Silicon Valley and out of the snow!"

02 *Allegra Segura* (BSEE) married Thomas Victor Burks III in San Antonio, Texas, on October 21, 2006. They currently reside in Austin, Texas.

04 *Bruce Bouton* (MSSAE) was inducted into the Technical Fellowship of the Boeing Co. He considers the Distance Education Network (DEN) an enabling technology to improve society by extending higher education beyond the campus boundaries and would like to salute the people who make it work. //

In Memoriam

Rex J. Crookshanks (BSEE '54) passed away on April 17, 2007, at the age of 80. He is survived by his wife, Leah Bonnickson, and son, Rory Crookshanks.

After serving in the Navy during World War II, Crookshanks went on to receive a bachelor's degree in engineering from USC. He also earned credentials in mechanical and electrical engineering. Later, he was hired as an engineering consultant at Hughes Aircraft, where he was asked to create a detailed design solution for a challenging satellite-communications-system requirement, which no one else was able to accomplish. Later, he transitioned to the Hughes staff as a senior scientist. Crookshanks was an avid inventor. While working at Hughes Aircraft, he was credited with more than 200 patents across a broad range of engineering and mathematical areas.

Crookshanks was also an active real-estate investor, which included buying, developing and remodeling properties both within and outside of the United States, up until his death.

Michael "Mike" Wayne Doss (M.S. '68), 68, died on March 8, 2007, unexpectedly at his home in Raleigh, North Carolina

He was born on July 29, 1938, in Winston Salem, N.C., to the late James Raymond Doss and Irene O. Doss Boyles. Doss was a graduate of North Carolina State University and USC. He served his country in the Marine Corps Reserves. Doss was an avid North Carolina State Wolfpack fan and loved his time spent with friends at the games. He was retired from a career in telecommunications, including positions with IBM, Codex, Netlink, Nortel, Siemens, and as a founder of CipherOptics.

Doss is survived by his wife of 47 years, Judith Butler Doss; his daughters, Leslie and husband, Ronnie Fuquay; Michelle and husband, Bryan Holjes; and Stephanie and husband, Scott Hawke; grandchildren, Calvin and Amy Hawke, and Carter Holjes; and stepgranddaughter, Amanda Fuquay.

He was loved by all who knew him and will be missed greatly by his family and friends.

William Anderson Knight (M.S. '72), born in 1930, passed away. Knight is survived by his wife of 55 years, Mary Lee Smith Knight; four children, William A. Knight Jr., Samuel Foman Knight, Sally Haviland Knight, and Virginia Lee Spiers; five grandchildren, Jennifer Dawn Helm, Samuel F. Knight Jr., Rebecca Erin Knight, Marshall Andrew Spiers and Georgia Lee Spiers; and two great-grandchildren, Wilson and Shawn Helm.

Born in Montgomery, Ala., Knight was a graduate of Auburn University and the USC School of Engineering. He served 26 years in the U. S. Air Force, entering service in 1953 at the close of the Korean War. Active in the Reserves, he was recalled to active duty for the Berlin Wall Crisis of 1961 and again in 1963 for the Cuban Missile Crisis. He served in Germany, Iceland, and Vietnam, as well as Washington state, Colorado, Montana, Florida and Virginia. Knight's citations include the Bronze Star, Meritorious Service Medal, National Defense Commendation, Presidential Unit Citation and Outstanding Unit Awards.

After retiring from the Air Force, he became an internal auditor for the Virginia Department of Social Services. During his lifetime, Knight was active in PTA, YMCA Indian

>>

PRAGNESH JAY MODI PH.D. CSCI '03

Pragnesh Jay Modi, an assistant professor of computer science at Drexel University in Philadelphia, who was a rising star in artificial intelligence and completed his Ph.D. in computer science at USC in 2003, died on April 9, 2007.

"Among Jay's many accomplishments was an NSF Career Award and an IEEE Intelligent Systems magazine award for 'AI's 10 to Watch,'" said Gerard Medioni, chair of the Viterbi Department of Computer Science. "He was one of the bright young stars in the area of agents and multiagent systems."

Modi joined the Drexel faculty in Pittsburgh in 2005, following a postdoctoral research position at Carnegie Mellon University. He received a prestigious National Science Foundation Career Award, as well as the IEEE honor.

Medioni said Modi's Ph.D. thesis at USC had been "foundational in the area of distributed constraint optimization."

"Jay will be remembered with fondness as a dedicated colleague and loyal friend," added Medioni. //

Guides, Cub Scouts, Military Officers Association and various civic and neighborhood organizations. He was a member of the American Legion, Veterans of Foreign Wars, Disabled Americans Veterans, the Association of Government Accountants, and the Institute of Internal Audit.

Anthony J. Miadich (BSCE '65, MSCE '67) died May 8 at age 64. Miadich was born Aug. 5, 1942, in Cleveland. He received his bachelor's and master's degrees from USC and a master's degree from UCLA. He moved in 1978 to Lake Oswego and was managing general partner for Orien Ventures. In 1965, he married Sharon L. McMahan.

Survivors include his wife; daughters, Traci Shields and Wendy Harmon; sons, Mike, Bart and Matt; and four grandchildren.

James E. Roberts (MSCE '66) died on July 6, 2006, at the age of 75. Roberts was a career highway worker who came west on Route 66 as a child fleeing the Dust Bowl and grew up to play a leading role in building and strengthening California freeways as the state's top bridge engineer.

Roberts joined Caltrans as a junior civil engineer in 1951 on the eve of a historic highway and bridge construction boom. Typically first to arrive at work and last to leave, he rose quickly during a career spanning five decades and held several key management jobs, including chief deputy director. In 1996, he became the only Caltrans employee to be inducted into the National Academy of Engineering.

Roberts served as director of the Caltrans Engineering Service Center, overseeing 2,300 engineers, architects, support staff and consultants responsible for designing, building and maintaining the state's 12,000 highway bridges. As state bridge engineer for about 15 years, he led efforts to retrofit bridges to withstand seismic shakes and spearheaded rebuilding of structures damaged in major earthquakes in Whittier in 1987, Loma Prieta in 1989 and Northridge in 1994.

At Caltrans, Roberts inspired loyalty among workers as a demanding but fair boss who preferred "coaching" over supervising employees. He fit the image of an engineer, with a sharp grasp of technical concepts, a disciplined approach to work and a crew cut that he maintained meticulously.

Roberts was born in 1930 in Jameson, Mo., to farmers battered by dust storms and the Depression. He was 6 years old when his parents packed four children and a cedar chest in the back seat of a car and headed for a better life in California.

The family settled in Bakersfield before moving to Oakland and Albany, where Roberts excelled in school. He entered UC Berkeley, and started working for Caltrans before earning a bachelor's degree in engineering in 1953.

He joined the Army for two years, working with the Corps of Engineers in Korea during wartime. Roberts also served 33 years in the Army Reserves, retiring as a colonel. In 1966, he earned a master's degree in structural engineering from USC.

Roberts is survived by his wife, Patricia Lee Brighton Roberts, two children, and two grandchildren.

Henry L. Sperow (BSME '60) passed away at his home on March 31, 2007, at the age of 85.

Born in West Virginia, Sperow was married to Alice, who preceded him in death in 1998. He was a Marine Corps naval aviator in World War II and was awarded the Air Medal after he flew his Corsair back from combat. Sperow was called back to duty and served in the Korean conflict. After returning home, he earned a bachelor of science degree at USC and went on to a career in the aerospace industry. After moving to Thousand Oaks with their family, the Sperows owned and operated Sperow Realty.

Sperow leaves behind his son and his wife, three grandchildren and three great-grandchildren.

Clay Williams (BSCE '51) passed away, after a lengthy battle with cancer, at the age of 83.

Williams, the only child of Ben F. and Hesper Odor Williams, was born July 29, 1923, in Glendale, Calif. He spent his youth in Oklahoma and served in the Navy during World War II. He returned to California and graduated from USC with a B.S. in civil engineering.

Williams worked for Rockwell International Corp. from 1955 until he retired. During this time, he was co-inventor of several patents in the nuclear field. While living in Tehachapi, Williams enjoyed engineering plans for several builders in the area.

He was preceded in death by his loving spouse of 29 years, Frances. Williams was remarried and is survived by his current wife, Dorthie. He is also survived by his three children, Ross Williams of Bakersfield, Dean and Nancy Williams of Tehachapi, and Keith and Rebecca Williams of Richmond, Va. His three stepchildren, Rita Barna, Jane Rollins and Doug Barna, who he dearly loved, also survive him. He has five grandchildren and one great-grandchild. //

David B. Wittry, a distinguished emeritus professor of materials science and electrical engineering at the USC Viterbi School of Engineering, died May 5 from complications of pneumonia. He was 78. Wittry made significant contributions to the field of materials science through his pioneering work in electron probe microanalysis.

"I profited from numerous conversations with David over the years in regards to academic policies and general professional matters," said John Choma, professor of electrical engineering. "He was a brilliant man, and his technical knowledge and intellect were matched only by his consummate professionalism."

A native of Iowa who grew up in Wisconsin, Wittry graduated from the University of Wisconsin-Madison in 1951 with a B.S. in applied mathematics and mechanics. He earned his M.S. and Ph.D. degrees in physics from the California Institute of Technology and joined the USC faculty in 1959.

Wittry held appointments in the Viterbi School of Engineering's Mork Family Department of Chemical Engineering and Materials Science and the Ming Hsieh Department of Electrical Engineering. In 1998, he received the USC Faculty Lifetime Achievement Award and was awarded Distinguished Professor Emeritus status.

"Dave Wittry was a pioneer in the best sense of the word," said Yannis C. Yortsos, dean of the Viterbi School. "He was one of the founders of the Microbeam Analysis Society and of our Materials Science Department. Professor Wittry was an important influence in the rise of our school."

Throughout his career, Wittry was involved with trailblazing research on analytical microscopy techniques involving X-ray, ion and electron beams. Among his most significant contributions was the basic design of one of the most successful commercial electron probe microanalyzers, which he patented in 1963.

Wittry also invented a dual cathode system for electron beam instruments, and a novel, rotating anode X-ray source for X-ray lithography. His pioneering work while on sabbatical at Cambridge University led to practical utilization of electron energy loss spectrometry for local microanalysis. Additionally, he developed a new type of diffractor for scanning X-ray monochromators that led to two patents and is considered one of the most significant advances in X-ray spectrometry.

In all, Wittry authored 23 patents and was chair of a committee that recommended patent policy adopted by USC. He subsequently chaired the USC Patents Committee for 25 years.

Although most of Wittry's inventions have been for materials science instrumentation, he was also awarded three patents for a rotary internal combustion engine. The so-called "Wittry Engine" combined the efficiency of a diesel piston-type internal combustion engine with the simplicity of a rotary engine.

He was a Guggenheim Fellow to Cambridge University in 1967-68 and a Visiting Scientist for the Japan Society for the Promotion of Science at the University of Osaka Prefecture in 1974.

Wittry received the Presidential Award from the Microbeam Analysis Society (MAS) for Outstanding Scientific Contributions to Microanalysis in 1980 and was an honorary member of the Microbeam Analysis Society. He won the Birks Award for the best paper presented at the MAS National Conference in 1987 and in 1989.

He received the Distinguished Scientist Award, Physical Sciences from the Microscopy Society of America in 1995 and the Distinguished Service Citation from the University of Wisconsin College of Engineering in 1996.

Wittry is survived by his wife, Elizabeth, five adult children and three grandchildren. //

Q&A

Q&A with Maja Mataric

Senior Associate Dean of Research; Professor of Computer Science and Neuroscience; Founding Director of USC's Center for Robotics and Embedded Systems

What is the single biggest trend in university research?

Without a doubt, it is interdisciplinary research. Today's most interesting and challenging research problems transcend any single discipline. USC is committed to fostering interdisciplinary research, and the Viterbi faculty have been campus leaders. We have a track record of collaborative research with almost every other school at USC, especially the Keck School of Medicine, the College of Letters, Arts and Sciences, the Annenberg School for Communication, and the School of Cinematic Arts. We are increasingly hiring faculty who have appointments in more than one school and who actively create interdisciplinary collaborative bridges.

How is the funding picture for university research changing?

The climate of the federal funding for research is not pleasant right now. Many of the major federal agencies have experienced funding reductions, including the National Institutes of Health (NIH), the Department of Homeland Security (DHS), the U.S. Geological Survey, the Environmental Protection Agency, and the Department of Defense (DoD). On the other hand, some agencies have received increases, including the National Institute of Standards and Technology, the National Science Foundation (NSF) and NASA Development and DoD weapons. The Department of Energy has less to spend on energy and a little more on basic science and in the areas of ethanol and biofuels. Overall, federal funding for basic research is down. But funding for more applied research has either held steady or is up in some specific domains.

Is the competition for big national research centers getting more or less competitive?

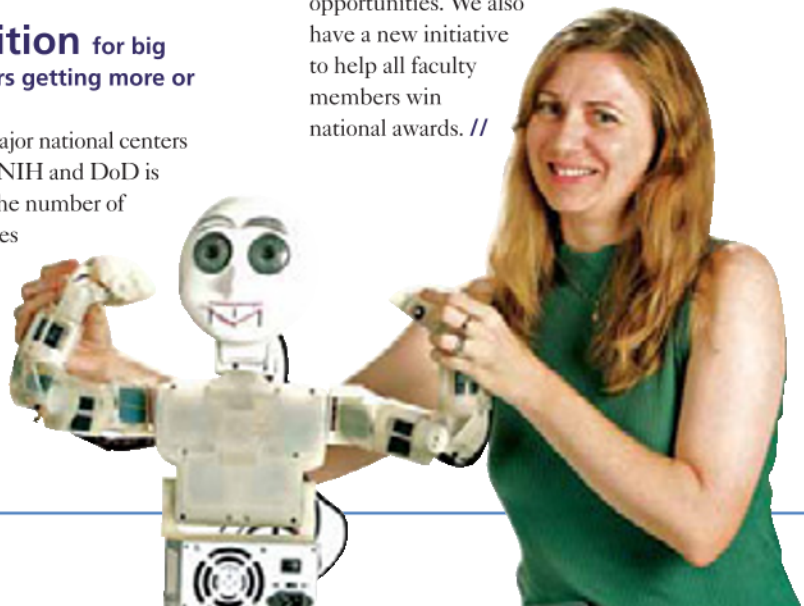
The competition for major national centers funded by the NSF, DHS, NIH and DoD is steadily increasing. While the number of applications from universities is growing, the number of center programs is not, so the probability for winning is getting smaller. The bar for success keeps going up. The Viterbi School has been superbly successful in winning new centers and renewing all of its current centers. This track record is particularly impressive given the steady increase in competitiveness of such awards.

Could you describe some of the challenges of corporate funding?

Corporations naturally have shorter horizons than federal funding agencies do. To remain competitive, corporations need to see results from research quite quickly, and they have to be able to translate those results to products. This has implications on both the nature of the research, which needs to be shorter term and more applied, and on issues of intellectual property, which must be carefully balanced. That can be a difficult problem, but it is solvable.

What is the Viterbi School and USC doing to help young academics win NSF or NIH Career Awards?

Because young investigators starting on a productive funding path is critical for their research success, the Viterbi School provides mentoring, training and funding information forums for junior faculty. We aim to keep all of our faculty, and especially our young investigators, actively informed, trained and encouraged to productively pursue external funding that will enable and sustain their research endeavors. We do this through one-on-one mentoring, small discussion groups, all-faculty open forums with invited expert speakers, direct connections with the USC Washington Office for Research Advancement, and regular email and Web updates about funding opportunities. We also have a new initiative to help all faculty members win national awards. //

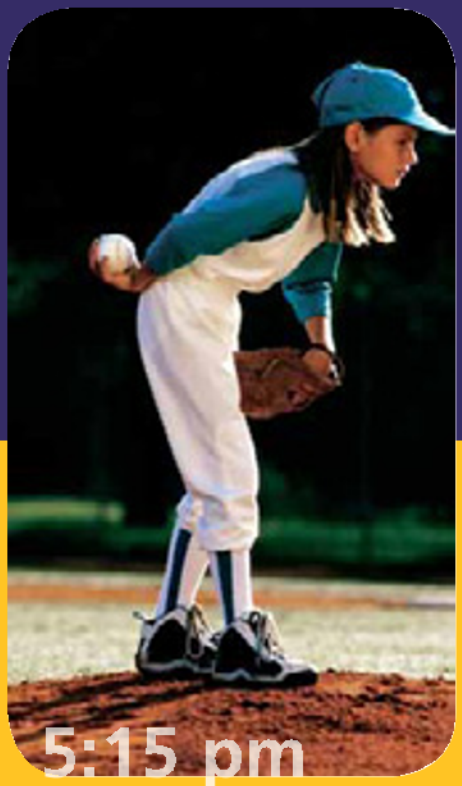


DISTANCE EDUCATION NETWORK (DEN)

Earn your

USC Master of Science degree online... while maintaining work, family, and life.

WEEKLY
TEAM MEETING



DAUGHTER'S
SOFTBALL GAME

PURSUE USC
GRADUATE DEGREE

USC's Distance Education Network (DEN) offers over 30 graduate engineering degrees—entirely online, including:

Aerospace Engineering • Astronautical Engineering • Biomedical Engineering • Civil Engineering • Computer Engineering • Computer Science • Electrical Engineering • Industrial & Systems Engineering • Integrated Media Systems • Mechanical Engineering • Medical Device & Diagnostic Engineering • Petroleum Engineering • Product Development • Engineering • System Safety & Security • Systems Architecture & Engineering • and more

CLASSES ARE OFFERED FALL, SPRING, AND SUMMER

USC **Viterbi**
School of Engineering

Visit: den.usc.edu
Email: info@den.usc.edu
Call: 888.495.1122

USC
UNIVERSITY
OF SOUTHERN
CALIFORNIA

USC Viterbi
School of Engineering

USC UNIVERSITY OF SOUTHERN CALIFORNIA

Office of the Dean
Olin Hall 200
213.740.7832
Web: viterbi.usc.edu

Office of External Relations
Olin Hall 500
213.740.2502

Alumni Relations
Web: viterbi.usc.edu/alumni
Email: viterbi.alumni@usc.edu

Communications and Public Relations
Web: viterbi.usc.edu/news
Email: viterbi.communications@usc.edu

Corporate and Foundation Relations
Web: viterbi.usc.edu/giving/corp_relations/
Email: corpeng@usc.edu

Development
Web: viterbi.usc.edu/giving

Office of Admission and Student Affairs
Ronald Tutor Hall 110
213.740.4530
Web: viterbi.usc.edu/students/undergrad
Email: viterbi.studentservices@usc.edu

Career Services
Ronald Tutor Hall 218
213.740.9677
Web: viterbi.usc.edu/students/undergrad/careers
Email: viterbi.careers@usc.edu

Center for Engineering Diversity
Ronald Tutor Hall 210
213.740.1999
Web: viterbi.usc.edu/students/undergrad/ced
Email: viterbi.ced@usc.edu

Office of Master's and Professional Programs
Olin Hall 106
213.740.4488
Web: viterbi.usc.edu/students/graduate
Email: viterbi.mapp@usc.edu

Distance Education Network
Web: den.usc.edu
Email: denadmin@usc.edu

Office of Doctoral Programs
Olin Hall 332
213.740.6241
Web: viterbi.usc.edu/students/phd
Email: egradaff@usc.edu

Academic Departments

Aerospace and Mechanical Engineering
213.740.4303 Aerospace
213.740.8762 Mechanical
Web: ame-www.usc.edu
Email: ame@usc.edu

Astronautics and Space Technology
213.821.5817
Web: astronautics.usc.edu
Email: info@astronautics.usc.edu

Biomedical Engineering
213.740.7237
Web: bme.usc.edu
Email: bmedept@usc.edu

Civil and Environmental Engineering
213.740.0603
Web: www.usc.edu/dept/civil_eng/dept
Email: ceedept@usc.edu

Computer Science
213.740.4494
Web: www.cs.usc.edu/
Email: csdept@usc.edu

Daniel J. Epstein Department of Industrial and Systems Engineering
213.740.4893
Web: www.usc.edu/dept/ise
Email: isedept@usc.edu

Ming Hsieh Department of Electrical Engineering
Web: ee.usc.edu

SYSTEMS:
213.740.4447
Email: eesystem@usc.edu

ELECTROPHYSICS:
213.740.4700
Email: eepdept@mizar.usc.edu

Mork Family Department of Chemical Engineering and Materials Science
Web: chems.usc.edu

CHEMICAL ENGINEERING:
213.740.2225
Email: chedept@usc.edu

MATERIALS SCIENCE:
213.740.4339
Email: masc@usc.edu

PETROLEUM ENGINEERING:
213.740.0332
Email: peteng@usc.edu

viterbi.usc.edu

USC Viterbi // Engineer

USC Viterbi School of Engineering
University of Southern California
Olin Hall 500
Los Angeles, CA 90089-1451

NON-PROFIT
ORGANIZATION
US POSTAGE
PAID
UNIVERSITY OF
SOUTHERN
CALIFORNIA