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 curricula

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USC Viterbi School of Engineering

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Research and Scholarship at Viterbi

The collaborative nature of research and scholarship has always been at the heart of the USC Viterbi School of Engineering. With a strong emphasis on interdisciplinary engineering, the school is ranked consistently among the top five in the nation in several research volumes and in the amounts of funded research per faculty member. It also accounts for about a third of all 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 Micro-Electronic Systems (BMES) Center

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

Interdisciplinary research and societal relevance is the core of an important third national center: The Water Resilience and Economic Analysis of Tiers -creaT (WATERCREAT), 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 CREAT -recombinates 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 for Intermodal Transportation Systems (CITRANS), 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 Intelligent Smart Oilfield Technologies (CISOT), 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 in 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 societal important problems.

With a brilliant history-as 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 aiming 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. graduates have averaged close to 45 percent of the number of tenure-track faculty.

Technology will relentlessly drive innovation and the solution of complex global problems.
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Strengths in research and scholarship have always been a defining mark 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 amounts of funded research per faculty member. It also accounts for about a third of all of USC’s research. The reasons are simple:

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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 area of flow-engineering gives a brief glimpse of this commitment.

Yannis C. Yorty
Director of Alumni Relations, Editor

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 redocking 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 Rehnuma Salemi; Ph.D. students Harin Chiu, Jacob Evarest, Felix Hou, Nareesh Kamasgire and Mike Rubenstein; and M.S. students Nick Kwonants 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.

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**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 Pearson, Praveen Paruchuri and Pradeep Varakantham. Professor Milind Tambe is in the center in the black robe.

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**PARTICLES**

**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.”

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“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—of any—in the United States can match this level of commitment.”
Super Bots
THEY WALK, THEY WIGGLE, THEY SLITHER AND ROLL

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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/
It’s A Done Deal
VITERBI SCHOOL ESTABLISHES NEW PARTNERSHIP
WITH TSINGHUA, CHINA’S TOP TECHNICAL UNIVERSITY

Viterbi School Dean Yannick 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 affiliate with the multidisciplinary Future Internet Technologies (FIT) Research Center hosted the workshop.

During the visit, Tsinghua and Viterbi faculty showcased their research 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 firsthand 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 Gadiji ‘Raju’ Raghavendra, professor of electrical engineering and senior associate dean of special projects, and Jin Li, executive vice dean at Tsinghua.

Jianjun Sun, dean of Tsinghua’s School of Information Sciences and Technology, and USC School Dean Yannick C. Yortsos share hands after shaking the MN.

Jianjun 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 (MSEE ’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 Neuren Technologies with two friends. He received the 2002 Renet X. 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 offices in 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 into being.”

New Faculty at Viterbi
SIX NEW FACULTIES 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, Mechanical and Aerospace Engineering Department, Joe Qin of the Department of Chemical Engineering at the University of Texas at Austin, Andreas Hodge of the Lawrence Livermore National Laboratory, Dongxi Zhang of the Lawrence Livermore National Laboratory, and Murali Annamalai of Intel Corp., Austin, Texas, and Noah Malmstadt from the Department of Biomedical Engineering 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 Biotechnology 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 Viterbi Family Department of Chemical Engineering and Materials Science, the Ming Hsieh Department of Electrical Engineering and the Daniel J. Evans 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 head of the Paul D. and Betty Robinson Mosk and American Petroleum Foundation Centennial Professor in Chemical Engineering.

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

His interest is in nanomechanics, nanocrystalline materials processing, high-temperature mechanics, thin and thick film coatings, biocompatible mechanics and foam processing. Assistant professor Murali Annamalai joined the Viterbi School’s Ming Hsieh Department of Electrical Engineering from the NASA Research Center in Pasadena, Calif. Prior to his work at NASA, Annamalai was a senior researcher at the initial 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 Dongxi Zhang has an appointment at the Department of Civil and Environmental Engineering and the USC Viterbi Family Department of Chemical Engineering and Material Sciences.

Prior to joining USC, he was the Miller Chair professor at the Mechanics School of Petroleum and Geophysical 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 1999, respectively.

Assistant professor Noah Malmstadt has joined the Viterbi School’s Ming Hsieh Family Department of Chemical Engineering and Material Sciences. Previously, he was a postdoctoral fellow in the Bioskyrd 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 biophysics in 2003 from the University of Washington, Seattle.

HONORING MING HSIEH

At the exclusive Jonathan Club in downtown Los Angeles, Trojan dignitaries gathered to recognize Ming Hsieh, BSEE ’51, MSEE ’61, for his generous gift to the Department of Electrical Engineering. Pictured to left to right are USC President Steven B. Sample, Kathryn Sample, Fong Liu, Ming Hsieh, Sheryl Yortsos and Viterbi School Dean Yannick C. Yortsos.

FALL 2007 VITERBI USEN
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SIX NEW FACULTY 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, Mechanical and Aerospace Engineering Department; Josquin of the Department of Chemical Engineering at the University of Texas at Austin; Andrea Hodge of the Lawrence Livermore National Laboratory; Dongxi Zhang of the Lawrence Livermore National Laboratory, Rauli Annunen of Intel Corp., Austin, Texas, and Noah Malmstadt from the Department of Biomedical Engineering 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 Biotechnology 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 José Qín accepted joint appointments in the USC Viterbi Family Department of Chemical Engineering and Materials Science, the Ming Hsieh Department of Electrical Engineering and the Daniel G. Donohue Department of Industrial and Systems Engineering.

Qín 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 Robinson Mosk and American Petroleum 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 are in nanomechanics, nanocrystalline materials, tribology, high-temperature mechanics, thin- and thick-film coatings, biomaterials mechanics and foam processing.

Assistant professor Rauli Annunen will join the Viterbi School’s Ming Hsieh Department of Electrical Engineering from the Nokia Research Center in Palo Alto, Calif. Prior to his work at Nokia, Annunen 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.

Assistant professor Noah Malmstadt has joined the Viterbi School’s Ming Hsieh Department of Chemical Engineering and Materials Science. Previously, he was a postdoctoral fellow in the Biophysics and Microsystems Laboratory at 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.

The new KAU Administration Building 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.”

Yuh and Yortsos 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.

“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 tell-tale 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.”

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 transpotation 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 all-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.

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 Victorian 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.”

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Colored arrows show airflow created by bat flight.

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The Viterbi School launched its second century with a new set of endowed annual keynote lectures. Each of the school’s academic departments now offer 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 from around the world of engineering.

Viterbi School Keynote Lectures

This year, the school launched a new series of endowed guest lectures hosted by each department.

- **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 Tidball 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 the University of Southern California.
- **The Albert Dorman Lecture**, sponsored by the Civil and Environmental Engineering Department, will be announced later this fall.
- **The Hsiuen K. Cheng Lecture**, sponsored by the Aerospace and Mechanical Engineering Department, will be announced later this fall.
- **The Fred S. Grodins Lecture**, sponsored by the Biomedical Engineering Department, which will feature Douglas Lanfrancon 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 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 Janet Laufer Lecture**, sponsored by the Aerospace and Mechanical Engineering Department, which featured Anja Romboli, the Theodore von Karman professor emeritus of aeronautics at Caltech, who discussed “Reflections of the Turbulence Problem.”

**Movers & Shakers**

Local engineers meet Transportation Secretary Mary Peters.

The Los Angeles area chapter of WTS—formerly Woman’s Transportation Seminars—hosted a dinner for the 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 Transportation Secretary Mary Peters earlier this year at the Millennium Biltmore hotel in downtown Los Angeles. The audience of more than 300 guests included transportation agency executives, city council members, county supervisors, mayors and transportation commissioners. Forty U.S. 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 firm CH2M HILL, DBM, HGA, Matttich & Eddy, and parent company AECOM Technology Corporation.

POMP AND PAGEANT: Commencement Day 2007

1,762 BEAMING VITERBI SCHOOL GRADUATES SEIZE THE DAY

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 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: 680
- Masters Degrees: 1,140
- Ph.Ds.: 142
- TOTAL: 1,962
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Visit our website
for up-to-date series information:
viterbi.usc.edu/news/events/keynotes

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- The Albert Dorman Lecture, sponsored by the George A. Bekey Lecture, sponsored by the Viterbi School Department of Chemical Engineering, which featured Steven Chu, Nobel Laureate in physics and director of the Lawrence Berkeley National Laboratory, and president-elect of the Institute of Electrical Engineers.
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Ph.D.s 142
TOTAL 1,762

Viterbi School Keynote Lectures
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Movers & Shakers LOCAL ENGINEERS MEET TRANSPORTATION SECRETARY MARY PETERS.

The Los Angeles area chapter of WTS—formerly Woman’s Transportation Seminar—hosted 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 and training services.

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 Department of Industrial and Systems Engineering, U.S. Transportation Secretary Mary Peters; and Stephanie Taylor, MSEE transportation engineering student. //
Honoring Excellence

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

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 to more than $1.52 billion in 2006.

Bartz serves on the boards of directors of several companies that grew in revenues during her 14-year tenure from $285 million to more than $1.52 billion in 2006. She has been a member of the board of directors of Autodesk, Inc. for 14 years.

Bartz received the 2007 CEO of the Year award from Computerworld and was named one of the most powerful women in business by Fortune magazine.

Sonny H. Astani, chairman and founder of Astani Enterprises, received the Mark S. Stevens Distinguished Alumni Award.

Astani entered USC in 1978 and earned his advanced degrees in electrical engineering at USC, leading up to his M.S. degree in 1986 and a Ph.D. in 1988.

Steven DenBaars, Carol Bartz and Karl Weiss. Dean Yannis C. Yortsos is on right.

In a specialized nanotech lab tucked safely in the basement of Titan 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 in “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 Edwin 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 Nano Letters, 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 (In2O3 and In2O3:Sn), one oxide of zinc (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 alons.

The process condenses the high-temperature (750-degree C) vapors on a nest of nanoscale gold particles, where they self-assemble into a transistor.

“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 James Baker.

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) in June 2005.

Prior to joining FXPAL, Baker was the director in charge of the three information and surveillance.

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Those receiving Viterbi alumni awards this year included, left to right, Sonny H. Astani, Steven DellB Raum, Carol Bartz and Karl Weiss. Dean Yemc C. Yortos is on right.

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GEN X-CELLENCE SCORES BIG

The buzz at Viterbi never stops. As the quality of our undergraduate students continues to rise, “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 Newman 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 Lumberge 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.
- **Viterbi School Dean Yannis C. Yortsos** joined Henry for an awards dinner, as did the directors of USC’s Center for 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.

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 C. C. 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.

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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.

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 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 Artificial Agents clusters.

Leonardo da Vinci: The Engineer

Leonardo da Vinci touched many lives in 15th-century Italy, not just with his paint- ings 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
FALL X-CELLENCE SCORES BIG

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

5. Miles Killingsworth, a senior majoring in astronautical engineering, has won the highly competitive 2007 Lum Scholarships, which will allow him to live and work in Aida for a year.

6. 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 Noyer Memorial Scholarship in a competition with students from 11 engineering schools in Southern California.

7. Reed Doucette, a mechanical engineering major with a 3.98 GPA, won the 2007 James Lumbarge Award for the highest GPA on USC’s basketball team. The Trojans, a smart and entertaining team, reached the Final 16 round of this year’s NCAA championships, higher than most predicted, and their best finish since 2002.

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9. Engineering undergraduates Pamela Fox, left, and Ryan Brown, right, were congratulated for creating the most useful 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

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Viterbi School Dean Yannis C. Yortos joined Henry for an awards dinner, as did the director of USC’s Collaboratory for Advanced Computing and Simulations (CACI) Professors Rajiv K. Kalia, Aichihiro Nakano and Priya Vashishta. All three have joint faculty appointments in the Viterbi School and the USG College of Letters, Arts and Sciences.

“I am a firm believer in the power of technology to change the world and the well-being of this nation,” Yortos 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.”

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Faculty Accolades
TH E LOW-DOWN ON ALL THOSE PROFESSORIAL AWARDS AND ACHIEVEMENTS

Alexander “Sandy” Sawchuk

Schorr

FALL 2007

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. //

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Faculty Accolades

THE LOW-DOWN ON ALL THOSE PROFESSORIAL AWARDS AND ACHIEVEMENTS

1. Herbert Schorr, 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 Medal.

2. A special USC Honors Convocation for 2007, 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.

3. Sami Masi, 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 Masi’s seminal work leading to the emergence of structural health monitoring as a vital area of research.

4. 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.

5. While Kanso’s award is of quite recent vintage, another 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.

6. 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 S. Louisa Achievement Award for 2007 from AMS (formerly the American Society for Metals International), the Materials Information Society.

7. George Chilingarian, 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.”

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9. Michael Gruntman, chair of the Viterbi School’s Aerosciences Division, has received the Luigino Napollano Award of the International Academy of Astronautics for his book on the history of rocketry.

10. Sanjit Mitra, the Varo Professor in the Hsieh Department of Biomedical Engineering, has received a Foreign Fellow from both the National Academy of Sciences, India, and a Foreign Fellow of the Indian National Academy of Engineering. Honors are nothing new to Mitra, who is also a member of the U.S. National Academy of Engineering.

11. A quick Jeopardy quiz: He’s the only person who has won both an Academy Award (an Oscar) and the IEEE. E. Harold Sawchuk.

12. Eun Sok Kim, professor of aerospace and mechanical engineering, received the Luigi Napolitano Viterbi School’s Astronautics Division, for his work in signal and image processing, recently achieved dual recognition. He has been named a Fellow of the American Society for Metals (AMS) International, the Materials Information Society.

13. Elaine Chew, professor in the Hsieh Department, known for his work in signal and image processing, recently achieved dual distinctions: He has been named a Fellow of both the National Academy of Sciences, India, and a Foreign Fellow of the Indian National Academy of Engineering. Honors are nothing new to Mitra, who is also a member of the U.S. National Academy of Engineering.

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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.
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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 innuscent 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 Mosk Family Department of Chemical Engineering and Materials Science, is exploring a completely new way of manipulating the body’s natural defense system.

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 makes it virtually impossible to puncture. But because the virus also has an immunity 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 2F3. 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, 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 immuno-therapy for HIV-infected people, as well as find ways to prevent it all together.”
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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 investigators David Baltimore of Caltech and co-principal investigator Pamela Bjorkman of Caltech. The USC student researchers working on the project are Leslie Ruths, Taejoon 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 seismological 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 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 Eva 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 build workflow architecture into their research plans.

“Workflows 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.

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They will also investigate mechanisms to support computer science to create a science of workflows.” The workshop suggested that scientists proactively build workflow architecture into their research plans. “Workflows 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.

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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 data 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 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.

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Computer science is helping researchers manage massive data flows.
Uncanny Swimmers
WHAT PROPELS DOLPHINS, TUNAS, WHALES, AND SEALS THROUGH ROUGH WATERS?

Fish use their cleverly streamlined bodies to exploit fluid-structure interactions in ways that no other swimming animal can. But their power comes from the fact that they are able to adapt to changing water conditions. 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.

Eva Kanai is investigating the science of hydrodynamic acceleration.

The more energy-efficient swimmers on Earth—dolphins, tuna, whales and seals—will burst through choppier waves, playing tag as they torpedo across the ocean's surface in a gory dry-dive. Diving, striking, through the immensity of the ocean, these majestic predators can follow ships cruising at up to 40 nautical miles per hour (knoots), 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 Kanai, a mechanical engineer who specializes in dynamical systems, wants to know. If she can unlock some of the hydrodynamic secrets of a marine mammal's uncanny swimming ability, that could lead to the development of a new generation of biologically inspired robots capable of exploiting 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 vertical force past the body," says Kanai, an assistant professor of mechanical engineering at the Vitale School's Department of Aerodynamics 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."

"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—such as Stanford, UC Berkeley, MIT, Cornell and Carnegie Mellon—are studying the same mathematical expressions of these dynamical solid-fluid systems in the hope of developing new high-tech robotic vehicles. Some of Kanai's colleagues at USD include Professor Tony Moxey, who leads the Smith International Chair in Mechanical Engineering and is also an associate professor of mechanical engineering. Moxey, an expert in the behavior of fluid-structure systems, says that his research group is working on developing new ways to apply the principles of aquatic locomotion to robotic vehicles.

Moxey predicts that the research is "very likely that any successfully engineered device will have to have some similar mechanisms of generating and controlling such fluid motions."

Similar principles may apply to swimming fish, an area that Kanai hopes to investigate as a postdoctoral researcher at Caltech. During that time, she modeled the fish at a deformable body made of an ideal rigid link 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 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, Kanai 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 finna can overcome its prey with a few bursts of acceleration, she may be able to explain it.
Uncanny Swimmers
WHAT PROPELS DOLPHINS, TUNAS, WHALES, AND SEALS THROUGH ROUGH WATERS?

Fish use their sleekly streamlined bodies to exploit fluid-mechanical principles in ways that naval science and technology can only marvel at today. It took 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 core concept of Kaneko’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 it undulates body creates as it moves through the water. For example, five fishereal vortices (whirls) and currents as they swim 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,” Kaneko 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, Kaneko 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 often 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 fists or lava flows.

Eva Kaneko is investigating the secrets of hydrodynamic acceleration.

The more 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 merry 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 (knoots), or about 46 miles per hour, using their vertical tail movements to accelerate and maneuver beyond any naval architect’s wildest dreams.

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A handful of specialists—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 hope of developing new high-tech robotic vehicles. Some of Kaneko’s colleagues at USC include Professor Tony Maxworthy, who holds the Smith International Chair in Mechanical Engineering, and his associate, Professor Geoff Spedding, a theologian by training who studies airflow and bird flight.

In 1979, Maxworthy, a member of the National Academy of Engineering, was the first scientist to demonstrate that many simple rings 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 complexes, time-varying fluid motions can make the difference between flying or being grounded.

Since then, the leading-edge vortex (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 Kaneko hopes investigating as a postdoctoral researcher at Caltech. During that time, she modeled the fish at a deformable body made of attached rigid links, and showed that it could propel and steer itself in potential flow solely by changing its shape.

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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 Supercenter (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 0.1 percent increase in the nation’s daily mortality rate.

“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 tim- est 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 Fuentes, 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 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 mud 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 ultrafine particulate matter.

But solving the problem isn’t easy or obvious, he says. And whatever improvements have been made as 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 consid- ering 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-exist- ing 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.”

Sioutas checks his PM monitor before starting data collection.

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Research at Viterbi:
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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.
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IMSC: The NSF Engineering Research Center with a Bonfire of Research

IMSC researcher, in their efforts gained momentum, acquired new funding to establish their own new labs, making room for more IMSC start-up efforts that, in turn, branched out. This following is just a brief sampling of a few of the research achievements at IMSC.

ULTRAWIDEBAND RADIO

Many utilities of radio involve modulating very specific radio frequencies to carry messages, or for that. At IMSC, Robert Scholz, professor in the Ming Hsieh Department of Electrical Engineering, provided a foundation for a new technology that has the opposite strategy. Scholz and his students developed techniques for generating, receiving, and using extremely weak pulses of radio waves spread across an extremely 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 Wi-Fi operations, with Scholz credited as a founder of technology.

IMMERSIVE AND VIRTUAL REALITY EDUCATION TESTING

Working at IMSC, Albert Skypio Rivas, 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 mimic users' interactions with computers to teach both students and assess skills. An influential example is Virtual Classroom, a virtual reality system for diagnosing attention deficit hyperactivity disorder (ADHD) in children. The recorded "immersive" videos, show how students' behaviors change with ADHD, and the system is being commercialized as a diagnostic tool.

HAPTICS

Margaret McIlinahan, 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, squeak, draw and push their
BMES: An NSF Engineering Research Center That Learns from Nature

The goal of the Biomimetic Microsystems (BMES) is to develop electronic devices that can sense, actuate, and control various biomedical applications, such as medical implants, neural interfaces, and tissue engineering. BMES was established in 2003 as an NSF Engineering Research Center (ERC) by a consortium of universities, industry partners, and government agencies. The center focuses on the development of novel micro- and nanoscale technologies for biomedical applications, including diagnostics, therapeutics, and prosthetics.

**IMSC:** The NSF Engineering Research Center with a Bonfire of Research

IMSC is another NSF ERC that focuses on the development of new technologies for the management of chronic diseases. IMSC aims to develop innovative solutions for the treatment of diabetes, obesity, and other chronic illnesses. The center involves collaboration between industry, academia, and government agencies, and it is funded by a mix of federal and private sources.

**THE BRAIN:** CHIPS FOR VICTIMS OF STROKE, EPILEPSY AND DEMENTIA

Ted Berger, professor of biomedical engineering and director of the Center for Neural Engineering, is working on developing implantable devices that can help people with neurological disorders. His team is developing chips that can monitor and stimulate brain activity, with the goal of improving quality of life for individuals with stroke, epilepsy, and dementia.

**THE BION:** REVITALIZING PARALYZED LIMBS AND BUILDING NEW ONES

Gerald Lohb, a professor of biomedical engineering at the Viterbi School, has developed a novel strategy for regenerating damaged nerve tissue. His team has created a device that can deliver electrical impulses to the damaged nerve, stimulating axonal growth and promoting regeneration.

**ENERGY, IMPLANTABILITY AND DATA PROCESSING**

Implanted devices must be able to transmit data wirelessly, a challenge that has been met by researchers at IMSC. They have developed a wireless power transfer system that can recharge the devices without wires, allowing for longer battery life and improved patient comfort.

**IMMERSIVE DATA AND VIRTUAL REALITY EDUCATION/TESTING**

Workers at IMSC, such as Najaf Shahabi, associate professor of computer science, are developing new training tools and simulations that can help users interact with complex systems. These tools can be used in a variety of settings, from medical training to industrial applications.

**HAPTICS**

Margaret McConnell, a professor in the USC Annenberg School of Communication, is developing haptic feedback systems for use in medical training. These systems allow users to feel the physical sensations associated with medical procedures, such as surgery or physical therapy, providing a more realistic training experience.

**IMSC - The NSF Engineering Research Center with a Bonfire of Research**

May 23, 1996, was Oscar night for engineering. After months of grueling competitions of no less than 117 can- didate schools, the National Science Foundation (NSF) was ready to announce the winning institution that would house its 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 exhilarated—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 part- nership with industry was a cornerstone of IMSC, a pattern now widely imitated at USC. But this bottom line and touchstones of IMSC was, and remains, a remarkable record in fostering exceptional cross-disciplinary and collaborative engineering research.

Many IMSC researchers, in their efforts gained momentum, acquired new funding to establish their own new labs, making room for more IMSC start-up effects that, in turn, branched out. The following is just a brief sampling of a few of the research achievements at IMSC.
IMMERSIVE AUDIO

IMSC investigators Chris Kyriakides, associate professor in the Ming Hsieh Department of Electrical Engineering, and Tomilson Holman, a professor in the USC School of Cinematic Arts, who is also a professor of electrical engineering and the ’TF” in the THX sound system, have revitalized the field of sound reproduction. Their work is rippling through the industry, accelerated by an IMSC-linked startup, Audioson Laboratory Inc. “To show off his work, Kyriakides plays a recording of the Holloch-Bimo Chorus from Handel’s Messiah.” reported Time Magazine. “Then, via digital filtering, he drills down to specific instruments, as if microphones had been placed near to them. A digitized symphony track is stunningly realistic and intimate.” The IMSC-created audio reproduction 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 the actual sound itself. IMSC pioneered technology to revitalize the immersive sound experience on the Internet, allowing performance on opposite sides of the continent to produce an audio effect in Los Angeles. Holman accompanied him.

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 ever in existence. The effects included new forms of display, waves to integrate views from overlapping camera views that allow an individual to take a virtual walk through an area. A collaboration with Cyrus Shahidi produced GeoDec, which allows computer operators to do the same walk with geospatial information.

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

ENGINEERING MUSIC

At IMSC, Elaine Chun, associate professor in the Daniel J. Epstein Department of Industrial and Systems Engineering, is a winner of the Presidential Early Career Award for Scientists and Engineers, awarded to build an oceanic infrastructure in L.A.

IMAGING SCIENCE

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 Reuther Hall.

Four years later, the Center for Risk and Economic Analysis of Terrorism Events, or CREATE, earns 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 partners.

CREATE director, Dorafshar Vossoughi, is a professor in the Daniel J. Epstein Department of Industrial and Systems Engineering at the Viterbi School, with a joint appointment in SPD. 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 (ISSM), which has the distinction of having granted graduate degrees to more currently serving Air Force generals—29—than any other school in the country.

Vossoughi 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 Fire Safety, in collaboration with the Federal Emergency Management Agency, for best response to emergencies.

SPECIFIC PLACE PLANNING

Emergency preparations need to be custom-tailored to individual places. CRATeS has done substantial work using economic analysis tools to estimate impacts of various interventions in the Southern California megapolises. 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 the Viterbi School have co-authored a study of the disrupting economic model, both for local use and as a prototуpe.

Dorafshar Vossoughi

Dorafshar Vossoughi, associate professor of computer science, is working with USC’s Department of Public Safety on improved flexible response, using GPS tools.

TRAINING TOOLS

One of the most striking and innovative CREATE products has been DEFACO, an application of artificial intelligence engine to training emergency responders. Tambe and Nathan Schauer, PhD, (CS 1970) who was Tambe’s graduate student, worked directly with the Los Angeles County Fire Department. CREATE is also working with the Caltrans Laboratory to build another fire-fighting game called FireCape, a 100.

To view the interactive version of this page, please visit the online version of this publication.
way to recovery, as described in a report in *Virtual Medical World*. "It lets them interact with virtual worlds by feel." Other work developed a device for non-surgeons, to allow virtual "touch" while a medical display is in operation.

**IMMERSIVE AUDIO**

IMSC investigator Chris Kyratzis, 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 "THF" in the THX sound room, have reconfigured the field of sound reproduction. Their work is rippling through the industry, accelerated by an IMSC-linked startup, Audyssey Laboratories Inc. "To show off his work, Kyratzis plays a recording of the Holocaust Choral from Handel's Messiah," reported Time Magazine. "This digital filtering, he drills down to specific instruments, as if microphones had been placed near to them. A digitized tapestry track is stunningly realistic and intense." This IMSC-based audio reproduction system ingeniously uses 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 solve the immersive sound exposure problem, allowing perfection on opposite sides of the room to continue with a pianist in Miami sounding as clear and real as the violinist in Los Angeles she accompanied.

**IMMERSIVE ENVIRONMENTS**

Ultric 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 effects 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 Cicago Shadok produced GeoDec, which allows computer operators to do the same trick with worldwide geographical information.

Combining visual advances with the immersive audio and haptic research in 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.

**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 music 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**

Shot 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 astonished Kyratzis laughter. Still another was a pioneering effort to have computers recognize the distinctive speech of children, who could then interact without 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 Persian (Persian) for a patient to hear. Then the same machine translated the patient’s spoken response into English for the doctor.

"The listing is only a part of the "benevolent and research and development" dictates by President Sample," said IMSC continuous throughout its second decade under the direction of James Baker, its new chairman and the chief executive officer of Fuji Xerox 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 Tavis Hall.

For four years, the Center for Risk and Economic Analysis of Terrorism Events, or CREATE, exerted 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 partners.

Doroth Winterfield, a professor in the Daniel J. Epstein Department of Industrial and Systems Engineering at the Viterbi School, was 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 is the distillation of having granted graduate degrees to more currently serving Air Force generals—29—than any other school in the country. Winterfield 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 threat and ways to combat them. For example, the second DHS center (in which the Viterbi School also participates) is the Center for Risk, Animal and Zoonotic Disease Defense (FAGD), aimed at developing tests, cures, vaccines 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 offices together. CREATE work includes a range of studies to develop a variety of tools, as described below.

**RISK ANALYSIS**

A study that Von Winterfield completed about the danger posed by small, shoulder-fired anti-armor rockets to the potential to hang down passenger airplanes illustrates the way CREATE works. Von Winterfield tracked consequences using “decision trees” of alternative possibilities to evaluate costs and benefits.

The analysis was widely admired and Michael Orszag, a project leader at the school’s Information Sciences Institute (ISI), working with ISI colleague Tatiana Kichkina and Robert Neucher, have made Von Winterfield’s approach accessible to risk analysts all over the nation with the Risk Analysis Workbook, or RAW.

**RISK MANAGEMENT AND EMERGENCY RESPONSE**

CREATE is also developing tools that can guide and speed responses to disasters. CREATE teams are analyzing new tools for three specific disasters or threats: Sandy Ma, professor of civil and environmental engineering, and Jean Paul Cafferty, research assistant professor of civil and environmental engineering, are working on an ongoing project that can analyze explosion threats against specific buildings and pre-coordinate responses.

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

**SPECIFIC PLACE PLANNING**

Emergency preparedness needs 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 USC’s Urban and Regional Planning department, are working on creating a model for the entire Southern California economy.

**DETECTION AND MILITARY**

Tambur, associate professor of computer science, is working with USC’s Department of Public Safety on improved flexible response, using GPS tools.

**TRAINING TOOLS**

One of the most striking and innovative CREATE products has been DEFSTO, an application of artificial intelligence technology for training emergency responders. Tambur and Nathan Schauer (Ph.D. CE’07) who was Tambur’s graduate student, worked directly with the Los Angeles County Fire Department. CREATE is also working with the Flame 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, gossipy ointments and intravitreal 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 intravitreal 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.

Glaucoma is an insidious 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 photoreceptor cells 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 2030, that number is expected to climb to nearly 3 million, and at the same time, an additional 9 million people will have clinical signs of AMD and be at high risk of progression to late-stage vision loss.

“There are photodynamic 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 be refilled.

“We are about two years away from commercializing the first implantable microfluidic 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 minute 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 intravitreal 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 engineering 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 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 intravitreal 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, an 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.

“Did we 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. If

Ellis Meng holds up one of her new eye implants, which is about the size of a wristwatch battery.
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, gory ointments and intravitreal injections for those suffering from glaucoma and other vision-threatening diseases.

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For the past two years, Meng and her interdisciplinary team of researchers, including 12 graduate students and two postdoctoral scholars, have been working on out-innovating the industry and developing a device that could eventually replace eye drops, gory ointments and intravitreal injections for those suffering from retinitis pigmentosa. This degenerative disease causes blindness as the rods and cones in the eye lose their ability to function.

Humayun is developing an implantable artificial retina that can stimulate the remaining photoreceptor cells in the retinas of people who are suffering from retinitis pigmentosus. This degenerative disease causes blindness as the rods and cones in the eye lose their ability to function.

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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 launch it.

The Viterbi School’s Lunar Entry and Approach Platform for Research on Ground—known as LEAPROOG—is the latest and greatest USC lunar landing vehicle to accomplish just that. Professor Mike Gustin, chair of the Astronautics and Space Technology Division and David Burchett, the director of the Aerospace Technology and Systems Center at the school’s Information Sciences Institute, have been supervising 18 astronautics 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 last time that week at the second Space Exploration Conference in Houston.

According to Burchett, 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’ LEAPROOG 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.

Burchett 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. LEAPROOG provides “an actual flight platform to test early prototypes of key landing subsystems,” Burchett 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.

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

This student participation was not just to assemble an existing idea. Rather, the effort involved everything from designing the engine, using solid-state 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 Rogoj (Engineering), Morgan Hendry (Guidance, Navigation and Control), Michael Rudolph and Allen Stover (Structures), Jason Cheng (Jet Engine), Laura Hugg (Power and Harness), Omar Fakhri (Communications), Nikola Jordan (Ground and Flight Systems), and Abtis Garcia, Jesse Martorella and Savithi Chuvan (Attitude Control).

Burchett says standout successes have included design and fabrication of the attitude control thrusters by Savithi Chuvan within six weeks, a process normally taking three months, assembling, purchasing and running the Rabbit microcontroller software and PLC hardware to control the jet engine and the ACS thrusters by Omar Rudolph and Cassandra Richlin, and successful test firing and characterization of the jet engine by Jason Cheng and Daniel Fishel on campus, within one week of training.

Meanwhile, last April, another student research group fired 45 pounds of carbon dioxide, Kevlar and solid rocket propellant 18.4 miles 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 DeLorean.

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

DeLorean, named for its carbon fiber construction as well as at the students’ favorite sci-fi restaurant, was baked in an oven big enough for a “really big pizza,” according to supervisors David Reece. It first flew in May 2006. After the success of that test flight, DeLorean, 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 23,000 feet.

Reese, a rocket hobbyist since age 9, eagerly responded when E riv asked his astronautics students about their interest in forming a student-run research organization to design, build and test compact aircrafts. Many of the students who responded are still part of the core group that includes leading rocket scientists ranging from freshmen to grad students. Ian Whitingh, a senior with years of rocket building experience, has led the group since its beginning.

The April flight tested two new systems. The Cluarjet—(small enough to fit in a soda can) carried a GPS position system to record position information and log its flight data. For this third flight, the RPL students replaced the nose cone aluminum with lightweight Kevlar to allow penetration of the GPS signals.

The telemetry download was successful and corroborated the integrated accelerometer data that showed spurs 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 doing in the rising 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 Jet Propulsion Laboratory). DeLorean is being renamed 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 (60 miles), which is the Klimt line, the boundary between the Earth’s atmosphere and outer space.

Video of DeLorean’s launches and of the students’ trips to the desert, as well as a blog can be found at RPL’s website at www.usc.edu/rl.
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This student participation was not just to assemble an existing idea. Rather, the effort involved everything from designing the thrusters, 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 Rodeck (Engineering), Morgan Hensley (Guidance, Navigation and Control), Michael Rubenstein and Allen Strumy (Structure), Jason Cheng (Jet Engine), Lucas Hough (Power and Harris), Osman Faghizadeh (Communication), Nicolas Jordan (Ground and Flight Systems), and Albit Garcia, Jose Martoza and Savith Chukan (Attitude Genes).

Rumbach says standout successors have included design and fabrication of the attitude control thrusters by Savith Chukan within six weeks, a process normally taking three months, assembling, purchasing and running the Rabbit microcontroller software and PLC hardware to control the jet engine and the AGS thrusters by Omar Rahban and Cassandra Rasnik, and successful test fitting and characterization of the jet engine by Jason Cheng and David Risch in campus, within one week of training.

Meanwhile, last April, another student research group faced 45 pounds of carbon fiber, Kerolus and solid rocket propulsion 18.41 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 Vitrcs astronautics students in the Rocket Propulsion Lab (RPL) built this demonstration flight vehicle from scratch under the direction of Professor Daniel Rewie.

Del Carbon, named for its carbon fiber construction as well as at the students’ favorite San Francisco restaurant, was baked in an oven big enough for a “really big pizza,” according to supervisors David Reece. In first flight in May 2006. After the success of that first 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 9, eagerly responded when Rewie asked his astronautics students about their interest in forming a multidisciplinary 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 building rocket scientists ranging from freshmen in grad school. Ian Whitmiller, a senior with years of rocket building experience, has led the group since its beginning.

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

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

The flight also tested a dual-stage parachute system. The purpose of the two-stage 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 Reece got summer jobs at NASA’s new Jet Propulsion Laboratory.

Del Carbon is being retooled after three successful flights. Thomas is coordinating RPL moves 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 launch and of the students’ skills to the drone, as well as a blog can be found at RPL’s website at www.uscrl.com. If

Producer Linda Davis contributed to this article.

FALL 2007 VITERBI/USC EDU

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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.

“With declining production, Indonesia is at a point where it’s actually beginning to import oil, and 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 Unocal 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 Carroll brothers started 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 eat, digest and get nutrients from eucalyptus leaves. In the past, they 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.

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. “If natural resources, 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.”
Going with the Flow

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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 a 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

ALUMNI NEWS

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. USG’s Project Manager for the Office of Capital Projects, Stan Westfield and Director of the Viterbi School’s Construction, Engineering and Management Program, Hank Kettmann 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 80-75.

Alumnus Robert Gray

Elected to NAE

USC alumnus Robert Gray, the Linstoc 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. 6. 2007. He was cited for his "contribution 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 1986, both in electrical engineering, and a doctorate in the same field from the Viterbi School of Engineering in 1989. 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 delays over Los Angeles, Viterbi alumni opened the evening at Dedeaux Field watching the Trojan men’s baseball team take on the Pepperdine Waves. During the game, alumni enjoyed Tacos 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 3-4 score, the Viterbi spirit was alive and well cheering them on the whole way.

Vice President Emeritus Tony Lastoria (BSCE ’74) joins Dean Yen-Yen C. Yates in thanking Ray Johnston (BSCE ’97) and Gregg Brandow (BSCE ’97). 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 ’87) and Roy Johnston (BSCE ’86). Gregg is the President of Brandow & Johnston Associates, a Los Angeles-based structural engineering consulting firm founded in 1945 by his father, George (BSCE ’46) 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.

Engineering Me

MY NAME: Geraldine Kroatz (Viterbi School Board of Counselors Member)

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

JOB TITLE: Executive Director, Port of Los Angeles

LIFELONG DREAM: Be a Philanthropist

FAVORITE VITERBI PROF: Joe DelValle

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

ON MY POD: Motivation

WORDS TO LIVE BY: “Do something that scares you everyday.” (Eleanor Roosevelt, but in my case it’s more like 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. to 7:30 a.m. (at quiet in the office)

FAVORITE GADGET: The thing that opens the pickle jars

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

TOUGHEST ENGINEERING CLASS: I don’t take that one

NUMBER ONE WEBSITE: Macy’s.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 traffic up our main channel into port—mesmerizing!

Me...Engineered
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Engaging Me

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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 DelValle

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

ON MY POD: Motivation

WORDS TO LIVE BY: “Do something that scares you everyday” (Elon Musk), but in my case it’s more like 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)

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TOUGHEST ENGINEERING CLASS: I didn’t take that one.

NUMERO ONE URL: bay.com

NUMBER OF TROJANS IN MY LIFE: There are so many! All my students in ENG 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—dramatic!

Me...Engineered
Engineering Me

Aluma 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 member privileges and courtesies reserved exclusively for Viterbi Society members. Most importantly, you will be invested 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.
Engineering Me

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

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
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pioneer in the fi eld 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 outstand-
ing contributions and leadership in
developing, and commercializing very
high-performance semiconductor and
OLED technologies.

Five former presidents of the USC:
Chapter of Chi Epsilon gathered to honor
Albert Dorman: Ed Reynolds (1981), Henry
Kuffman (1982), Dorman, Ryan Anderson
and Greg Brandow (2002-03).

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.

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For more information, and a list of membership benefits, contact Matt
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The Viterbi Store

Introducing the Viterbi Store! We have just
created a brand new line of
Viterbi Society 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
viterbi.usc.edu/viterbistore to purchase your items today!

The Viterbi School hosted its fi rst 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. Tzortzis spoke
of the importance of these donors in
attracting and retaining top engineer-
ing 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 ensure the connection with alumni by alerting them 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 Viterbi Alumni Office at vit@usc.edu or call (213) 821-2424.

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 contact 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 Viterbi Alumni Office at vit@usc.edu or call (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 engineering leaders.

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 vit@usc.edu.

WOMEN IN ENGINEERING
The Women in Engineering (WIE) Office invites female alumni to participate in the “Connections” mentoring program. WIE recognizes the valuable insight and support an alumna 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 one individual mentoring session and can include emailing, phone conversations, in person meetings, etc.

If you are interested in participating in the Connections program, please contact the WIE Office at vit@usc.edu or call (213) 740-4530.

PREVIEW DAY: USC GRADUATE ENGINEERING STUDY day, Thursday, September 27, 2007 8:00 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. It is a great chance to reconnect with faculty members and help the Viterbi School in the present!

Please visit viterbi.usc.edu/preview or contact Camilla Lee at camilla@usc.edu.

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 Gudisea House at (213) 740-9577 or house@usc.edu.

The Engineering Career Fair provides an excellent opportunity to increase your company’s visibility among our top engineering students. We offer two technology-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 2,000 of our students.

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

ME...ENGINEERED

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 Vanter, Maja Matarić, Michael Croulley, Jason Lidow, Joseph Greenfield, and the list goes on)
BOOK/’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 friend at my graduation
TOUGHEST ENGINEERING CLASS: Operating Systems (I used to dream about the solutions to the project)
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

Visit our website today to update your information: viterbi.usc.edu/alumni
Volunteer Opportunities

VITEROI 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 accept and distribute 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 Viterbi Alumni Office at viteroi.alumni@usc.edu or call (213) 821-2424.

VITEROI 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 contact 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 Viterbi Alumni Office at viteroi.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 practicing 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 at 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 alumni to participate in the “Connections” mentoring program. WIE recognizes the valuable insight and support alumni can offer to undergraduate students and wants to connect all alumni, 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 one 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
11:00 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 fun-filled 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 present!

Please visit viterbi.usc.edu/preview or contact Camilla Lee at camilla lee@usc.edu.

UNDERGRADUATE 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 or 100 engineering employers and approximately 1,700 to 2,200 of our students.

Register at viterbi.usc.edu/careers before September 28 to qualify for early registration!

Engineering Me

MY NAME: Vijayakrishna ‘Vij’ Panati
DEGREE: B.S. Computer Science, 2007
JOB TITLE: MIS Manager
LIFELONG DREAM: To make a true difference in people’s lives
FAVORITE VITEROI PROF: Too many to list (Richard Vanter, Maji Mataric, Michael Crowley, Jason Lidor, 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.gutenborg.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

Visit our website today to update your information:
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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
VSE Asia Alumni and Recruiting Tour October 2007 Taiwan, China, Korea
USC Global Conference – Viterbi Reception October 26, 2007 Evening – TRD Tokyo, Japan
Preview Day: USC Graduate Engineering* September 28, 2007 USC Campus
USC Homecoming 2007 – Annual Viterbi Reunion Picnic November 4, 2007 USC Campus
Viterbi Bay Area Alumni Reception November 9, 2007 Downtown San Francisco – TRD
USC Basketball Viterbi Alumni Night January 2008 USC Galen Center
Spring Engineering Student Career Fair* February 27, 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 TRD
VSE India Alumni Tour August 2008 TRD
Regional Networking Events Capping Los Angeles, Orange County, San Diego, San Francisco

USC EVENTS
Fall Semester Classes Begin August 25, 2007
Home Football – USC vs. Idaho September 1, 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
Home Football – USC vs. UCLA December 1, 2007
Spring Semester Classes Begin January 12, 2008
Commencement May 15, 2008

Class Notes

George Nugent (BSIE) and his wife, Bonnie, recently celebrated their 50th wedding anniversary. The couple has three sons.

Arthur Noeberger (MSEE) recently published three books based on personal experiences: Decorated Space Projects (U.S. Space Station), Solar Energy Systems (Heating-Cooling-Residential), and Small Town America (Families Along the Oregon Rver). The books are published through Xlibris Corporation, Philadelphia, Pa.

Robert Miller (MSIE) successfully defended his Ph.D. thesis on 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 Group, Wright-Patterson Air Force Base, Ohio.

Al Merlo (MSIE), was named President of Searches 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, Merlo 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 Sveringhaus (MSEE) was elected Chairman of the Executive Committee of Simulation Interoperability Standards Organization (SISO) Inc., an interna- tional MRI standards development organization. Sveringhaus works in the domain of command-level decision processes, human performance and human systems integration. // St. Mary Land & Exploration Company announced that Julio Quintana (MSIE) has been appointed to serve as director of the company. Quintana was appointed to the board on July 7, 2006. With his addition, the board will have eight members. Mark Holkema, chairman and chief executive officer, comments, “We are pleased to have an individual of Julio’s talent 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 TESSCO 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 TESSCO. 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.

INDIA ALUMNI TRIP
Dean Yannis C. Yortsos celebrates Viterbi engineering alumni with India. He was joined by Associate Dean Gopinath Raghavendra, third from left and Kelly Goulis, second from right.

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 to 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 at VSE Office of Alumni Relations at (213) 821-2424 or online at viterbi.usc.edu/alumni.
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USC Global Conference October 25-27, 2007 Tokyo, Japan

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 (BSME) and his wife, Bonnie, October 6, 2007. His solo recital for couples who have been married for 50 years or more. The couple has three sons.

67 Arthur Nuemberger (MSME) recently published three books based on personal experiences: Managed Space Projects (Upfit in Space Station), Solar Energy Systems (Harnessing Virtue Power: Small Thermoelectric Power), and Small Thermoelectric Power (Small Thermoelectric Power). The books are published through Xlibris Corporation, Philadelphia, Pa.

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

81 Al Medved (MSEE) was named President of Searches Consulting Group. In addition, he is currently an Industry Professor at the USG Industrial and Systems Engineering Department. An international expert in operational improvements, organizational turnaround and restructuring, Medved 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. 2005 in the summer of 2005. Rick Serrveringhaus (MSEE) was elected Chairman of the Executive Committee of Simulation Interoperability Standards Organization (SISO), an international M&S standards development organization. Serrveringhaus works in the domain of command-level decision processes, human performance and research and systems integration. St. Mary Land & Exploration Company announced that Julio Quintana (RSMEE) has been appointed to serve as director of the company. Quintana was appointed to the board on July 7, 2006. With his addition, the board will have eight members. Mark Holdren, chairman and chief executive officer, comments: “We are pleased to have an individual of Julio’s talent 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 it. 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 the 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 in Unocal Corporation, where he spent 20 years working in reservoir engineering and leadership roles.”

ALUMNI NEWS > 47

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 to find these fellow engineers?[1]

You can email us names, spread the word to your friends and family and update your information online. To help, please contact us via Office of Alumni Relations at (213) 821-2424 or online at viterbi.usc.edu/alumni.

ALUMNI NEWS

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FALL 2007 VITERBI USC ENG
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 https://viterbi.usc.edu/alumni or by contacting the VSoE Office of Alumni Relations at (213) 822-2424.

STAY CONNECTED

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 Bomickson, and son, Roy 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. ’90) 68, died on March 9, 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 Reserve. 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, Neldix, Nortel, Siemens, and as a founder of CipherOptics.

Doss was survived by his wife of 47 years, Judith Barker Doss, his daughters, Leslie and husband, Ronnie Fapury; Michelle and husband, Bryan Holjes; and Stephanie and husband, Scott Hanke; grandchildren, Calvin and Amy Hanke, and Carter Holjes; and stepgranddaughter, Amanda Fapury.

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 35 years, Mary Lee Smith Knight; four children, William A. Knight Jr., Samuel Foman Knight, Sally Haviland Knight, and Virginia Lee Spiers; five grandchildren, Jennifer Downs Helm, Samuel F. Knight Jr., Rebecca Erin Knight, Marshall Andrew Spiers and Georgia Lee Spiers; and two great-grandchildren, Wilson and Shaun 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 as 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.
CLASS NOTES

82
Wispy, Inc. announced the appointment of Collin Baker (BSEE) to its executive team. Baker joins Wispy as vice president of computer engineering. He comes to Wispy with more than 25 years of semicon-

83
Noushin Faghih (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 corpora-ions. We currently have offices in Taipei, Beijing and Shanghai and serve many interna-

88
Dannies Hutaepa (BSCEE) 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. My new position as a Project Engineer is in the 10th year of my working life. I married my wife, Nami Pratama, in December 1998, and we now have two boys, Darren and Denzel, 5 and 3,

97
Tom S. Dalal (MSBME, Ph.D. BME) and his wife, Nita Pantry-Dalal are happy to announce the birth of a son, Milan, born March 3, 2007. Milan joins big sister, Naina Yashu Peter Liao (Ph.D. BME) and Piajun Mao Liao are happy to announce the birth of their daughter, Anna Yu-An Liao, on January 4, 2007. The family lives in Warren, Indiana, and would like to express special thanks to Dr. Bradford L. Bopp (M.D. ’91) at the Midwest Fertility Specialists. j

99
Anjana N. Chaudhary (BME, MSCAI), at age 29, was selected as one of the youngest recipients of the 2007 “40 under age 40 accomplished leaders” by the San Francisco Valley Business Journal, for his accomplishments in the healthcare 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 Information Infrastructure Western Region from 2002-2004.

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 Bomrick, and son, Roy Crookshanks.

After serving in the Navy dur-

praghesjaymodi@usc.edu

Elizabeth J. 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 101 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 multibot systems,” Modi joined the Drexel Faculty in Pittsburgh in 2005, following a predoc toral research position at Carnegie Mellon University. He received a prestigious National Science Foundation Career Award, as well as the IEEE Medioni said Modi’s Ph.D. thesis at USC had been “founda-

golden opportunity.”

Jay will be remembered with fondness in the area of distributed constraint optimization.”

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

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golden opportunity.”

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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 Auditors.

Anthony J. Madiash (BSCE ’65, MSCP ’67) died May 8 at age 64. Madiash 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 Oregon Ventures. In 1965, he married Sharon L. McMahon.

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 5, 2007, at the age of 75. Roberts was a career highway worker who came west on Route 66 as a child flying 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 construction assistant in 1951 on the eve of a 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 shocks 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 Jamestown, N.Y., 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 Altamont, 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 Reserve, 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. Spencer (BSME ’60) passed away at his home on March 31, 2007, at the age of 85.

Born in West Virginia, Spencer was married to Shirley, 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 flew his Corsair back from combat. After moving to Thousand Oaks with his 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 ’53) passed away, after a lengthy battle with cancer, at the age of 83. Williams, the only child of Ben H. and Euphor Odor Williams, was born July 29, 1923, in Glendale, Calif. He spent his youth in Oklahoma and was 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 Tustin, Williams enjoyed engineering plans for several buildings 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, Dorthy. He is also survived by his three children, Ross Williams of Bakersfield, Dean and Nancy Williams of Tustin, and Ketah and Rebecca Williams of Richmond, Va. His three stepchildren, Rita Banta, Jane Rollins and Doug Banta, who dearly loved, also survive him. He has five grandchildren and one great-grandchild.

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. He won the IRIS Award for his work in electron probe microanalysis. Additionally, he developed a new type of detector 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 M Icombeam Analysis Society (MAS) for Outstanding Scientific Contributions to Microanalysis in 1980 and was an honorary member of the M icrbeam Analysis Society. He won the Birs Award for the best paper presented at the MAS National Conference in 1987 and in 1989.

Throughout his career, Wittry was involved withtrailblazing 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 microanalyzer, 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.
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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.

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.

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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 microanalyzer systems, 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 detector 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 M-cube beam Analyist Society. He won the Birks Award for the best paper presented at the MAS National Conference in 1987 and in 1989.

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Q&A with Maja Mataric
Senior Associate Dean of Research, Professor of Computer Science and Neuroscience; Founding Director of USC 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 ramping 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 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 on the areas of defense 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, NIH, DHS, DOD and other federal agencies 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 surprisingly 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 managed. 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 informational forums for junior faculty. We aim to keep all of our faculty, and especially our young investigators, actively informed, trained and encouraged to be productive and compete for 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.

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FALL 2007 VITERBI USC EDU

3:30 am WEEKLY TEAM MEETING
5:15 pm DAUGHTER’S SOFTBALL GAME
8:45 pm PURSUE USC GRADUATE DEGREE
Q&A with Maja Mataric
Senior Associate Dean of Research; Professor of Computer Science and Neuroscience; Founding Director of USC Center for Robotics and Embedded Systems

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