USC Engineer

A Journal for Alumni & Friends

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The Robot Revolution
USC Robotics Leads the Charge

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On the Road with Y.H. Cho

CEO of Korean Airlines Pulled the Strings to Create Engineering's Newest Institute

Fall/Winter 2002

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Join your fellow alumni and friends at the 2002 School of Engineering Homecoming Picnic and Reunion Celebration on November 16, three hours prior to the USC vs. Arizona football game. For more details click here.

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The School of Engineering Alumni Relations Office welcomes your suggestions about new services and programs that you would like us to offer through our website. Please email us at uscengineer@usc.edu with your ideas.

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In 1977, USC Engineering's MESA program was working with 100 students in four schools. Today, Director Larry Lim manages a program that annually aids 1,500 high school students in 21 nearby public schools. "Our main goal is getting kids interested in engineering," Lim says.

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The USC School of Engineering is grateful to the following corporations, foundations and organizations for their generosity and support during the last fiscal year.

To receive information about how your company or organization can impact the engineers of the future, please contact:

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Technology

Technology continues to shrink the globe, working like a magnet to pull the diverse people of the world, their thoughts and cultures, closer together. The world of the 21st century offers new and bold opportunities, as well as new challenges, and our School is a clear reflection of the changes globalization has produced. The pursuit of knowledge at schools like ours, sparks innovations that improve humanity's condition.

Our new Pratt & Whitney Institute for Collaborative Engineering is a prime example of the interconnectivity between corporations, cultures, nations, and international universities. An American engineering and manufacturing corporation working in partnership with one of its largest customers, a Korean transportation giant, has drawn together our School of Engineering and Inha University in Incheon, Korea, to develop closer ties and collaborative research. That a Korean engineer and businessman, who not only attended USC and is a University trustee, but who is also in love with American culture, drove the creation of this magnificent new institute, surely points to the potential for a globally bright future. Y.H. Cho has done a great service for our School.

Our Distance Education Network (DEN), using Internet technologies and expertise from the School's Information Sciences Institute, is now delivering interactive education across our continent via the Internet, rather than the satellites it utilized in the past. It is not hard to imagine that in time, our School will be delivering knowledge to thousands of people across the globe.

The immersive, multimedia technologies of the next-generation Internet already exist in our Integrated Media Systems Center (IMSC). A new technology called Remote Media Immersion (RMI) can send high-resolution synchronized video and audio over the Internet in real-time. This technology will eventually bring a much higher level of interactivity to the pursuits of not only distance education programs like ours, but to corporate and governmental conferences taking place in locations that are separated by several time zones. In short, by making multimedia far more powerful, our School will bring people around the world closer together.

And our electrical and materials engineering efforts have now produced a chip that converts digital "ones and zeroes" into light waves. The optochip will be used by NASA to reach beyond our globe and solar system. It will maintain a multi-ship, deep space telescopic array in perfect synchronous orbit, delivering a stable platform from which Earth-bound scientists can peer more deeply into the universe.

The 1366 average SAT score for our incoming freshman class is the highest the School has ever had. For the first time ever, the School's average SAT score leads all of USC. Our SAT scores are now competitive with those of other top schools of engineering. In short, students electing to come to USC Engineering could have chosen to go anywhere. Along with our rise to number 8 (out of 300 schools) in the *U.S. News and World Report* rankings, the increase in the quality of the students applying to USC is another indicator that our school is on the rise.

Many of the innovations that come from the faculty and students at our School have international reach and impact. My sincere hope is that reading about them instills a great sense of pride among our alumni, friends, and supporters. We are engaged in work that makes the world not only a smaller, more closely knit place, but a better one.

C.L. Max Nikias
Dean
School of Engineering

PUBLISHER'S NOTE

I n the year since Dean Nikias established a new alumni relations program with unprecedented support and enthusiasm, the School has connected, and re-connected, with hundreds of alumni, all over the country and the world. In that time, I personally have spoken to, or heard from, many of these individuals, and have been impressed not only by the spirited, entrepreneurial nature of our engineering alumni, but also by their desire to stay in contact with the School and their fellow alumni.

Our desire is the same. And in looking toward the future, our goals remain clear. We continue to strive for ever-increasing alumni participation in School programs, communications, events and initiatives. Without the ideas, challenges, contributions and involvement of our alumni, an important aspect of what makes us a highly ranked school of engineering would be missing.

Carl Sarrazolla and I at the Tech Equity Conf. in San Diego.

But that is what we get out of your participation. What do you get out of it? Again, as we look toward the future, we see the growing need, especially in the current economic climate, to offer new programs and features to our alumni that will directly benefit their lives. The new alumni web page, premiering in late Fall 2002, is an example of one. It will offer access to contact information for fellow alumni through the first-ever Engineering Alumni On-Line Directory, in addition to several other exciting features.

This very magazine is another new part of our effort to give back to you. *USC Engineer* was created for the purpose of bringing the School to you twice a year. Through articles about extraordinary research, individuals, and contributions to the School, you can easily remain informed, and undoubtedly proud, of USC Engineering.

In the coming months, we will also continue to bring the School to your neighborhood with regional alumni receptions. These receptions continue to be the best way for us to connect with you, to discover your thoughts about the School, and to facilitate networking opportunities between you and your fellow alumni. Some of these receptions will be held at the homes of alumni, the kind of important support that the School's alumni program continues to depend on. We are currently planning several of receptions based on alumni who have volunteered either their homes as a location, or their time to assist in planning the event in their area.

One such alumnus is Carl Sarrazolla, BS EE '84. Carl is an incredibly active alumnus. In addition to owning his own consulting firm, he is currently the president of the San Diego Alumni club, one of the largest, best organized, and most active USC alumni clubs in the nation. At his club's monthly mixers, he has connected with dozens of School of Engineering alumni. With Carl's help, we are planning a joint event with the San Diego Alumni club for Spring 2003.

Dedicated alumni like Carl will help us to connect with hundreds of alumni again this year. We are grateful to him, and to his peers, for their continued support. The School is fortunate to have these kind of exceptional alumni that continue to grow and impact the world around them. Several more of them are profiled in this edition of *USC Engineer*. We thank them for sharing their stories with us.

Again, we hope to hear from all of our alumni, to know of the successes, as well as the challenges you face. We share in them, just as you share in ours.

ANNETTE BLAIN
DIRECTOR, ALUMNI RELATIONS

INT

3-D Immersion via the Internet Premieres at USC

REMOTE MEDIA IMMERSION TECHNOLOGY FROM USC'S INTEGRATED MEDIA SYSTEMS CENTER USHERS IN THE NEXT PHASE OF THE DIGITAL AGE — by Matthew Blakeslee

Remote Media Immersion (RMI), a break-through Internet technology that generates an immersive three-dimensional experience on home theater-sized screens, was unveiled this past spring by the School of Engineering's Integrated Media Systems Center (IMSC), which is a National Science Foundation engineering research center.

The power of RMI, a patented technology that combines high-resolution video and immersive audio technologies, was demonstrated using dramatic footage of the space shuttle launch on a screen measuring nine by five, which provided the audience with an unparalleled sense of the sights and sounds of a lift-off.

By merging the flexibility and interactivity of Web browsing with high-fidelity imagery and immersive audio, RMI delivers an experience superior to traditionally "flat" Internet and broadcast video technologies. "Remote Media Immersion provides the clearest vision yet of how the audio-visual experience will evolve over the coming decade," says Ulrich Neumann, director of IMSC and a USC professor of computer science. Researchers say the technology—using the high-speed capabilities of the Internet to transmit multiple streams of picture and sound across the nation—dramatically surpasses the quality achievable with high-definition broadcast television.

"This technology offers a large-screen high-definition experience via the Internet," says Dean Nikias. "This is not simply an incremental improvement in streaming media. We have effectively re-created the experience of being at a remote location, or on-site at a

sports event, concert, or conference," explains the Dean.

Major corporations, universities, and government agencies already have access to broadband services of 60 megabits per second or more, says Neumann, and these are potential users of RMI technology today. "However, even at lower data rates of 10-20 megabits per second, which widely deployed broadband access technologies will attain within five years, Remote Media Immersion will deliver significant improvements over current technology," he says.

The IMSC technology uses less than half the compression needed for broadcast high-definition TV, thus affording greater clarity of the final picture. The uncompressed HDTV video data rate of 1.5 gigabits per second is compressed to 35-45 megabits per second, as compared to standard high-definition television's maximum data rate of 19.4 megabits per second after compression.

Yima', the trademarked software and hardware streaming architecture developed at IMSC, delivers multiple, simultaneous high-bandwidth streams of images and sound, all synchronized with each other. Novel network protocols for error correction and synchronization are implemented in the Yima architecture.

Multichannel Immersive Audio uses multiple loudspeakers and algorithms to generate the sound field that can immerse a group—rather than just a single individual—

In a sample of IMSC's Remote Media Immersion of the future, doctors perform a remote procedure, perceiving the fine details of surgery.

in extremely realistic audio environments. Ten loudspeakers and two low-frequency subwoofers (for 10.2 channels rather than the 5.1 channels of commercially available Surround Sound) will be used to seamlessly envelop the audience in a three-dimensional sound field.

A further IMSC innovation is the development of RMI as a distributed application rather than a point-to-point system. Servers in multiple cities can host a movie, and all may be called on to transmit various parts of the movie's video and audio streams, offering critical protection against delays in Internet traffic and other delivery problems. All streams arrive at the user's destination to provide a complete, synchronized presentation.

IMSC was established in 1996 by the National Science Foundation as its only engineering research center for multimedia and Internet research. The center has earned widespread recognition for the pioneering development of "Immersipresence," its vision of the future of the Internet.

"We regard Immersipresence as the next great breakthrough in this Digital Age," says Dean Nikias. "We believe it will dramatically transform today's two-dimensional world of computers, TV, film, and audio into three-dimensional, immersive environments in homes, offices, schools, and theaters."

USC VISION SYMPOSIUM

A USC Vision Symposium held in the Andrus Gerontology Center September 5 featured a keynote address by Don MacLeod of UC-San Diego and six talks by USC faculty conducting vision research.

"The major purpose of the symposium was to introduce biological vision research to our campus community and promote research collaboration across the schools," said Noberto Grzywacz, professor of biomedical engineering, who hosted the event. "The symposium demonstrated that USC has an impressive vision community and lends further support to the new vision center that we are developing."

Grzywacz said the proposed USC Center for Vision Science and Technology would include research from the College of Letters, Arts & Sciences, the Keck School of Medicine, and the School of Engineering. It would focus on vision research, combining studies of the brain, computation, and technology

In the keynote lecture, MacLeod described the visual experiences of a 43-year-old man, blind since the age of three and with no memories of visual imagery as a sighted person, who regained his vision through a corneal transplant. The case has implications for how the brain learns to see during childhood as opposed to adult life.

The USC speakers included:

- **JEANNIE CHEN,** associate professor of ophthalmology, who discussed the role of certain proteins in the regulation of light and dark adaptation in photoreceptors;
- **NORBERTO GRZYWACZ,** who gave an engineering perspective of the retina, describing how it codes information from the visual environment;
- **MARK HUMAYUN,** visiting professor of ophthalmology, who described the progress that his group is making in their efforts to develop a retinal prosthesis;
- **JUDITH HIRSCH,** assistant professor of neurobiology, considered how synaptic mechanisms in the visual cortex allow it to detect the orientation of borders;
- **BOSCO TJAN,** assistant professor of psychology, used psychophysical techniques to explain how the brain identifies letters; and
- **IRVING BIEDERMAN,** Harold Dornsife Professor of Neuroscience and professor of psychology, presented research on how primate brains recognize objects.

The symposium included 23 scientific posters from USC vision researchers on display at the Hedco Neuroscience Building.

Said Grzywacz about the day — "During lunch, coffee breaks, and the reception at the end of the day, one would walk around and hear the most impressive conversations that are only possible in a symposium like this. USC people discovered that they had interesting colleagues close to home."

THE FIRST ANNUAL ANDREW J. *V*ITERBI
DISTINGUISHED LECTURE IN COMMUNICATION

The Viterbi Lecture was created as the School of Engineering's premier academic distinction in information technology and digital communications, an area of research in which the School is a national leader. Each year, an awardee that has made fundamental contributions of profound impact in communication will present the Viterbi Lecture.

The School is proud to have Andrew J. Viterbi (PhD EE '62) as the first honoree. Viterbi is co-founder and retired vice chairman and chief technical officer of QUALCOMM.

His principal research contribution, the Viterbi Algorithm, is used in most digital cellular phones and digital satellite receivers, as well as in such diverse fields as magnetic recording, voice recognition and DNA sequence analysis. More recently, he concentrated his efforts on establishing CDMA as the multiple access technology of choice for cellular telephony and wireless data communication.

Viterbi is a member of the National Academy of Engineering, the USC Board of Trustees and the Engineering school's Board of Councilors. He has been awarded several honorary doctorates and the Claude Shannon Award of the Institute of Electronic and Electrical Engineers' Information Theory Society.

Viterbi's lecture was entitled: "The Science, Technology and Business of Digital Communications." The lecture took place on Thursday, November 14, 2002 at USC.

Computer Scientist Keith Uncapher Dies at Age 80

FOUNDER OF USC INFORMATION SCIENCES INSTITUTE

Computer scientist Keith Uncapher, 80, whose pioneering research and development on computer networking helped lay the foundations for the Internet, died on October 10, 2002 in Los Angeles from a heart attack.

Uncapher founded the School of Engineering's Information Sciences Institute (ISI) three decades ago and served as its executive director until 1987. Under his leadership, ISI researchers developed such key elements of the Internet as the "dot.com" domain name system, and made major contributions to electronic mail and basic Internet protocols.

"Keith was present at the creation," says Uncapher's successor, ISI Executive Director Herbert Schorr. "When the smoke clears and historians are able in a hundred years to take a look back, they'll see that he and his creations were at the center of the information technology revolution of the late 20th century."

Prior to starting ISI in 1972, Uncapher was director of the computer science division at RAND Corporation in Santa Monica. His work on the technology of packet switching, in which digital messages are broken into small packets, sent over a network and reassembled at their destination, had attracted great interest at the Department of Defense Advanced Projects Research Agency. He helped officials see the technology's vast potential for facilitating a revolution in computer communications.

Uncapher persuaded both the government and the late dean of USC Engineering, Zohrab Kaprielian, to form a sophisticated university-based research agency, and one month later ISI opened the offices it still occupies in Marina del Rey, California.

"Vietnam was winding down," Uncapher recalled in 1997. "ISI was designed to help rebuild the bridge between the Department of Defense and academia."

Packet switching research and development led first to the military's Arpanet, and then to the Internet itself. Under Uncapher, ISI grew from a staff of three to 240. It now has a staff of more than 350.

While still at RAND, Uncapher designed the first time-sharing computer system for mathematicians. He led the packet-switching technology project and the RAND Tablet Project, a computer system for recognizing hand printed characters using a tablet and stylus.

"Keith Uncapher was a brilliant pioneer whose work advanced not only USC and its School of Engineering, but the whole field of computers," says fellow engineer, USC President Steven B. Sample.

"Very early on, Keith grasped the potential of packet switching technology," says C.L. Max Nikias, dean of the USC School of Engineering. "With his marvelous talents for engineering and administration, he has made the world both a smaller and better place for all of us."

Uncapher was born in Denver, Colorado on April 1, 1922. He attended Glendale College and completed his BS degree in electrical engineering at Cal State-Poly in San Luis Obispo. He also served four years in the U.S. Navy during World War II.

At the time of his death, Uncapher was senior vice president of the Corporation for National Research Initiatives in Reston, Virginia, an organization he co-founded in 1986 with fellow Internet pioneers

Dr. Robert E. Kahn and Dr. Vinton Cerf. There he was pursuing several technology initiatives, notably one on micro electro mechanical systems. He was also associate dean for Information Sciences, Emeritus, at the USC School of Engineering.

His honors included a Distinguished Service Award from the American Federation of Information Processing Societies; the Department of the Air Force's highest civilian award, the Decoration for Exceptional Civilian Service; and the Institute for Electrical and Electronic Engineers Computer Society Centennial Medal.

"When the smoke clears and historians are able in a hundred years to take a look back, they'll see that he and his creations were at the center of the information technology revolution of the late 20th century."

The citation upon his election in 1998 to the National Academy of Engineering, engineering's most distinguished society, noted his contribution to "information technology on the national level."

Uncapher chaired the Stanford University Computer Science Advisory Committee, and the Carnegie-Mellon University Computer Science Advisory Board. He was a member of the United States Air Force Scientific Advisory Board; the National Research Council, Board of Telecommunications; the Defense Information Systems Agency's Scientific Advisory Group; the Federal Judicial Center's Scientific Advisory Group; the Carnegie-Mellon Visiting Committee on Science; the Institute for Defense Analyses Computer Science Advisory Group; and the EDUCOM Board of Trustees.

Uncapher was a resident of Playa del Rey. He is survived by his wife Doris and two sons, William B. Uncapher and Jeffrey K. Uncapher. A memorial was held for him at United Methodist Church in Westchester on Tuesday, October 15, followed by a reception at the California Yacht Club. There were hundreds in attendance.

On November 13, 2002 the School of Engineering and ISI also held a memorial in the Engineering Quad at the USC campus in celebration of Uncapher's life and career contributions. Dean Nikias announced the creation of the Keith Uncapher Endowment Fund, which will support the area of computer science. To find out more about the fund, or to make a contribution, please contact the School of Engineering at 213/740-2502.

Engineering Goes Hollywood

When the U.S. Army awarded a $45 million contract to the University of Southern California on August 18, 1999 to create the Institute for Creative Technologies (ICT), headlines focused on the unlikely marriage of Army green to Hollywood glitter and glitz.

But in addition to Hollywood talent, technologies from the USC School of Engineering, especially the Integrated Media Systems Center (IMSC), and the Information Sciences Institute (ISI), have been key to ICT's success. Expertise in multimedia, artificial intelligence, and other engineering areas were as crucial as the Hollywood connections of the USC School of Cinema-Television, and the communication smarts of the Annenberg School for Communication in convincing the Army to choose USC.

ISI's Paul Rosenbloom wrote much of the initial application for the grant. Dean Nikias, who was then IMSC's director, recalls handling the visit of a top-level Army delegation, at which IMSC showcased its pioneering immersive media technology with audio and visual elements of unparalleled realism. "They were visibly impressed," recalls Dean Nikias. "USC's Hollywood connection was the sizzle, but engineering provided the steak."

Engineering skills are essential elements in ICT's most spectacular projects. Key technical personnel, including technical director William Swartout, came from USC Engineering. Swartout, formerly the director of ISI's Intelligent Systems Division, continues to hold an appointment as research associate professor in the department of computer science.

Swartout has spearheaded ICT's Mission Rehearsal Exercise, a remarkable virtual reality tour de force combining state-of-the-art immersive technology from IMSC, with

In Flatworld, the different views are evoked directly by the participant's movements: as a participant's head turns, the view changes.

advanced artificial intelligence from ISI. In a special theater-like space created by IMSC, a giant 150-degree screen wraps around the junior officer undergoing the training. A 3,500-watt directional sound system blasts the sounds of engines revving, aircraft passing, and occasional distant gunfire with startling clarity, while a gripping scenario in a troubled village of war-torn Bosnia unfolds in high-resolution animation. The officer is a lieutenant leading a small detachment through the town where an army vehicle has just hit and seriously injured a child. The child's mother is distraught. A restive crowd is gathering. The radio crackles with commands and messages regarding another unit under fire and in need of help. What should the lieutenant do?

Hollywood contributed this scenario, but the immersive technology that renders the scene with such precision and clarity comes from IMSC. Associate Professor Chris Kyriakakis created and customized the multi-channel audio system using immersive audio acquisition and software for dynamic rendering that seamlessly combines the sound with the visuals. Room equalization ensures the same experience for every participant no matter where they are in the room. The ability of the virtual characters to respond to words and even gestures by the human participant, rather than just repeating a pre-recorded script, comes directly out of ISI's vast expertise in artificial intelligence. Particularly important is ISI's agents technology. Agents are computer programs that can perform autonomously as if they are independent beings.

W. Lewis Johnson, director of the ISI

Center for Advanced Research on Technology in Education, has been developing software agents for educational purposes. The basic model, developed years ago for the Navy, is called "Steve." All of the animated characters in the Mission Rehearsal drama are versions of Steve with a range of differing appearances and voices, yet all driven by the same computational programming. Johnson, a senior project leader at ISI, who is also an associate professor in computer science, worked with his longtime collaborator, project leader/assistant professor Jeff Rickel, who collaborated closely with Swartout.

Rickel says the combination of personality, emotion, and ability to respond to speech, facial expression and gesture in the characters is something new. "No one has ever before put together a team with expertise in all of these areas," he says.

Flatworld

Engineering also contributes heavily to another jaw dropping ICT demonstration called "Flatworld," which is a "mixed reality" rather than a pure virtual reality simulation. In Flatworld, individuals walk and run freely in a place that is partly physical props—chairs, tables, and so forth—and partly a digital environment. The name of the project evokes "flats," the painted backdrops used behind props on theater and film sets.

But theatrical or studio flats are just that—flat. They are designed to be viewed from one angle only, and have a limited range of positions. The digital flats of Flatworld change as a *continued on page 10*

BOARD OF COUNCILORS GAINS STRENGTH

DEAN C.L. MAX NIKIAS HAS MADE EIGHT KEY ADDITIONS TO THE SCHOOL'S BOARD OF COUNCILORS.

SONNY H. ASTANI (MS ISE '78) is president of Astani Enterprises in Beverly Hills, the sole American franchise of the British company, Lambert Smith Hampton (LSH). LSH is the largest commercial real estate brokerage firm in Beverly Hills. Astani Enterprises, established in 1978, buys and manages commercial real estate and builds and restores commercial buildings, restaurants, offices and residential condominiums. Astani was born in Iran and came to USC to pursue his master's degree. He started his career at Hughes Aircraft in El Segundo, before changing his focus to property management, and founding Astani Enterprises. His wife Jo Cho and he have two children, a girl and a boy.

YANG HO CHO, a USC trustee, is chairman and CEO of Korean Air. Cho is also chairman and CEO of Hanjin Information Systems and Telecommunications Company, Ltd. Cho received an MBA from USC in 1979, and has been on the USC Board of Trustees since 1997. (*See "On The Road with Y.H. Cho" on page 16 for more information.*)

DR. ALICE P. GAST (BSc ChE '80) is the vice president for research and associate provost at the Massachusetts Institute of Technology. In addition to her administrative positions at MIT, Gast is MIT's Robert T. Haslam Professor of Chemical Engineering. She coordinates policy regarding research and graduate education and oversees the Institute's large inter-school laboratories. Gast, who joined the Stanford faculty in 1985 after earning her Ph.D. from Princeton University, is an expert on complex fluids and colloids. She is a member of the National Academy of Engineering, the American Association for the Advancement of Science, the American Chemical Society, the American Institute of Chemical Engineers, and the American Physical Society.

THOMAS O. GEPHART (BSME '62) is founder and chairman of Ventana Global. Gephart has led the successful global launch of five U.S. technology private equity funds, and Ventana has 70+ technology portfolio companies that have attracted over $3 billion in equity financing, including direct investments from Ventana's 84 multinational investor-partners representing 20 countries.

Gephart founded Ventana in 1974. In 1982, Ventana's Board decided upon a Global Charter for Ventana's first Institutional Venture fund, which was established in 1984. As Ventana's driving force, he has implemented the firm's proactive investment style. He has served as chairman and director for both public and private companies, including APTA Group, Inc., Cellnet Corporation, Fidelica Microsystems, HemaCare Corporation, Infrasonics, Inc., Maxim Pharmaceuticals, Inc., and Medical Imaging Centers of America, Inc.; R2 Medical Systems, Inc.; SenDx Medical, Inc. and Tickets.com.

KENNETH R. KLEIN (BS BME '82) currently serves as chief operating officer and a board member of Mercury Interactive. Klein is responsible for Mercury Interactive's worldwide operations, including sales, customer support, professional services, field marketing, and information technologies. During his nine-year tenure at Mercury Interactive, he has held several positions, including president of North American operations, vice president of North American sales, director of Western area sales and regional sales manager for the Southwest region. Prior to joining Mercury Interactive, Klein served in various roles at Interactive Development Environments, Daisy Systems, and Hughes Aircraft Company. In addition to his bachelor's degree in biomedical engineering, he has a BS in electrical engineering from USC.

PROFESSOR GERALDINE KNATZ (MS ENV '77, PhD BS '79) is the managing director of the Port of Long Beach, a post she assumed in 1999. She is responsible for the port's $1.9 billion capital improvement program. She serves on the National Academy of Science's committee to review methods of analysis and peer review used by the Army Corps of Engineers. She also teaches graduate courses in Ecology and Environmental Compliance in the School's Department of Civil Engineering.

DR. ALEXIS LIVANOS is executive vice president of Boeing Satellite Systems (BSS), the world's leading satellite manufacturer. In this position, Livanos is responsible for managing the execution of the BSS business plan, including Spectrolab, Inc., and Boeing Electron Dynamic Devices subsidiaries. Prior to joining BSS, Livanos was executive vice president of Operations at Loral Space and Communications and was responsible for engineering, manufacturing and programs. Before that, he spent 16 years in various, increasingly key positions at TRW, Inc. Livanos received his BS in mechanical engineering, his MS in engineering science, and his Phd in engineering science and physics from California Institute of Technology. He has applied for three patents, and published 18 technical papers in refereed journals. Livanos and his family live in Palos Verdes Estates, California.

JOHN MORK (BSME '70) holds a BS degree in petroleum engineering from USC Engineering. Mork is founder, CEO and president of Energy Corporation of America (ECA). The company has made large investments in oil and gas exploration in New Zealand. The Energy Corporation of America Foundation, through which Mork has been a frequent supporter of USC, has interests that include education, health, youth services, and civic organizations, with a focus on curriculum development, employee matching gifts, matching/challenge support, program development, and scholarship funds. Mork's daughter Alison is a current sophomore at the Marshall School of Business.

SUPERCOMPUTING

— by Gia Scafidi

A renowned trio of researchers and their large supercomputing group has relocated to the University of Southern California from Louisiana State University. Priya Vashishta, Rajiv Kalia and Aiichiro Nakano have received joint appointments in the USC College of Letters, Arts & Sciences and the USC School of Engineering.

Kalia will be a professor of physics, Vashishta a professor of materials science, and Nakano an associate professor of computer science. Their research and teaching will be based in computer science, materials science, biomedical engineering, and the physics departments.

"Anyone who cares about science at USC has to be excited about these appointments,"

says Dean C.L. Max Nikias. "Doctors Vashishta, Nakano, and Kalia head up one of the world's leading research groups in advanced computational simulations. Such simulations are key to the interdisciplinary scientific focus of USC's strategic plan."

USC College of Letters, Arts & Sciences Dean Joseph Aoun says theirs is "a specialty that cuts across all disciplines," allowing USC to conduct simulations of highly complex systems ranging from earthquakes to computational biology. "Having them here enhances USC's ability to attract and train undergraduates, graduate students, and post-doctoral fellows in important emerging fields," says Aoun.

The three scientists have collaborated since the 1980s, when they worked together at

Argonne National Laboratory, one of the government's oldest and largest scientific and engineering research laboratories. "Any specialty on its own is always a great endeavor," says Vashishta. "But when you group multiple specialties, *continued on page 14*

photo by Jim Zeitz

The immersive technology that renders ICT's Mission Rehearsal Exercise with such precision and clarity comes from Chris Kyriakakis, IMSC investigator.

Engineering Goes Hollywood

continued from page 8

participant-spectator moves, so that as he or she goes around the side of a building, the scene changes continuously, as it would in reality. The different views are evoked directly by the participant's movements: as a participant's head turns, the view changes.

Flatworld is a modular set. Therefore, several digital flats can be rapidly assembled in any open space to simulate multiple situations in a variety of geographic locations. The experience is heightened with additional effects such as wind and vibrating floors. This approach of using physical props within a virtual environment creates a "mixed reality," seamlessly blending the physical with the virtual.

IMSC Director Ulrich Neumann and Swartout co-directed Flatworld. It brings into play IMSC expertise in head tracking, allowing displays that change according to how a user moves his head. Human perception, 3D graphics, and stereo-display systems are also key School of Engineering contributions.

"USC can be proud that, with ICT, we are providing a state-of-the-art facility to the Army," notes Dean Nikias. "And the School of Engineering is proud that our expertise is making it state of the art."

The ICT experiment was initially set up as a five-year study—and now has two years of achievement on its resume. What will the next three years bring? "Bring it on," says Dean Nikias. "The needs of ICT push the skills of Engineering in a way that is good for all of us."

Faculty Profile: K. Kirk Shung
Mr. Ultrasound

Professor K. Kirk Shung has joined the School's department of biomedical engineering. Shung heads the Ultrasonic Transducer Research Center (UTRC), which is the nation's only resource center for the development of ultrasonic transducer/array technology for medical diagnostic procedures. "I have been working in biomedical ultrasonics for more than 30 years," Shung says. "I came to USC because I see the School of Engineering on the upswing, and am delighted to be a faculty member of a top-notch university."

He is internationally recognized as one of the top five researchers in biomedical ultrasound technology. The first 30 MHz transducer/array was created in his lab. His research of ultrasonic transducer technology is fully supported and funded by the National Institutes of Health. In short, he is Mr. Ultrasound. According to Shung, "The lab is currently supported by four grants with an annual funding exceeding 1.5 million dollars."

K. Kirk Shung has joined the biomedical engineering faculty, bringing with him the Utrasound Transducer Research Center and its staff.

At USC, Shung has been offered "better facilities than I had at Penn State. And I am bringing 10 people from PSU, including five graduate students, four research staff, an engineer, and a technician." A big reason for the move is that "the new dean has a vision and is keen on promoting biomedical engineering activities," Shung says.

The Alfred E. Mann Institute for Biomedical Engineering is providing additional funding to accelerate UTRC research. "The Mann Institute," Shung says, "is a big plus and a major factor in our move because our research is focused on biomedical devices."

Mr. Ultrasound sounds good, maybe ultra-good for the School of Engineering.

School of Engineering Leadership Team

Herbert Schorr
*Associate Dean, School of Engineering
Executive Director, Information Sciences Institute*

Yanis C. Yortsos
Associate Dean, Academic Affairs

Randolph Hall
Associate Dean, Research

Kathleen Ash
Associate Dean, Administration

Christopher J. Stoy
Chief Executive Officer, External Relations

Louise A. Yates
Assistant Dean, Undergraduate Student Affairs

Margery Berti
Assistant Dean, Graduate Student Affairs

Susan S. Lewis
Assistant Dean, Program Planning and Design

Boeing Flies a Crucial Support Mission

Undergraduate engineering education has come down with a cold

While many of the nation's brightest and best students choose to study engineering, too many never complete their degrees. It is happening at engineering schools across the nation, and it is happening at USC.

"Even though USC's retention rate of 55 percent is equal to the national average of other schools, that rate is too low. It is simply not good enough," says Yannis Yortsos, the School's associate dean for academic affairs. "Dean Nikias identified the problem and last spring we launched a retention initiative to combat this large-scale problem."

Yortsos is in charge of the initiative, and he has found an excellent and very able partner in USC alumnus Rick Stephens, Boeing's vice-president and general manager of Homeland Security and Services, who is also chairman of the Board of Councilors' Education Committee at the School of Engineering.

Stephens is an affable and energetic executive with over two decades with Boeing and a passion for education. The aerospace giant's designated liaison to USC, Stephens earned a bachelor's degree in mathematics from USC in 1974. He also has a master's degree in computer science from California State University, Fullerton.

"Rick has worked with countless educational institutions and organizations, including USC, through support of important education initiatives," says Jim Albaugh, president and CEO of Integrated Defense Systems, a $23 billion unit of Boeing that includes the company's total space, defense, government, intelligence, and communications capabilities. He is also Stephens' immediate superior. "As a leader in workforce development, Rick has helped align Boeing with USC in an effort to produce quality engineers with diverse backgrounds and experiences."

While leading Boeing's Space and Communications Services, Reusable Space Systems, Naval Systems, and Tactical Systems, Stephens was responsible for programs in intercontinental ballistic missile guidance and control systems, tactical missiles, submarine combat systems, and the space shuttle. In his current role, he has taken on what he describes as "a large-scale systems integration problem." He oversees a contract to supply airports with systems to detect bombs in baggage. The contract includes the daunting task of quickly training 20,000 federal employees.

Boeing currently employs some 799 USC alumni. Janell Hanley, a Boeing campus relations manager who works closely with Stephens, says, "When I talk to USC engineering students, I know I'm talking to the best. They are technically well qualified and have very strong communication and leadership skills."

It is critical to companies such as Boeing that a stream of well-trained, technically adept young engineers continues to flow from engineering schools. "Youth is the work force of the future and not enough of them are becoming engineers," says Stephens. Media sets the tone for youth culture, and heavily markets youth. It doesn't send the right messages about math and science. Leaders in both education and industry have to recognize this communications gap. There are many local programs, some of them quite good, aimed at the problem, but they don't necessarily work in conjunction with each other. "We have no strategic philosophical focus," explains Stephens.

Stephens suggests that the School partner with high schools to develop programs that make math and science more understandable, as well as demonstrate to students the benefits of majoring in engineering. He adds that early mentoring is a key element.

"Early on, students need to see what an engineer does," he says. "Some students get into engineering simply because they're good at math and science without any real understanding of the field. Everyone needs a role model."

In college, Stephens wants engineering students to learn about business realities that impact engineering. "I look at 60 or 70 Boeing business development plans a year, and I've tried to create an entrepreneurial environment in a large company," he says. "I need engineers who know how to come up with ideas that fit into Boeing's business plan."

In addition to the School of Engineering, Stephens has a corporate advisory role at the Marshall School of Business, and directly interfaces with the Rossier School of Education and the Annenberg School for Communication. He thinks cross-disciplinary collaboration between the School of Engineering and the Marshall School can enhance engineering students' technical education with an ability to address business needs. The two schools have begun working on just such a program.

Through the School's Distance Education Network (DEN), Boeing engineers take courses at their worksites leading to master's degrees or graduate certificates in systems engineering. The program is a joint venture with the University of Missouri, Rolla. Boeing is the largest corporate participant in DEN with approximately 200 students taking classes at over 22 sites nationwide, including Hawaii. *(See "DEN—The Future is Now in Distance Education" on page 20 for more information.)*

Stephens fondly recalls working as a camera operator at DEN when he was an undergraduate, so he understands DEN well. "It is a great asset to both the School and USC. More and more students must recognize that distance education from work to earn advanced degrees is going to be a way of life in the future," he says.

Boeing has also been a long-time supporter of engineering research, including many of USC's research centers, such as the Center for Software Engineering and the Integrated Media Systems Center (IMSC), where it is a corporate partner. The company has licensed IMSC technology and worked with IMSC on a NASA project.

Stephens wants to strengthen research ties and has matched 17

Rick Stephens, vice president and general manager, Homeland Security and Services, Boeing Company, and chairman of the School of Engineering's Board of Councilors Education Committee.

Bill Steier, professor of electrical engineering/electrophysics.

Opto-Chip in Orbit

It is a tiny, sparkling fiber strip of technology that is going to be out of this world. Look closely with a magnifying glass and at either end of the strip you can see a gold USC School of Engineering logo that has been laid down by photolithography at the W.M. Keck Photonic Research Laboratory.

"This device, call it an opto-chip or electro-optic modulator, combines electrical signals with light waves. It modulates them onto an optical beam," says Bill Steier, professor of electrical engineering/electrophysics and co-creator of the opto-chip. "Devices like this are the interface between electronic data and the optical signals that go out over fiber-optic cables."

Two years ago, a team of researchers led by Larry Dalton, co-director of the USC Loker Hydrocarbon Institute and an adjunct professor of chemistry and materials science, synthesized a family of new polymers. Another research team

led by Steier used those new materials to design and fabricate a device that can translate electrical signals into optical signals ten times faster, while using only a fraction of the power of current technology.

Steier is now working with a west Los Angeles company, Pacific Wave Industries, to commercialize the technology. With ever-larger quantities of communications data moving around the world through networks of fiber-optic cable, a device that can more efficiently convert the familiar "ones and zeros" of a microprocessor into information-laden light waves, has great economic potential.

However, this particular device has been built to boldly go where no human has gone before: deep into space for a stunning exploration mission. The NASA Jet Propulsion Laboratory has an ambitious plan to place a formation of two or more spacecraft into orbit and turn them into the largest-ever telescope. Astronomers hope to peer across the Milky Way to study other planets orbiting nearby stars. In addition, they plan to observe distant galaxies to better measure and understand the size and age of the universe.

"Each satellite would act as an element of the telescope's mirror," says Steier. "The concept depends on knowing exactly where each satellite is in relation to the others in the formation, to within a micron, or less." A micron is a millionth of a meter, (a human hair is 50 to 100 microns in diameter). The spacecraft will be orbiting 10 kilometers, or about six miles, from one another.

When using electronic means to measure distances in space (or between two points on earth like, mountaintops), Steier says that accuracy depends on wavelength. The shorter the wavelength, the more precise the measurement. Radio waves, or radar, which have long wavelengths, can measure gross distances but with less than perfect accuracy. "Radar will give us the distance between the satellites within a few centimeters," says Steier.

Optical waves have very short wavelengths and can provide measurements from less than one micron, up to a little over one micron. Steier says USC alumnus Dr. Serge Dubovitsky (MSEE'89, PhD EE'94) of JPL, came up with the idea to use one of his opto-chips. Steier designed a device that modulates light and has a wavelength of 1.3 microns. It has a signal that has a wavelength of half a centimeter, and it will provide measurement precision to within a micron.

"We'll actually be measuring distance over a band of wavelengths. Radio waves will give us the gross distance, but for precision we need the optical," says Steier. "The USC device is the critical element in that approach."

Wavelength bears an inverse relationship to frequency: that is, the smaller the wavelength, the higher the frequency of the waves. Steier's device is a 60-gigahertz modulator, which means it has a frequency of 60 billion cycles per second.

This space mission will probably not launch for almost a decade, and it will be longer still before the spacecraft, loaded with the giant telescope, reach their distant stations and begin sending back any data. Steier says he may not live long enough to see any results. But his 60-gigahertz modulator, with its sparkling USC School of Engineering logo, will be there, helping to answer questions that people have pondered around campfires for millennia.

FACULTY AWARDS

The Shannon Award, which is presented for "consistent and profound contributions," is the highest honor conferred by the IEEE's Information Theory Society (ITS). As part of his winning honors, **Lloyd Welch** of the School of Engineering, will present the prestigious Shannon Lecture at the 2003 International ITS Symposium, to be held in Yokohama, Japan.

Welch is the third member of the communications group at the USC electrical engineering

department to earn the award, joining Irving Reed (1982) and Solomon Golomb (1985). A fourth scholar closely affiliated with USC Engineering, Andrew Viterbi (PhD EE '62), who is a member of the School's Board of Councilors and the University's Board of Trustees, was honored in 1991. Four (out of 23 total in the Shannon Award's history) is the most won by individuals at any single institution.

Professor Terence Langdon was elected to the UK Royal Academy of Engineering.

In computer science, USC Engineering was prominent at the 2002 IEEE International Conference on Robotics and Automation (ICRA), held recently in Washington, D.C. **George Bekey,** an NAE member and a USC university professor, was honored at ICRA with the annual Pioneer Award, bestowed to individuals who have initiated "new areas of

research, development or engineering which have had a significant impact on development of the robotics and/or automation fields."

USC faculty presented 14 papers at ICRA, the most from any institution. One of these papers, presented by the Computational Learning and Motor Control research group of **Stefan Schaal,** won the best overall paper award. **Auke Ijspeert, Jun Nakanishi** and Schaal authored the paper,

2002 has been an extraordinary year for the USC School of Engineering and we are happy to report that the nation's media has taken notice. Between February and June, no less than five articles in *The New York Times* have focused on the School's research achievements. Actually, there were six stories if one counted the February story about grid computing, which included mention of several other institutions besides the School's Information Sciences Institute (ISI). But *The New York Times* was not the only media covering USC Engineering. Here is our 2002 Top Ten media hit parade for the USC School of Engineering.

1 Distinguished Professor Leonard Adleman turned strands of DNA into a computer, which he used to process the largest problem ever solved by non-electronic means. His research was published in *Science* and in the *New York Times* on March 19 with the headline "In Classic Math Riddle, DNA Gives a Satisfying Answer." A renowned cryptographer, he is one the creators of the widely used RSA system for data encryption. The "A" in RSA stands for Adleman.

2 On June 20, the "Circuits" section of *The New York Times* described Professor Theodore Berger's quest to create a computer chip that could be implanted in the brain to take over some of the work of a damaged hippocampus. Berger's research was also featured this year on *CBS 48 Hours* and *Science Times, The New York Times* television program that appears on the *National Geographic Channel.*

3 The March 2002 issue of *InfoWorld* named Information Sciences Institute (ISI) researcher Clifford Neuman as one of the Top 10 Technology Innovators of 2001. Neuman is the principal author of Kerberos, a computer network authentication protocol that applies cryptography and systems engineering to securely identify users on open networks. Kerberos is commercially successful in a variety of versions.

4 On April 23, *The New York Times* outlined Professor Costas Synolakis' remarkable paper published in *Proceedings of the Royal Society,* explaining in detail how a massive underwater landslide, triggered by an earthquake, caused the catastrophic 1998 tsunami in Papua New Guinea. Synolakis' research has been covered in the News Focus section of *Science* and on several specials on the *Discovery* and *National Geographic* channels.

5 Bart Kosko is an electrical engineer who has published seven op-ed articles in the *Los Angeles Times* and *Newsday* since July 2001.

6 On May 9, *The New York Times* "Circuits" section reported on Remote Media Immersion (RMI), a breakthrough Internet technology developed by the Integrated Media Systems Center (IMSC) at USC. The Center's demonstration was also covered by local television.

7 In March, *TechTV* aired two major back-to-back stories about IMSC research projects: haptics (a remote touching technology); and immersive audio and video technologies.

8 Computer scientist Gaurav Sukhatme was singled out by *The New York Times* in a February 28 story exploring emerging robot technology. The star of the story was his remarkable autonomous robot helicopter.

9 This year, the *National Geographic Channel* and *TechTV* both reported on the BION™, a tiny stimulator that can be injected into or near muscles and nerves. Developed by physician and biomedical engineering professor Gerald Loeb of the Alfred E. Mann Institute, the devices help patients suffering from paralysis, spasticity, and other neurological problems. Canada's *CTV News* and *Science Today* also ran BION™ stories.

10 Transportation guru Jim Moore, who has appointments in the School of Engineering and in the School of Policy, Planning, and Development, wore both hats for the PBS' national program, *Think Tank,* which was broadcast in June. Moore discussed advanced transportation technology and proposals for congestion taxes in a program about the future of automobiles. He also explained why high-speed rail in America competes poorly against the automobile and air transportation.

FACULTY AWARDS

entitled "Movement Imitation with Nonlinear Dynamical Systems in Humanoid Robots." Schaal also received the School of Engineering's 2002 Outstanding Research by a Junior Faculty Member Award.

Tony Lewis, an alumnus who is a recent computer science PhD graduate, was a finalist for the best paper award in the vision track at ICRA.

Milind Tambe of computer science and the Information Sciences Institute (ISI), and ISI computer scientist David Pynadath, won the best paper award at the 2002 Autonomous Agents and Multiagent Systems conference, held in Bologna, Italy.

Another best paper award came at the International Conference on the Simulation of Adaptive Behavior, in Edinburgh, Scotland. **Wei-Min Shen** of computer science and ISI, won the award, which is formally called the "Paper with the Most Philosophical Consequences Award". The title of the paper is "On the Use of Sensors in Self-Reconfigurable Robots." The authors are K. Stoy, W-M Shen, and P. Will, also from ISI.

In materials science, **Florian Mansfeld,** the department chair, earned the 2002 H. H. Uhlig Award, the top honor of the Electrochemical Society's Corrosion Division, for "excellence in corrosion research and outstanding technical contributions to corrosion science."

Oren Benami and **Yan Jin** of the School's IMPACT Lab (Manufacturing Productivity) won the 2002 XEROX Best Paper Award at the ASME 2002 Design Theory and Methodology Conference.

Antonio Ortega, whose research focuses on digital imaging and video compression, has been selected for an Okawa Award, presented for "significant contributions to information communications research."

Boeing Flies a Crucial Support Mission

technology thrusts at Boeing with relevant research centers in the School and other parts of USC. "We hope to increase the Boeing-USC strategic technology synergy."

For many years, Boeing has also directly supported students by funding fellowships and scholarships, as well as providing funding for student clubs and curriculum initiatives. The effort extends to minority students through the Center for Engineering Diversity (CED), which supports about 240 minority-engineering students. This year, Stephens earmarked part of Boeing's support specifically for retention. The money will go to student groups whose mission includes tutoring, scholarships, and other activities that impact retention.

Yortsos says the School has begun putting in place retention reforms such as improved mentoring, better advisement, and changes in the curriculum that match changes in the field and increase flexibility to students. In addition to Boeing, other companies are recognizing the immediate need for retention reform and are also pledging their support.

"We cannot expect to be one of the nation's elite engineering schools by meeting the average on retention. We must successfully address the retention problem," says Dean Nikias. "The help from Rick Stephens and Boeing, as well other valuable sponsors, is absolutely crucial to our success."

Boeing representatives view graphics during a September visit to the Integrated Media Systems Center. Left to right in background are William C. Beavin, associate technical fellow, Modeling and Simulation, in Boeing's St. Louis headquarters; Frank Farrington, Southern California lead for Theater Simulation, Phantom Works in Seal Beach; and Michael S. Anderson, associate technical fellow, Simulation and Software, Phantom Works. Left to right in foreground are Prof. C.C. (Jay) Kuo, a key IMSC investigator, and Randall Baker, project lead, Simulation and Visualization, Seal Beach.

SUPERCOMPUTING

you become unique. This is our strength."

Among its many accomplishments, the group has developed unique computer software that allows the visualization of billions of atoms of material at one time. These large-scale simulations produce results that cannot be observed in a real-world environment or with the naked eye for various reasons, including the velocity of certain chemical reactions.

"To learn the microscopic properties of many things, from materials to chemicals to biological systems, you need simulations of billions of atoms," says Nakano. "The principles involved in our work can be applied to everything because all things are composed of atoms. This technology and research will help in the advancement of science."

The computing systems used by the researchers are referred to as "supercomputers." Currently, the world's fastest computers are able to perform at the "teraflop" level, or 1,000,000,000,000 mathematical operations per second. The group is working toward developing computer simulation software for a system that is 1,000 times faster, at the "petaflop" level, capable of 1,000,000,000,000,000 mathematical operations per second.

The main goal of their research has been to find ways to achieve greater strength and toughness in ceramic materials and greater speeds in electronic devices.

But the computing techniques have wider potential applications. When the trio achieves the faster supercomputer, the unprecedented computing power will enable them to carry out realistic simulations of complex systems in areas of materials, nanotechnology, molecular biology, pharmacology, and bioengineered systems.

At LSU, Vashishta was the Cray Professor of Computational Science, a post he assumed after years as a senior research scientist at Argonne National Laboratory. A fellow of the American Physical Society, he has edited or co-edited 10 books and is the author or co-author of more than 240 papers.

Kalia was a professor at LSU in physics, astronomy, and computer science, and specialized in molecular dynamics. A strong believer in interdisciplinary study, he was the force behind creating programs at LSU that challenged students to answer complex science and engineering problems with the aid of algorithms and high-tech computing. Throughout his career, Kalia has organized more than 20 conferences and symposia on the computational sciences, and has authored more than 220 research papers and eight books.

Nakano was an associate professor of computer science at LSU. He is a recipient of a National Science Foundation Career Award and received the Best Technical Paper Award at the IEEE/ACM Supercomputing 2001 Conference. He has authored 151 reference articles, including 89 journal papers.

The trio will bring with them seven post-doctoral researchers, ten graduate students, a systems manager and their own 166-node supercomputer. They will work closely with the USC Center for High Performance Computing and Communications, which has a 320-node supercomputer. USC's Information Services Division and the USC School of Engineering's Information Sciences Institute operate the facility.

MENTORING THROUGH MESA

For more than 30 years, the State of California's Mathematics Engineering Science Achievement program, known as MESA, has been helping middle and high school students prepare for college and eventually for careers in science, math, and engineering. MESA, which the School of Engineering has participated in since it was adopted statewide 25 years ago, uses teachers and volunteers to coach and encourage students from ethnic groups who are under-represented in the science and technical professions. African-American, Latino, and American Indian youths, especially those from poor-performing schools, can receive mentoring, academic counseling, extra coursework, field trips, and SAT preparation through MESA.

In 1977, the USC Engineering's MESA program was working with 100 students in four schools. Today, Director Larry Lim manages a program that annually aids 1,500 high school students in 21 nearby public schools. "Our main goal is getting kids interested in engineering," Lim says, "but we'll count it a success if they instead choose to study math, physics, chemistry, or biology." USC's chapter is one of the largest and most acclaimed of the state-funded MESA programs, which now serve approximately 32,000 students in 440 California schools.

"Our target population is economically or educationally disadvantaged youth, who are often the first kids in their family who will attend college," Lim says. "We would like our MESA students to come to USC Engineering, but wherever they go is fine, so long as they go to college."

MESA was started in 1970 at UC Berkeley when several professors of engineering sought to increase the enrollment of minority students, but found few who were academically prepared for the field. They began to work with a science teacher at a local high school to create a program to prepare minority students.

In 1977, this Bay area program received funds to expand statewide, and USC was in the front ranks of universities joining the effort, with Clarke Howatt, then an assistant dean of engineering at USC, starting the School's MESA chapter.

Louise Yates, currently assistant dean of engineering for undergraduate student affairs, now oversees the program and serves as the principal investigator for the State of California grant that supports MESA. Beyond Yates, the School's MESA staff is comprised of Lim, academic coordinator Ben Louie, and counseling coordinator Darin Gray. They train two to three teachers at each MESA school and provide other services, curriculum, and support. Funds for supplies and stipends for teachers come from the state as well as private foundations and industry. USC School of Engineering students volunteer or earn work-study funds to tutor MESA members, and lead workshops and classes.

"It's an incredible program," says Ericka Lieberknecht, an electrical engineering senior who has volunteered with MESA for four years. "It helps kids excel to a level that I didn't think was possible. The student volunteers and staff want to help kids really do well. They're always worrying about what the kids need."

The teachers trained by a university's MESA staff work with MESA students at their schools, either before the school day, during lunch, after school, or on Saturdays. At the middle school level, activities are largely hands-on science explorations performed in small groups; building model planes and bridges, or designing and carrying out experiments are typical projects. High school MESA students focus more on academics, receiving tutoring, advice on prerequisites needed for college acceptance, and attending academic excellence workshops to learn study techniques.

Since its California-wide rollout in 1977, MESA-style programs have been introduced in seven other states.

MESA's statistics are impressive: 85 percent of MESA high school seniors go to college, compared to 50 percent of all California graduating high school seniors. Thirty percent of MESA high school graduates who are African-American, Latino, and American Indian are eligible for UC admission, compared with a 2.8 percent of black students and 3.8 percent of Latinos statewide.

A 1983 Hewlett Foundation evaluation concluded that the SAT performance of MESA students was on par with that of college-bound seniors nationwide, despite the fact that the schools sampled were among the lowest achieving in the state.

"MESA has been tremendously successful," Lim says. "It has helped a lot of kids go to college who would not have, but a big percentage of the population still needs our help. The program hasn't put itself out of business, and isn't about to. There will always be a need."

student works

On the Road

with Y.H. Cho

CEO OF KOREAN AIRLINES IS
FIRST AND FOREMOST AN ENGINEER

He Pulled the Strings to Create Engineering's Newest Institute

Yang Ho Cho loves America, the real America.

He loves the small towns, the small highways and the great big national parks. He loves Americans, and he likes Elvis too. So, he went to Graceland and he liked what he saw. He went to Little Rock, Arkansas, and sat in the same governor's chair once occupied by a young Bill Clinton. He went to Zion, Bryce Canyon and Monument national parks. He sang American songs and danced in a funky Santa Fe Mexican restaurant. He walked the French Quarter in New Orleans. All told last year, he drove 6,000 miles in 18 days with five good friends in two SUVs, and it was one perfect vacation.

As chairman and CEO of Korean Airlines, one of the world's largest, he can go anywhere he wants. But where he wants to go when he gazes down at the flat American farmland from one of his big KAL Boeing 747-400 aircraft, are the John Denver country roads that wind through dusty towns where he can stop, mingle with the locals, and browse at garage sales.

"I don't buy anything. I talk to people," he says. "All the states are like different countries with different cultures and different peoples. I love American culture."

Cho is a tall athletic looking Asian man in his early fifties from one of Korea's most well known families. His father, Choong Hoon Cho, is a Korean Horatio Alger who started the Hanjin Group, a mammoth transportation conglomerate that spans the planet with shipping, trucking, buses and the airline. It is Korea's sixth largest company.

The younger Cho, who is usually called "Y.H.," is a builder like his father, thinking up, and helping to construct great things. Most recently, he was the catalyst responsible for orchestrating the creation of the Pratt & Whitney Institute for Collaborative Engineering, established jointly at USC and Inha University in Korea.

"Y.H. Cho and his entire family have a great respect and genuine passion for education. I've been working with him for the past three years to make this institute a reality, and have been impressed by his leadership qualities, friendliness and hospitality," says Dean C.L. Max Nikias of the School of Engineering.

The USC School of Engineering will partner with Inha University, with Pratt & Whitney, the aircraft engine giant, its parent company United Technologies Corporation (UTC), and Korean Airlines.

"This new institute will substantially increase international teaching and research opportunities for both Inha and USC engineering students and faculty, which is the objective of the internationalization theme of USC's strategic plan," says Richard Drobnick, USC vice provost for international affairs.

Nikias explains that the new institute would work on applied research projects, "think-tank" industrial feasibility studies, educational and distance learning initiatives and other teaching and research missions.

"USC engineering faculty will work jointly with faculty from Inha University's School of Information and Communications to produce new technologies," says Nikias. "Our first project is focusing on information technology with Pratt & Whitney's Applied Technologies Group."

A key objective of the institute will be to explore the development of new distance-learning curricula that will advance Inha University's efforts to implement research projects with companies in Korea's Media Valley. Similar to California's Silicon Valley, Korea's Media Valley is an area around the New Songdo district of Incheon, where high-tech industries have begun to concentrate.

"I think UTC, USC and Inha University will learn a lot about how to do things in different cultures through

this institution. It should benefit each of the partners and people in both countries," says Cho.

Cho and his family have always embraced America, education and engineering. And they have strong ties to USC. All told, Cho has lived in the U.S. for 10 years and has degrees from both USC and Inha University. He is a USC Trustee, as well as a member of the USC School of Engineering's Board of Councilors. He also serves as chair of the Inha Board of Trustees. Two of Cho's brothers, Soo Ho and Jung Ho, earned BA degrees at USC in 1979 and 1982, respectively. His sister, Hyunsuk Cho Lee, earned a master's degree from the Rossier School of Education in 1978, and a cousin, Jin Ho Cho, got his MBA in 1990 from the same Marshall School of Business program that Y.H. Cho completed in 1979.

Inha University is a fascinating example of how closely America, Korea and the Cho family are intertwined. Early in the 20th century, successive waves of Korean immigrants settled in Hawaii to work on sugar plantations. In 1953, Korean-Americans living in Hawaii celebrated the 50th anniversary of immigration to the U.S. by raising money to establish a school in Korea. Their plans were to create "the M.I.T. of the Eastern World." The Korean government found land in Incheon, but the funding that gave birth to the school came from Koreans in Hawaii. When the school began to founder, the Korean government turned to Cho's father who established a private foundation under Korean Airlines that today operates the school. The elder Cho became chairman of the Inha Board of Trustees in 1968, the same year that the Inha Institute of Technology was renamed Inha University.

"The name of the university is a combination of "In" for Incheon and "Ha" for Hawaii," says Y.H. Cho. "Until ten years ago, Inha concentrated on engineering. The USC School of Engineering has the best multimedia school in the U.S., and Inha is also very good in multimedia. Therefore, I thought it would be mutually beneficial to stimulate collaboration between the two schools."

Drobnick says that in the spring of 2000, Cho told him over lunch that he wanted both Inha and USC to work together on research projects, and to facilitate technology transfer from the academic institutions to both Korea and the U.S. Drobnick says he immediately thought Nikias was the right person to work with Cho, given his success with the Integrated Media Systems Center (IMSC), and he introduced the two of them. Then, before he became dean, while he was director of IMSC, Nikias introduced Cho to the dazzling multimedia and internet research at IMSC, and began facilitating collaborations among faculty at IMSC and Inha.

"Max showed me a lot of things in multimedia and they were excellent. That's why I got interested and started this project," says Cho. "I knew Max before he was dean, and USC selected the right person for the job."

On June 10, 2002, Cho, Nikias and representatives from Pratt & Whitney, United Technologies and Inha University met at the Korean Airlines headquarters in Seoul to formally sign the memo of understanding (MOU) that gave birth to the new institute. Following the signing ceremony, the dignitaries attended a World Cup soccer match between the U.S. and Korea, which ended in a 1-1 tie. Korea, however, would go on to finish fourth overall in the tournament, its highest ever finish.

"Inha's engineering school is emerging as one of the strongest in all of East Asia, thanks to Cho's dynamic leadership and his very able administrators," says Nikias. "Y.H. is not only a great leader and a successful businessman, he is a remarkable engineer who applies his formidable engineering skills to all endeavors."

At his very core, Cho is an engineer.

"Engineering is fundamental to life. It sets you up with basic disciplines for life. It teaches you linear, logical thinking," Cho says. "My father was a marine engineer and when I was a boy my playground was full of trucks, trailers and engines. Naturally, I grew friendly with machines."

Cho's father dreamed of owning a shipping business, but the cost was prohibitive, so he invested in trucking after World War II. He lost almost all of what he had built during the Korean War, and once again had to start from scratch. Y.H. Cho does not remember the war, but he does remember his father's trucks and trailers in the yard around the Incheon house where he and his family lived. His father ran his businesses from a downstairs office. After re-establishing the trucking business, Cho's father started doing business with the U.S. Army, winning the contract to maintain their vehicles.

"He had a good reputation as a hard worker, honest and punctual, and he was able to expand the business. The credibility he gained for his hard work was fundamental to the success he later achieved when he went to Vietnam and worked there with the U.S. Army. Others could not have done what he has done," says Cho. Because of his obvious business savvy and success, when the Korean government privatized Korean Airlines in 1969, they asked the elder Cho to take over. Reluctantly, he agreed.

"It was just a small domestic airline at that time," recalls Y.H. Cho. "It had only four turboprop aircraft, no jets."

As he set about building up Korean Airlines, Cho's father continued dreaming about the shipping business. He was, after all, a marine engineer, and he was brimming with innovative ideas. Korean Airlines expanded rapidly in the 1970's, and so did Korea's export-based

> ## "Engineering is fundamental to life. It sets you up with basic disciplines for life," says Y.H. Cho.

Y.H. Cho, Dean Nikias and other participants from the MOU signing ceremony travel to a Buddhist temple during their visit to Korea.

economy. Late in the decade when Cho's father was finally able to capture his dream, he started by building ships.

"He knew the latest technology. He took what he learned from the aviation industry and applied that technology to shipbuilding. He built more than 20 large container ships for use in the shipping company, and succeeded in making Hanjin Shipping one of the top five shipping companies in the world today," says Cho. "My father did not follow the practices of other businesses at the time. Other Korean companies were running many different kinds of businesses. My father knew transportation best, and concentrated on all forms of it, except railroads, which are still government owned. This is the main reason that he has been so successful."

The elder Cho was the first to create a container ship system in Korea, as well as the first to start inter-city bus lines. In a slight departure from transportation, he was also the first to establish a LPG distribution station in Korea. He built his own private container port in Incheon. He called his parent company Hanjin.

"'Han' means Korea, and 'jin' means forward, so Hanjin means 'moving Korea forward,'" explains Cho.

Meanwhile, Y.H. was growing up. In the 1960's, he began his love affair with America while attending Cushing Academy in Ashburnham, Massachusetts. Even then, he indulged his wanderlust. He remembers finding himself in San Antonio, Texas, in 1969, and being shocked because "no one spoke English. Until then, I thought everyone in America spoke English."

Like all Korean men, Cho had to serve in the military. He was stationed in the DMZ (Demilitarized Zone) in Korea, and also spent a year in Vietnam. Discharged from the military in 1973, he met Myong-Hi, an artist and graduate of Seoul National University. Following a whirlwind three-month courtship, the couple married and have been together for almost 30 years. They have three children, known as Emily, Heather and Walter in America, and Hyun-Ah, Hyun-Min and Won-Tae in Korea. Emily attends USC, and is a communications major at the Annenberg School for Communication.

After Cho earned his degree in industrial engineering from Inha University, he went to work running the Los Angeles office of Korean Airlines. He was placed in charge of marketing. Later, he was given responsibility of maintenance and purchasing for the airline. His engineering training prepared him well.

"Because of my background in engineering, I knew how to buy and how to compare, technically as well as commercially. I knew how to talk to technical people

Y.H. Cho, Dean Nikias and representative from both Inha University and Pratt & Whitney at the MOU Signing Ceremony.

in the airline. If your background is only marketing, you might not know what the technical people are talking about," he says. "In my opinion, it is best to first get a technical degree in engineering, then a business degree."

Working in marketing, Cho knew he wanted to learn more, and when he decided to pursue a business degree in 1979, he turned to the USC Marshall School of Business. He enrolled in the very first class of the school's International Business Education and Research program (IBEAR), a one-year intensive curriculum that attracts mid-career executives from about 15 countries. Drobnick, who is also executive director of IBEAR, says, "The students, as well as the IBEAR faculty, learn about international business practices from people who are at high levels in the chain of international business decision-making."

Armed with a USC MBA degree, Cho ironically turned to engineering at Korean Airlines. He set about changing the engineering and purchasing systems. His goal was to move everyone toward a more systematic mindset.

"My father was an entrepreneur who started from scratch, who made all the decisions himself and everything was based on expansion. There is a limit to that approach," explains Cho. "When a company reaches a certain size, it has to be run by systems and not by one or two men. We are

moving from an entrepreneurial culture to a systems-oriented culture."

Cho completed his education with a doctoral degree in business administration from Inha University in 1988. He became president and CEO of the airline in 1992 and chairman in 1999. In addition to his responsibilities at Korean Airlines, he concurrently served as president for various other companies within the Hanjin Group.

Cho has substantially revamped systems at Korean Airlines, concentrating on safety and service, to thrust the international airline into the 21st century. It is Korea's flagship carrier. It now has one of the industry's youngest fleets, with its 120-plus Boeing and Airbus aircraft averaging 7.6 years of age. It has more destinations than any other major global airline to China from the U.S. It is the third largest commercial airline cargo carrier, and the largest trans-Pacific cargo carrier. The Los Angeles cargo facility of Korean Airlines is the largest on the West Coast.

"My life and my business success come from engineering," Cho says, and he adds some advice for engineering students. "Engineering is difficult. It is harder than business. Learn it wisely because engineering can be the basis for your life."

Then, remembering his 18-day trip across the country he adds one more thought:

"Young people should try it. Don't drive all day and all night, but stop and see America. See a lot of different scenery and different cultures."

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DEN

—at USC Engineering, the Future is Now in DISTANCE ED

It looks like a typical academic scene at USC: Computer Science professor Michael G. Crowley is presenting a lecture in his CS571 course in computer programming to a class of engineering graduate students in an ordinary looking lecture hall. Beyond the subject, the only things that set this engineering class apart from those given 50 or 100 years ago are the visual aids. Instead of drawing his charts and formulas on a blackboard, Crowley uses a computer to bring up illustrations as he explains the intricacies of a programming design.

But appearances are misleading. The 45 or so students in the classroom are only a fraction of the students taking Programming Language Design from Crowley. The rest are watching the lecture on computer screens from the comfort of their dorm rooms on campus, while others are spread out across the country, at work in high-tech companies from Seattle to San Diego, from Hawaii to the East Coast.

The students located far from campus are part of one of the most successful Internet "distance learning" programs in the world, the USC School of Engineering Distance Education Network (DEN), a program that U.S. News and World Report has named as among the nation's best in engineering.

At many colleges and universities, and many schools of engineering, distance education is a futuristic vision, one talked about endlessly and earnestly, with glowing predictions of what it will someday mean to the department, the school, and the world.

Not at USC Engineering, where the pot of gold at the end of the rainbow can be found in the DEN offices of Olin Hall. Instead of predictions, more than 700 engineering professionals are enrolled each year in a well-established and extraordinarily successful operation. DEN currently offers full-time working engineers an opportunity to earn their Master of Science in 13 different degrees within six disciplines, all from their homes or workplaces. DEN is not just a rosy plan for future business, but a program with a long, satisfied and growing list of industry-leading clients, including employees of Boeing, QUALCOMM, United Technologies Corporation, Intel, Aerospace Corporation, Raytheon, Ericsson, SAIC, Northrop-

Grumman, TRW, Lockheed Martin, and many more.

"Distance learning is a reality, not a dream at USC Engineering," says Dean C.L. Max Nikias. "We have used our strengths and experience to create a program that has attracted international recognition. DEN is an important part of our plan to take USC Engineering to the next level, and so far it is performing above expectation."

One case in point is the academic career of Raytheon's Kevin Halligan. Studying while working in Tucson, Arizona, Halligan was called up to active duty in the Middle East early this year. Normally, a person's continuing education would be put on hold in this situation. But through DEN, Halligan was able to continue his course work, using a military Internet link to take the two classes he needed to complete his degree. When examination time came, his commanding officer proctored them. He received his M.S. from USC in May, right on schedule.

A distant outpost of a major corporation found the USC program to be just what the staff needed. "Since our office is located in Maui, our staff embraced DEN with open arms. Employees were thrilled to earn credits from a top school such as USC. The e-learning courses are very flexible and easy to use, and the responsiveness of the DEN team working to accommodate our staff's work schedules and demands was a key to success," says Wil Otaguro, a School of Engineering alumnus who is now chief scientist at the Boeing Corporation's Maui High Performance Computing Center.

The roots of DEN's success extend back more than 30 years when what was then called the Instructional Television Network

(ITV) began broadcasting televised course offerings to the Southern California aerospace companies in 1972. Thousands of professionals have since earned their USC degrees from DEN. In 1999, the transition from a system based on television to an Internet-based operation began and ITV's name was changed to DEN. With the help of a $900,000 grant from the Lord Foundation, DEN was able to upgrade equipment, hire more personnel, and improve overall service and offerings.

A key element in the improvement of e-learning technology has been the involvement of the Information Sciences Institute. The ISI/DEN collaboration accelerated with the appointment of ISI Executive Director Herb Schorr as associate dean of Engineering in 2001. "ISI is proud to contribute to the improvement and expansion of DEN, and we are continuing to pursue research on innovative technologies that may be incorporated into DEN over the next few years," says Schorr.

And DEN is picking up speed this fall, according to Executive Director Kelly Goulis. "Within the last ten months, we have designed an entirely new business model," she says. "Our focus is now on innovative e-learning delivery; improved tools and resources for students and faculty, including automation within the areas of Administration and Student Affairs. We are also concentrating on attracting unaffiliated students, students who aren't employees of the companies we work with. We want to the expand alumni relations program, and expand professional development."

This fall, DEN began using a custom encoding application developed by Computer Services Manager Binh Tran and Technical Specialist Christopher Soto to digitize video and capture presentation slides to be then produced live to online students. In the new format, DEN students can view the professor talking on the left side of the screen, while simultaneously viewing the enlarged presentation slides or notes produced by the professor on the right side of the screen.

The presentation slides and notes presented in class are now available for download and printing, allowing students to concentrate on listening to the professor and learning the topic being discussed, rather than trying to frantically take notes. Most crucially, this has eliminated the previous half-hour delay between the television version (seen by about 40 percent of students) and the web version. Web viewers can now actively participate in classes, either by phone or online.

(left to right) Kelly Goulis, executive director; Binh Tran, manager, computer services; Jacqueline Williams, marketing manager; Laura Richter, director, administration and Carolyn Suckow, director, student and corporate affairs.

Such real-time interactivity is a very important issue for DEN, Tran says. "We've also introduced online chats so that students can talk to teachers, and other students, and we are testing two-way web video conferencing technology."

This will make a big difference to teachers like Crowley, who says that while his DEN teaching is effective at the present time "almost all the feedback I get now—most of the questions—are from the students physically present in the room."

"DEN has made it a priority to ensure remote students have access to the same experience as on-campus students," Tran continued. "We are fortunate to have guidance from ISI, one of the nation's strongest research groups in distance learning. With their help we have been able to move high-quality video over the web while still catering to minimal bandwidth. Even with the slowest Internet connection (56K), DEN programming still works effectively for students."

One limit to DEN's growth has been program production capacity, because all programming had to originate from the five studio class-rooms in Olin Hall. But this fall, DEN began testing a new prototype portable system that can deliver live e-learning courses from any classroom, anywhere on campus.

"This will give us the technical capability to scale up our operations significantly," Goulis explains. "Having to perform only minimal post-production on our web classes means that we could easily handle ten times as many students as we do now, at least on the production side."

The prototype system, developed by Tran and ISI researchers Richard Nelson and Dale Wong, will go into general use in the 2003 spring semester.

ISI researcher Richard Nelson (left) and ISI Executive Director Herbert Schorr. Nelson and fellow ISI researcher Dale Wong created DEN's new Internet content distribution system.

E-learning is only part of the DEN package. To improve services to students and faculty, DEN redesigned its web site at (http://den.usc.edu) for greater flexibility and power. "Instead of having a site that tried to cater to all audiences but satisfied no one," says DEN Marketing Manager Jacqueline Williams, "we now have several mini-portals containing relevant information for the five main end-user groups we have identified- prospective students, current students, corporations, alumni, and faculty."

Of these, the most important and improved Web site portals are for faculty and students. The faculty portal
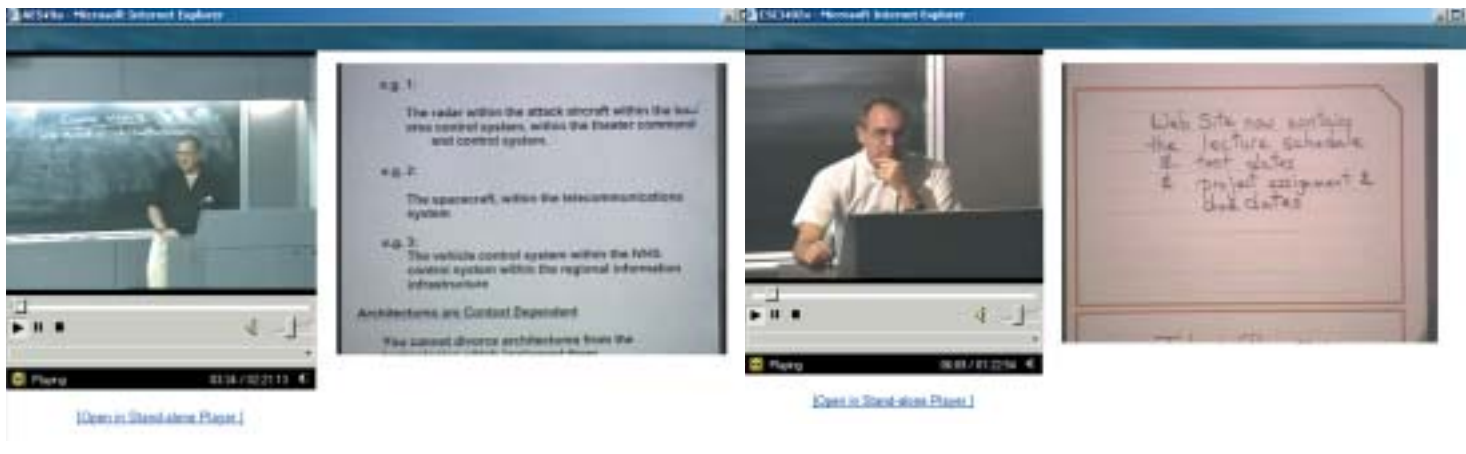
DEN broadcast of Professor Elliot Axleband's and Lecturer Michael Crowley's lectures, as seen by DEN's remotely located students.

provides resources and tools to help manage their course web site, contact students, download web-ready presentation templates, and much more. "DEN faculty are essential to our success," says Director of Administrative Services Laura Richter. "We will be working with them even closer to provide the support they need."

The password-protected student portal provides access to course Web sites and class notes. Students can also submit homework, add/drop classes, and most importantly, view their classes.

But the Internet is not the only contact DEN students have with USC. DEN has an entire administrative team dedicated to their needs. Director of Student and Corporate Affairs Carolyn Suckow emphasized that even though students may be physically off campus, DEN has the infrastructure in place to attend to broader questions. "We know that even with the best technology, students can feel removed. Our staff serves as their representatives with on-campus offices such as the Registrar, Admissions, Cashier, and academic departments, in order to facilitate the distance learning process."

The connection won't end when the students graduate. Suckow and her colleagues are building a DEN Alumni web site that will contain information on career development, DEN alumni news/spotlights, upcoming networking events, mentoring opportunities, industry news, and more.

Jerome Colello, an MSSAE '02 candidate, attends an evening class via the Internet from New Britain, Connecticut. His son often joins him, but usually falls asleep before class is over.

And these students will be coming from more and more places. In the 2002 spring semester, DEN began accepting remote students who are not affiliated with a corporation—students who meet USC's strict admission requirements, but who are on their own financially. Already, more than 20 such students are enrolled, and many more are expected in the near future. To reach this new potential pool of unaffiliated individual students, DEN has refocused its marketing efforts.

DEN is also adding curriculum that is likely to appeal to this audience. Parallel to the introduction the new e-learning technology, DEN is rolling out a suite of professional development courses with topics that span programming languages, information technology, and leadership/management skills, as well as courses to help professionals stay at the leading edge of their specialties and advance in their fields. DEN offers these courses to all professional engineers, with a discounted rate to USC alumni. DEN currently has approximately 50 such courses, and is planning to expand exponentially.

"We are proud of our ability to continue our tradition of enabling professional engineers to advance their education from one of the nation's top ten schools of engineering," says Goulis. "We are dedicated to continuous innovation, and we look forward to working closely with faculty and research centers to keep testing and expanding the boundaries."

(left to right) Stefan Schaal, assistant professor of computer science and director of the Computational Learning and Motor Control Laboratory; Aude Billard, research assistant professor in computer science; Auke Ijspeert and Sethu Vijayakumar, research assistant professors in computer science.

The Robot Revolution

FROM FLYING ROBOTS,

TO ROBONAUTS, TO HUMANOIDS,

USC ROBOTICS LEADS THE CHARGE

"Please pay attention, class! Robot School is beginning," proclaims headmistress Maja Mataric, who is an associate professor of computer science, and director of the new Center for Robotics and Embedded Systems, as well as an exacting teacher. She needs to be exacting because most of her pupils are not too bright. Like the Scarecrow in The Wizard of Oz, every "pupil" in this school is searching for a brain. And most are not half as handsome as the Tin Man.

However, they have come to the right place for a brain transplant. The USC School of Engineering's robotics faculty is a world leader in artificial intelligence software, the key to contemporary robotics.

As testimony to its strength, the School's faculty presented 11 papers at this year's annual International Conference on Robotics and Automation, the most of any university. A project headed by Auke Ijspeert, research assistant professor in computer science, received the award for overall best paper out of 700 submissions. Ijspeert is part of the research group of Stefan Schaal, assistant professor of computer science. Schaal's research group also received a best paper award at the same conference two years ago. And George Bekey, university professor and Gordon Marshall Professor of Computer Science, received the Pioneer Award, the highest award given by the Institute of Electrical and Electronics Engineers' (IEEE) Robotics and Automation Society. Milind Tambe, associate professor in computer science and the Information Sciences Institute, walked off with the best paper award at the 2002 Autonomous Agents and Multiagent Systems Conference in Bologna, Italy in July. And USC robotics wizards are scheduled to present another 14 papers at the International Robotics Conference in Switzerland this fall.

Maja Mataric, associate professor of computer science, and director of the new Center for Robotics and Embedded Systems.

"We're interested in using principles of neuroscience, not just traditional artificial intelligence, to create a robot that behaves like a human," says Schaal.
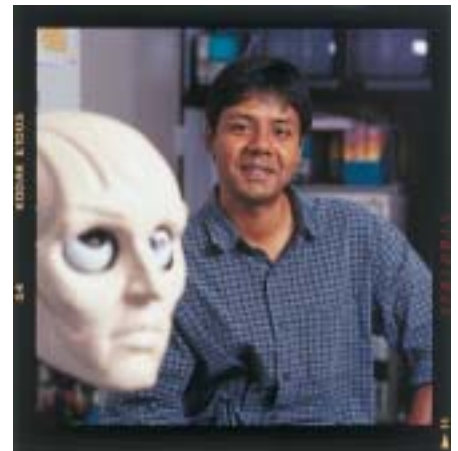
Defining Robotics

Exactly what is a robot? Mataric defines a robot as "an autonomous system which exists in the physical world, can sense its environment, and can act on it to achieve defined goals."

A computer chip and temperature sensors connected to a home furnace that together regulate a house's temperature constitute a robot. The robots populating television and the movies are often nothing more than remote-controlled machines with humans at the tiller. Many people see robots in terms of exotic hardware. But it is the software that gives a true robot its ability to control its hardware, and act autonomously, without constant human intervention and guidance. Little wonder that today's roboticists are mostly computer science engineers, not mechanical or electrical engineers.

Machines like the Sony Aibo robotic dog can be readily made and sold to consumers. The next step is giving such robots artificial intelligence, and the ability for truly autonomous action in the world. "Robot brains use artificial intelligence," Mataric says. "Companies are making more and more robots, but the real question is, who is going to program them?"

Cute and Ugly

"We now have the second largest robotics effort in the country," says Mataric. "We are working with almost 60 robots on campus." The cutest is a Sony Aibo robot dog that is currently being reprogrammed and "hot-rodded" to perform advanced robotic tasks like fetching a stick or bringing in the morning paper, tricks that no standard Aibo could ever perform.

Far from being cute, MAVERIC, in the lab

of Stefan Schaal, is currently nothing more than a head with all the visual charm of a novelty store Halloween mask. "It will eventually go on top of a humanoid robot," says Schaal about this a project headed by Sethu Vijayakumar, a research assistant professor in computer science. "We're trying to understand and duplicate the behaviors of the ocular motor system in humans."

Schaal directs the Computational Learning and Motor Control Laboratory where the robotics research focuses on motor control and learning in humanoid robots. Like other USC roboticists, he draws inspiration from biology, particularly the primate brain. He is a neuroscientist as well as a computer scientist. MAVERIC has two cameras in each eye, one for close vision and one for distance. It can also hear and has a system for maintaining balance, duplicating the function of the vestibular apparatus in the human inner ear. "People don't just move, they perceive, react, plan a precise movement, move, and stay balanced while moving," notes Schaal. "We're interested in using principles of neuroscience, not just traditional artificial intelligence, to create a robot that behaves like a human."

Schaal also directs a group doing motor control research on one of the few full-body humanoid robots in the world, located in Japan at Advanced Telecommunications Research International, which is that country's version of Bell Labs. It was started by the telecommunications giant NTT (Nippon Telephone and Telegraph). Several Japanese corporations are investing aggressively in the development of humanoid robots, as recently compiled in the

book "RoboSapiens," which also features a humanoid project of Schaal's that was showcased in WIRED magazine in September 2000.

Robonaut: R2D2's Prequel?

More fully formed than MAVERIC is NASA's Robonaut, who has a head, torso, and arms. He won't miss having legs when he works in the zero gravity of space. NASA hopes he will be able to perform difficult and dangerous tasks at the space station. For every hour of work in space, a human astronaut needs 48 hours of preparation and recovery, which makes robots

Schaal directs a group doing motor control research on one of the few full-body humanoid robots in the world, located in Japan at the Advanced Telecommunications Research International.

an attractive option. Robonaut "learns" from a human instructor who shows him what to do while wearing a "sense-suit." The suit contains sensors and transmits the movements to the robot, which memorizes them. It is comparable

Robo sapiens photo by Peter Menzel

to a golfer who perfects his grip and swing, while the club pro places his hands directly over the golfer's to demonstrate the proper technique. This research is done in collaboration between NASA's Johnson Space Center and Mataric's research lab at USC.

"When we teach robots to perform human-like tasks, they usually learn from some kind of human demonstration that they then mimic," says Mataric. "We need more natural human interaction with robots. If robots are going to be truly useful, people have to be comfortable with them, like they are comfortable with their home's thermostat." A new theory on imitation learning in humanoids was what gained Auke Ijspeert's project the best paper award mentioned previously.

Imitation learning and social interaction are also a central part of a new robotics course developed by Aude Billard, research assistant professor in computer science, where students learn how to program complex mini-humanoids, called Robota dolls.

In the Interaction Lab, also directed by Mataric, lives the Nerd Herd, an early effort in robotics that is best described as a gaggle of toasters on wheels. Smarter progeny has supplanted the Nerd Herd: larger robots called Pioneers, and four robots known as the Socially Mobile. After a decade of laboring on distributed robotics research in the Interaction Lab, the Nerd Herd has officially retired, though knowledge gained with the Herd is the basis for the far more adept and capable Pioneers. The Nerd Herd never lacked for ability: at international robotics demonstrations in the 1990's, the Herd played robot soccer and performed plays by Shakespeare and Moliere.

Pioneers of AI

Monica Nicolescu, a PhD student in computer science who is part of Mataric's group, has been teaching the Pioneers, who resemble vacuum cleaners crossed with coffeemakers, with a little bit of camcorder thrown in. Nicolescu programs a robot with a set of basic skills such as the ability to recognize colors, distances, and angles, as well as

Monica Nicolescu, a PhD student in computer science.

to detect a target like a ball or box. Then she leads the robot around an obstacle course. As it follows her, the robot learns to navigate the course itself.

"My software does the mapping between what the robot senses and its own set of basic skills," Nicolescu explains. When the robot has learned the obstacle course, it can teach another robot by leading it around the course. "I've had as many as seven robots going around the course. Each has learned from the robot in front of it, except for the lead robot, which learned the course from me."

When NASA's Robonaut goes to the space station, it will learn new tasks from human astronauts, who will simply show him what to do, and then Robonaut will be able to teach other robots.

There is another startling revelation about current robotics. Nicolescu first teaches a robot to find a small box, pick it up, and bring it to another location. She then complicates the task by wedging the target box

among larger boxes where it is visible but inaccessible. She then leaves the lab.

The robot finds the box, but can't pick it up. After a few tries, it scans the room and spots a human. It rolls over to the human, gets his attention, and then leads the human to the inaccessible box. It is asking for help in fulfilling its task, and showing an astonishing ability to reason out a solution to its problem. "The model we use to teach robots is biology," says Mataric. "This is the kind of thing your dog might do if you forgot to feed him."

Scout Helicopters

Outside the Lab, one of the School's robotic helicopters is showing off its ability to hover. Hovering is one of the most difficult skills for a helicopter pilot to learn, and most pilots would be amazed that a machine can do it without human guidance or intervention. Gaurav Sukhatme, assistant professor of computer science, not only taught the helicopter to hover, but also to use its on-board camera to first locate then settle on a landing pad. Currently the robo-chopper is learning to interact with the Pioneer robots on the ground, and to chase after moving targets so it can land on them. Sukhatme directs the Robotic Embedded Systems Laboratory where the research focuses on flying robots, and large-scale robotic sensor networks.

Sukhatme has two large robot helicopters with rotors six feet in diameter, and he's hoping to develop two miniature helicopters, perhaps small enough to fly indoors. Sukhatme aims to develop a robot helicopter so small, light, and smart that a soldier can carry it in a backpack and use it to scout dangerous terrain. Small robot helicopters equipped with miniature cameras might also augment or replace traffic helicopters flown by humans.

"In an earthquake or other emergency, we could send teams of heterogeneous hovering robots out to find people who are injured or trapped," says Mataric. "The robots would interact with each other and with humans."

At their current rate of evolution, in our lifetime, robots might be interacting with humans on a daily basis.

*Assistant Professor Gaurav Sukhatme with one of his robotic helicopters.*

DIVA SINGS

Smart Memory Chip Breaks the Memory Wall

Researchers from the School of Engineering's Information Sciences Institute (ISI) have designed a "Smart Memory" chip that can speed some computer calculations by at least an order of magnitude. The new chip, which the researchers are still perfecting, is being evaluated by the Hewlett-Packard Company for use in their McKinley server. It could find ready application in multimedia, scientific modeling, and databases.

The chip, a product of ISI's Data IntensiVe Architecture (DIVA) project, was first demonstrated on July 31 at the DarpaTech 2002 Symposium in Anaheim, California.

ISI computer scientist John Granacki, co-leader of DIVA, says the new chip addresses a longstanding and growing mismatch in computer components. While central processing units (CPUs) are running ever faster, much of the data that these chips process comes from separate random access memory (RAM) chips. The connection between the two has become a bottleneck, a bottleneck that increasingly restricts performance.
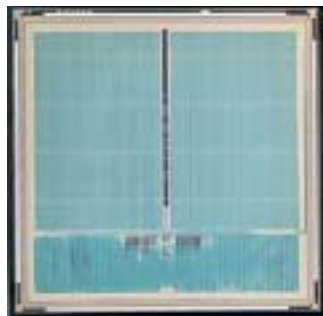
ISI's DIVA chip

Granacki notes that computer scientists have experimented for several years with combining CPU and RAM functions on a single piece of silicon, an approach known as the Processor in Memory (PIM) chip.

"RAM chips are finally dense enough that we can afford the space for processor logic on them," explains Mary Hall, the other DIVA co-leader. "Because the processors and memory are so much closer and are on the same chip, this design not only cuts the time delay per computation, but also increases the potential bandwidth for data transfer between them."

She says the DIVA PIM chip is not the first device to have a processor-in-memory functionality. "Computer scientists have been talking about the potential of PIM chips for most of the past decade and have released

devices they call PIM chips. However, this is the first smart-memory device designed to support virtual addressing, and is also capable of executing multiple threads of control."

Granacki says that other PIM devices have had "a strict, unchangeable protocol that limits their usefulness." He adds that existing CPUs also have a small amount of memory built in, called a cache, that substantially speeds processing for many applications. But for many others, cache capacity is not sufficient, and the processor waits while data is sought and retrieved from separate memory chips.

This delay is called the "memory wall." Normally, a CPU fetches data from memory chips in chunks that are 32 bits long, or in some cases 64 bits. With Diva's processor in memory design, the data arrives in 256-bit chunks. This overcomes the memory wall by vastly expanding cache memory. It allows the chip to take better advantage of software that processes 256 bits of information in each operation cycle, rather than the standard 32.

Groups of DIVA chips can serve both as a parallel processor, performing most of the program calculations internally, as well as a set of "smart co-processors."

Instead of dragging each piece of stored data to the central processor for computation, the PIM chip passes each computation to the processor unit, or node, that is nearest to the data it needs," explains Hall.

Tests are proceeding to gauge how completely the new chip realizes the hopes of its designers. However, researchers say the new chips have executed some benchmark tests with results more than 10 times faster than conventional systems. The team believes they have the potential for speed-ups ranging to several hundredfold.

The PIM chip contains 55-million transistors and is one of the largest functioning chips to result from academic research. The DIVA team hopes to produce a full prototype system
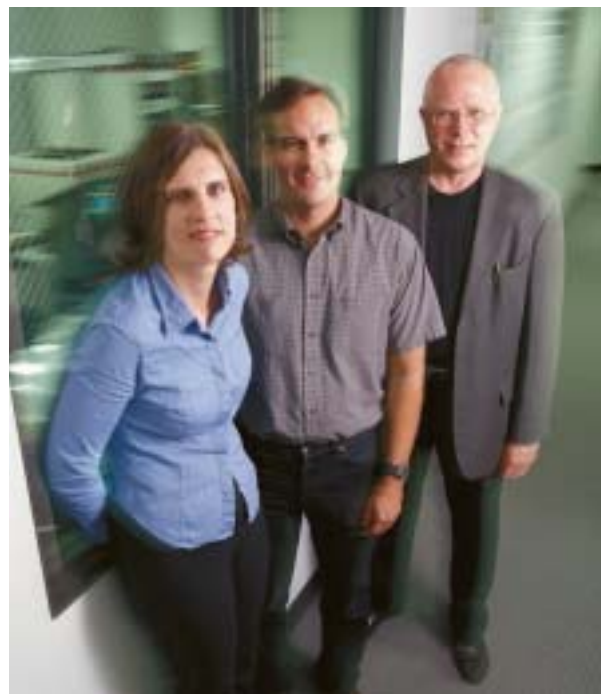
ISI's DIVA chip team of Mary Hall, Jeff Draper, and John Granacki.

with chip groupings by 2003. However, the unit demonstrated at the conference, which was a two-DIVA-chip unified module, already represented a substantial step in that direction.

The Defense Advanced Research Projects Agency (DARPA) funds the DIVA research, and was also the host of the Anaheim conference. After the demonstration, a representative of DARPA's High Productivity Computing Systems initiative announced the collaboration between ISI and Hewlett-Packard. Jeff Draper, an ISI project leader, says the DIVA team will attempt to insert 16 or 32 PIM units into the Hewlett-Packard McKinley server. Researchers expect that the first machine should be ready for testing in 12 to 18 months.

ISI cooperated on the development of the system architecture with researchers at the University of Notre Dame, Caltech, the University of Delaware, and Alphatech Inc., of Burlington Massachusetts.

In addition to Granacki, Hall, and Draper, major contributions to the project came from ISI researchers Jacqueline Chame (Simulation, Benchmarking, and Compiler), Jeff LaCoss (Emulator), Tim Barrett (System Integration), Jeff Sondeen (VLSI), Dale Chase (Emulator and System Integration), and Craig Steele. Many USC graduate students also contributed to this project.

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will receive USC School of Engineering caps!*

Jennifer Harris Trosper, MSAE '99

Jennifer Harris Trosper is a well-traveled Trojan. On her way to Mars, she passed through the USC School of Engineering, not to mention the Ukraine, Mexico, and Peru.

Trosper received her master's degree in aerospace engineering from USC in 1999, and is currently the lead systems engineer on the Mars Rovers Project at NASA's Jet Propulsion

One of two powerful new Mars rovers NASA is sending to Mars in 2003.
Courtesy of NASA's Jet Propulsion Laboratory

Laboratory in Pasadena, California. The goal of the ambitious project is to land two powerful new rovers on different areas of Mars in 2004. Each spacecraft will use a parachute and retro-rockets to slow its approach to Mars, and then airbags will cushion the landing, bouncing the lander along the planet's surface until it stops. Then the bags will deflate, petals will open up to upright the lander, and the Mars Rover, which is capable of covering 100 meters per day, will roll out to explore the Red Planet.

After two failed missions to Mars, and an investment of $700 million in the Mars Rovers Project, there will be considerable pressure for success on JPL, on NASA, and on Trosper.

"It has to work. Everybody is looking at what we are doing because we failed the last two missions to Mars. From a risk point of view, it is high risk because we're moving so fast." She grimaces and then smiles, "but it has to work." The first launch is scheduled for May 30, 2003. "Whatever we have built and tested by May 30th goes on top of that rocket, and it goes to Mars," she says. "That's why it's so

important to ensure we have done everything necessary to test the vehicle in flight-like environments and be certain that it will work."

Trosper is an engineer who manages. She has learned that precise communications, which help everyone to understand how their piece fits into the whole, are as important as all the technical skills she learned in school. The days when a few smart guys, and they were all guys, could grasp all the technical details of a space project are long gone.

From all over the world, perhaps a thousand engineers and other technicians are designing the smaller systems, building hardware, assembling packages of instruments, calculating trajectories and writing reams of software for the Mars Rovers Project. These have been tested individually, but how well will everything work in concert?

For example, when the launch vehicle pitches the spinning and wobbling spacecraft in the direction of where Mars will be seven months later, its trajectory will undoubtedly need corrections.

"We'll have to damp out all the rates that aren't sending the Rover in the right direction. There are going to be misalignments. There are going to be errors," says Trosper. "The only information we'll have is what we told it to send down to earth, so we have to verify that we've designed it correctly."

To do this, Trosper organizes a test in during which the spacecraft star scanner is stimulated with pulses of light that simulate the sun and stars from the location in space where the spacecraft will be after the real launch. Can the attitude control software determine the location of the sun and identify the stars accurately? While the vehicle is moving and spinning, will its computer and software understand where the spacecraft is, and accurately perform the commands from the ground controllers to fire the thrusters at the right time, in the right direction and for the right duration?

"When we designed it, we said 'Here's the information that we think we'll need on the ground to assess how that vehicle is doing,'" she says. "We also have a limited amount of bandwidth to work with."

This is just one of several major tests that

she'll run and all the time a voice in the background is whispering, "it has to work." She seems uniquely prepared to handle the pressure.

Trosper grew up in rural Ohio where her father was an engineer in the auto industry. A talented pianist as a child, Trosper attended a summer music camp. By the end of summer, she knew that music would not be her life's work. But what would be? Her father had worked in southern California on some of the early rockets, particularly Nike-Zeus and Thor. There were pictures on the wall of their den and fascinating stories about tests at White Sands. Aerospace engineering seemed like an exciting major.

Trosper received her undergraduate degree from MIT. A scholar-athlete, in 1989, her senior year, she captained the volleyball team that went to the Division 3 NCAA tournament, and later became the first MIT graduate inducted into the Verizon Academic All-America Hall of Fame.

At JPL, Trosper started as a power subsystem engineer, contributing to the development of the Cassini spacecraft, now on its way to Saturn. She began moving into management with the successful Mars Pathfinder project, and around this time, started working toward her master's degree at USC.

July 4, 1997, Pathfinder's first spectacular day of successes on Mars was a glorious personal day for her. Trosper, who at that time was still Jennifer Harris, was the flight director seen by millions on television. Her photograph appeared in Parade magazine and she received many congratulatory letters from people around the world. One such letter was from a Dallas woman who asked if her son, an Air Force pilot, named Randy Trosper might have a tour of the lab. Jennifer Harris agreed, and subsequently became Jennifer Harris Trosper.

There is yet another dimension to Trosper.

Feng Deng, MS CENG '93

Feng Deng did not just dream of being an entrepreneur, he dreamed of being a Silicon Valley entrepreneur.

Deng has achieved his dream. He is the co-founder, vice president and member of the board at NetScreen Technologies, a Sunnyvale-based public company with 500 employees, specializing in Internet security systems. He knows precisely when the dream started.

"It was 1986 in Beijing. I was 22 years old and a senior at Tsing Hua, the MIT of China, when I read the Chinese translation of 'The Fire in the Valley,'" he says. "It was all about Silicon Valley, and from then on I wanted to build my own business."

After graduating from Tsing Hua, Deng worked in China for several years before coming to America in 1990 to pursue his PhD. He and his future wife, Hu Birong, came to Los Angeles, where Deng won a scholarship to USC, while Hu attended UCLA to study biology. She now works as an engineer for Agilent.

"USC is a very good school, and I was excited to see it ranked number eight in the last *U.S. News & World Report* poll," he says. "I liked the campus, the architecture of the buildings, and I miss it."

Deng received his master's degree, completed his doctoral coursework and had taken the PhD screening exam, when through a friend he received a job offer from Intel, a Silicon Valley company for which he still has immense respect. The temptation was too great and he left USC.

He held a variety of technical positions with Intel, helping design and develop several generations of microprocessor and chip-set products. In 1997, he and his partner Yan Ke founded NetScreen. Before founding the com-

pany, Deng explains how the two generated "tons of ideas" in brainstorming sessions, including a plan for a multimedia gateway.

"I can't remember why we dropped it, but someone else did the same thing and they were acquired by Cisco," he says.

NetScreen is now a leading developer of purpose-built, integrated security systems, and network traffic management firmware and software. The firm has a very broad line of products that integrate key security features such as firewall, virtual private networks (private networks that use public network infrastructure), and denial of service attack protection.

Selling directly and through resellers to large enterprises and telecommunications service providers, revenue has risen from $8 million in 1999, to $40 million in 2000, to $97 million in 2001, and is projected to be $150 million in 2002. This past June, Deng and Ke, who is vice president and chief architect at NetScreen, received Ernst & Young's 2002 Northern California Technology Entrepreneur of the Year award.

"Success doesn't come from one or two people with a good idea. More important is the stellar team that it takes to execute the good idea," Deng says. "I feel very proud of the whole team here."

Deng says he now has three main roles in his company. He is one of the founders, and thus responsible for the company's culture. As vice president, he is the senior manager in charge of research and development with about 150 engineers reporting to him. And finally, he has fiduciary duties as a member of the company's board.

Deng advises engineering students to pay attention to all of the details they learn in their

courses. "First you need the dream. Then you have to work hard, always working toward it. Most days, I have to go back to the books and the things I learned at USC," he says. Those

days are long. Deng estimates he has worked ten hour-days, six-and-half days a week for the past five years. "My only regret is not having more time to spend with my wife and five-year-old son Alec."

Only rarely does he catch some of a Trojan football game on television. In his two years at USC, he and his wife attended a single game, a USC/UCLA struggle. They sat with the Bruin section. "I had to keep my mouth shut," he says laughing.

Knowing how busy Deng's life is, Dean Nikias is pleased to have recently met him, and enjoyed the opportunity to speak with him about the bright future of the School. "Reconnecting with alumni like Deng is the best part of my job. Individuals like him serve as powerful role models for students and other alumni of the school."

Trosper   *continued*

In 1994, she took a leave of absence from JPL to go to the Ukraine with a church group. She taught Bible study and English at a business school in an area where there were few teachers and a surplus of economically battered, yet friendly people.

"It could be an all-day struggle just to find something that you could actually eat," she says, "but the people were wonderful. I had some of

the most stimulating conversations of my life."

She spent another summer in a Peruvian camp for homeless children putting thatch roofs on cabins. And she makes regular weekend trips to Mexico to help build houses for families living in cardboard boxes.

"When I started doing mission trips, I realized how much it had changed my perspective," she says. "I think we are placed here to do great things, like work on a team that

sends vehicles to Mars. That's an opportunity that's been presented to me by God. It's also important to realize that there are those less fortunate who don't have the opportunity to work on spacecraft to Mars, and it's very important to help those folks also."

And yes, the voice could be right. The mission could fail. "In the grand scheme, I think we'll make it through," she says. It seems if anyone can, it's Jennifer Harris Trosper.

snapshots

USC School of Engineering Events
Fall 2002

Executive Director of ISI Herbert Schorr and Dean Nikias at the ISI@30 Celebration.

A distinguished panel leads a discussion on tech transfer at the Technology Equity Conference in September.

Corporate representatives, faculty, alumni, and students enjoy networking during the Tech Equity Conference reception.

ISI@30

The Information Sciences Institute was founded at the USC School of Engineering in 1972, and has since made significant contributions to the development of technologies like the original ARPAnet, grid computing, and intelligent agents. On September 9th, Executive Director of ISI and School of Engineering Associate Dean Herbert Schorr, and Dean Nikias celebrated the Institute's 30 years of advanced computer engineering at a day-long anniversary celebration. The event took place at the California Yacht Club in Marina Del Rey. Research presentations were made throughout the day commemorating three decades of excellence.

TECHNOLOGY EQUITY CONFERENCE

Engineering faculty presented more than a dozen technologies ready for commercialization to alumni, venture capitalists, and other industry representatives at the School's first-ever Technology Equity Conference on September 24 at the Paradise Point Resort in San Diego.

The conference was co-chaired by Dean C.L. Max Nikias and Thomas O. Gephart (BSME '62), the founder and managing partner of Ventana Global.

USC's Vice Provost for Research, Dr. Neal Sullivan, gave the University perspective on the technology transfer process.

Dr. Isaac Maya, director of Industry and Technology Transfer Programs of the Integrated Media Systems Center (IMSC), presented a brief overview of technology transfer success stories at the School.

The major research areas included

Information Sciences Institute-associated research, IMSC-associated research, and biomedical technology.

After a fascinating half day of presentations, a panel discussion, moderated by Gephart, focused on the challenges and advantages for industry in working with universities in technology transfer. The panelists included Kathy Allen, clinical professor, Greif Center for Entrepreneurial Studies, Marshall School of Business; Daniel J. Epstein, chairman and chief executive officer, ConAm Management Corp.; Jay Kear, president, Kear Enterprises; David Lane, general partner, Diamond Head Ventures; William Quigley, managing partner, Clearstone Venture Partners; Andrew Viterbi, president, The Viterbi Group, and Dean Nikias.

The panel led a lively discussion which brought questions from both industry representatives and faculty.

Deputy Director of ISI East Robert Parker speaks about the institute at a reception in Washington D.C. with Dean Nikias.

Dean Nikias, Setiawan Aluni, ISE '81 and Vice Provost Michael Diamond at the last International Alumni Conference.

Alumni and friends celebrate their school spirit at an Associates Pre-Game Picnic.

RECEPTION WITH THE DEAN, WASHINGTON DC

On October 2, alumni, ISI-East staff, senior staff from USC and friends of the School of Engineering, met at the Marriott at Metro Center in Washington, DC, to network and re-connect with the School. Dean Nikias outlined his goals for the future of USC Engineering and highlighted several current success stories. Robert Parker, deputy director of USC's Information Sciences Institute East in Arlington, Virginia, also addressed the guests. Both he and Nikias underscored the significance of ISI, a hidden jewel of the School of Engineering. In a PowerPoint presentation, Parker highlighted several of ISI East's projects, and discussed its research work for government agencies and industry. The following evening, Dean Nikias attended a special reception hosted by USC University Relations targeted at bringing USC trustees, deans, and senior administration together with representatives from Capitol Hill to discuss political issues that concern USC and Los Angeles.

PRESIDENT'S DISTINGUISHED LECTURE SERIES

On Tuesday, October 8, the USC President's Distinguished Lecture Series featured Lech Walesa, the first democratically elected president of Poland and winner of the Nobel Peace Prize. Dean Nikias and his wife Niki hosted an intimate pre-lecture dinner for several parents of current USC School of Engineering

students at the USC Faculty Center. Following the dinner, the group attended Walesa's lecture in McCarthy Quad. As part of Dean Nikias's dedication to continually improving the School's undergraduate programs and curriculum, he welcomes opportunities like these to hear from current parents about their perspective, and their student's experience.

USC INTERNATIONAL ALUMNI CONFERENCE, SHANGHAI, CHINA

For the second year, Dean Nikias attended and was a featured speaker at the USC International Alumni Conference, this year held in Shanghai from October 17- 19. He also led a distinguished panel on "Telecommunications, Information Technology and Life-Long Learning," a key session in the conference's overall theme — *Challenges and Opportunities for Pacific Rim Societies in the 21st Century.*

Also speaking at the conference was Professor Theodore Berger, who leads a vanguard effort by a team of USC neuroscientists and engineers to develop the technology required for highly advanced microchips to be used as neural prostheses for the replacement of damaged or diseased brain tissue.

On Friday, October 18, the Dean and Berger hosted a dinner for USC Engineering alumni and friends at Meilongzhen, a renowned restaurant in Shanghai.

While in Asia, Dean Nikias also spoke at a special "Discover USC" student recruitment event in Hong Kong.

USC ASSOCIATES PRE-GAME PICNICS

The USC School of Engineering is pleased to host alumni and friends at the USC Associates pre-game picnics prior to each home football game. Many of the School's most dedicated supporters, including Dean's Circle members, enjoy these days of food, football, and fun with the rest of their Trojan Family. The picnics are held three hours prior to kick-off in Founders Park, just north of Bovard Administration Building, and reservations are required. If you are interested in the Dean's Circle/USC Associates and participating in football festivities, please contact Lisa Van Ingen Pope at vaningen@usc.edu or 213/740-2502.

Anthony Ordonio, BSME '91, and his wife Kelly enjoying a picnic.

MARK YOUR CALENDAR!

Scheduled Events for Late 2002 and Early 2003

Please call External Relations at the School of Engineering at 213/740-2502 for more information about these and additional future events. This list does not include all events scheduled.

Andrew J. Viterbi Lecture Series in Communication
November 14, 2002
Inaugural lecture
by Andrew J. Viterbi
Presenting "Science, Technology, and Business of Digital Communication"
5:00 pm Reception, 6:00 pm Lecture
Leonard Davis Auditorium
USC Campus

2002 Board of Councilors Meeting
November 15, 2002
8:30 am to 4:30 pm
USC Campus

Homecoming School of Engineering Celebration USC vs. Arizona State
November 16, 2002
Picnic 3 hours prior to kick-off
1:00 pm Picnic
South side of Doheny Library
USC Campus

Computer Science Distinguished Lecture Series
November 20, 2002
"Machine Learning and Bioformatics"
Featuring: Pierre Baldi
Director, Institute for Genomics and Bioformatics, UCI
12:00 pm
Leonard Davis Auditorium
USC Campus
For more info go to www.cs.usc.edu
or call 213/740-4498

School of Engineering Holiday Party
December 2002
Time TBA
Town & Gown, USC Campus

Computer Science Distinguished Lecture Series
December 4, 2002
"The NSF View on Robotics Research"
Featuring: Junku Yuh
Director, Robotics and Human Augmentation Program, NSF
12:00 pm
Leonard Davis Auditorium
USC Campus
For more info go to www.cs.usc.edu
or call 213/740-4498

School of Engineering Alumni Reception
January, 2003
Ventura County/Santa Barbara Area
Time and Location TBA

President's Distinguished Lecture Series
January 17, 2003
Featuring: Amy Tan
Author of "The Joy Luck Club"
Lecture 7:00 pm
Newman Hall, USC Campus

Pratt & Whitney Institute of Collaborative Engineering Founding Celebration
also honoring USC Trustee Y.H. Cho
January 29, 2003
Time and Location TBA

Computer Science Distinguished Lecture Series
February 19, 2003
"Open Problems in Peer-to-Peer Systems"
Featuring: Hector Garcia-Molina
Chairman, Computer Science Department, Stanford
12:00 pm
Leonard Davis Auditorium
USC Campus
For more info go to www.cs.usc.edu
or call 213/740-4498

Computer Science Distinguished Lecture Series
March 5, 2003
"Representing Multi-Agent Decision Problems"
Featuring: Daphne Koller
Associate Professor, Computer Science Department, Stanford
12:00 pm
Leonard Davis Auditorium
USC Campus
For more info go to www.cs.usc.edu
or call 213/740-4498

President's Distinguished Artist Series
March 7, 2003
Featuring: Lynn Harell
World-renowned cellist, musician, conductor, and teacher
Lecture 7:00 pm
Bovard Auditorium, USC Campus

Academic Honors Convocation
March 11, 2003
USC Campus
Time and Location TBA

25th Annual Engineering Awards Luncheon
April 2003
Time and Location TBA

Tutor Building Ground Breaking Celebration
Spring 2003
Time and Location TBA

If you would like to work with the Alumni Relations office at the School of Engineering to help organize an alumni reception in your area, please contact our office at 213/740-2502.

Alumni
news & notes

Summer and Fall 2002

1959
Robert Glen Bezzant (MSCE) is keeping up with 31 grandchildren and five great grandchildren. He is doing church service and lives on a beautiful lot fronting the Provo River in Utah.

1961
James W. Williams (MSEE) has recently returned to Southern California after being away for many years. He is now with Boeing Satellite Systems in El Segundo, but plans to return to Boeing-Anaheim to continue his high voltage power electronics career.

1962
Jim Upton (BSAE) received the International Society of Flight Test Engineers Fellow award for attainment of notable distinction in the field of flight-testing at its September symposium in Seattle. He has also written his third book for Specialty Press, *AirlinerTech, Lockheed L-1011 TriStar.*

1963
David A. Johnson (BSEE '49, BSCE '63) currently lives in Arizona and conducts forensic studies to determine the cause of fires.

1965
Dennis A. Rhoads (MSME) retired after 40 years in the aerospace industry. He spent the last 36 years at TRW Space and Electronics, where he was the department manager of their Thermal Systems Design and Test Department.

1969
Moiz Beguwala (MSEE '69, PhD EE '75) was recently named to the Board of Directors at Intrinsyc Software, Inc. He is currently senior vice president and general manager of the Wireless Communications Division at Conexant Systems, Inc.

1972
Walter J. Falgout III (BSCHE) has designed the Cost Management System (CMS) implemented by Parsons Energy and Chemicals Group, Inc. The system provides a structured environment for budgeting, forecasting and control for capital projects of all sizes. The system provides important drivers for communication among the project team members. The products of this activity give project decision-makers what they need to manage their projects effectively. Parsons Energy and Chemicals Group is headquartered in Houston, Texas and provides engineering, procurement, construction and project management services to the petroleum, chemical and power generation industries around the world.

1974
Michael J. Briggs (MSOE) completed his PhD in Ocean and Coastal Engineering at Texas A&M University in May 2001.

Peter Himmelberger (MSSM) was named senior vice president of DynCorp's Systems & Solutions unit.

1977
Marshall Lee (BSEE) was recently appointed vice president of engineering at Emulex Corporation.

1979
André A. Anderson (MSENVE) was promoted to senior vice president and director of Environmental Services at Integrated Resources, Inc.

David Garcia (BSEE) was named vice president of Sales for AMD. Garcia will be responsible for field and sales marketing activities in the U.S., Canada, and Latin America.

1982
Mohammad Movahed-Ezazi (MSEE) was recently named vice president of engineering for Atrenta Inc., which is a Predictive Analysis company.

Farzad Naeim (PhD ENGR) was named the new editor of Earthquake Spectra, a professional journal published by the Earthquake Engineering Research Institute.

1984
Arlyn Alonzo (BSAE '84, MSAE '88) recently became a partner for the international law firm of McDermott, Will and Emery. She is a partner in the firm's Intellectual Property department.

Bahman Pouranpir (EISE) and wife Azita Pajand are enjoying life in Irvine, California with five-year-old son Aryan, and nine-month-old daughter Aveen.

1985
Charles N. Belk II (BSEE) was named CTO and vice president for Promotional Technology & Operations of Hothouse Inc. The sports and entertainment promotional marketing agency was recently named one of the 100 best companies to work for in Atlanta.

1989
Truong T. Le (BSAE) received his MBA from UC Irvine in June 2000. He and Michaela Schmidt were married on May 26, 2001, and have relocated to Seattle, Washington. Le currently leads a financial management team for a business unit within the Boeing Company.

1989 continued

Paul Sannerman (MSEE) is currently working for Swales Aerospace, which recently announced the realignment of its engineering department into two separate units. Sannerman will head one of these units.

1990

Janine Nghiem (BSEE) and husband Michael B. Diamond (MSME '91) announce the birth of their son Jared Matthew. He joins brother Bryan, age 3, and sister Rachel, age 2.

David E. Wang (BSEE '87, MSEE '90) and wife Tina celebrate the birth of their son Nathan David Wang, born on April 12, 2002.

1991

James V. Tufty Jr. (BSEE) was recently promoted to project manager at Square D

in Florida. He is also engaged to be married in November.

1993

Feng Deng (MSCENG) recently received Ernst & Young's 2002 Northern California Technology Entrepreneur of the Year award at a ceremony held on June 21, 2002 in San Jose. The award honors the industry's most outstanding business leaders for their innovation and performance. Deng is vice president of engineering and co-founder of NetScreen. (*See the alumni profile of Deng on page 31.)*

1994

Lisa Renne Drake (BSAE) and husband Dan Gievers (BSBUAD '92) announce the birth of their son Steven Joseph, born on August 2, 2002.

Benjamin Kuo (BSEE) and Jennifer (Miyasaka) Kuo (BSEE '96) announce the birth of their daughter Maile Kunie Faye Kuo, born on June 25, 2002. She joins brother Jonathan, age 4.

Roman Michael James Nation (BSAE) celebrated his marriage to Kelly Elizabeth Garcia in New Orleans on June 14, 2002.

1995

Sunil Dalal (MSBME '95, PhD BME '97) celebrated his marriage to Sonal Pandya on June 30, 2002.

Joseph Wayne Hower (MSME) was promoted to Principal of ENVIRON International Corporation. He recently moved to ENVIRON's downtown Los Angeles office, where his focus is on air quality-related consulting. He works primarily for the industry and other entities that are regulated by the South Coast Air Quality Management District.

1997

Dongjin Cai (MSCSCI) and wife, Rong Yang, announce the birth of their daughter Melinda MengDie Yang, born on August 16, 2002.

1998

Andrew W. Owens (BSBME) has graduated from the University of Texas Southwestern Medical School. In July, he began his residency in internal medicine at Washington University in St. Louis, Missouri.

2001

David Sterling Adler (BSME) and wife Jennifer celebrated the birth of their son Aiden Sterling Adler, on May 11, 2001. Both mom and dad did attend graduation and Aiden was born just hours after the ceremony.

Digeesh Awasthi (MSEMT) is working for International Rectifier as an industrial engineer.

Viswanathan Natarajan (MSEEVL) is currently seeking his MBA at Loyola University in Chicago.

Chris Tiberius Sharpe (BSAE '97, MSAEAN '01) was married on August 10, 2002 to Annik-April Asadourian. The two reside in their new home in Huntington Beach.

Alumni Recognition

Erik Zandvliet (BSCE '89) recently received the "Young Transportation Engineer of the Year 2001-2002" award from the Institute of Transportation Engineers, Southern California Section. The Institute of Transportation Engineers (ITE), an international individual member educational and scientific association, is one the largest and fastest-growing multimodal professional transportation organizations in the world. The award is given to recognize a person involved in the transportation engineering field who has made noteworthy accomplishments to the profession, and has an ongoing commitment to ITE. The person must be 35 years old or younger, with good prospects of continued professional growth.

Zandvliet was selected for his specific contributions to the Southern California Section. He is responsible for improving and streamlining the operation of the Section through technology (databases, spreadsheets, archives on CD-Rom, email notification lists, etc.) as well as professionalism in the field of transportation engineering and devotion of extraordinary amounts of personal time for Section events.

Zandvliet is a supervising engineer at Willdan with more than twelve years of experience in traffic and transportation engineering. He is a registered professional traffic engineer in the state of California. He brings a wide range of abilities equally suited to serving public agencies as well as project management. He is responsible for analysis, coordination, and design of a variety of projects, including traffic signal plans, sign and striping plans, preparation of traffic impact studies, engineering and traffic surveys, and design projects. He is currently under contract as the city traffic engineer for the cities of La Canada Flintridge, San Marino, Rolling Hills Estates and Manhattan Beach.

Prior to joining the Willdan team, Zandvliet worked for the city of Burbank as city traffic engineer, where he was responsible for the overall management of the Traffic Engineering Division. Prior to this employment, he served as city traffic engineer for the city of Downey. Zandvliet lives in Bellflower, California with wife Yvonne Bartoli.

Alumni in the News

Ravi Chatwani (BSEE '92, MSEE '94), is president and CEO of Prosum, Inc., which has been ranked one of America's entrepreneurial growth leaders by *Inc.* magazine, whose 2002 special Inc. 500 issue hit newsstands on October 15th. *Inc.* magazine ranked Prosum the 163rd fastest-growing private company in the nation.

The El Segundo, California company offers strategic IT consulting, application development and integration, systems and network infrastructure, and specialty IT search of high potential IT candidates and IT managers. Their clients include Unocal, Guitar Center, Universal, General Motors, Armored Transport, Disney, Raytheon, Farmer John, The Capital Group, Warner Music, The Sports Club, USC, Countrywide, Long Beach USD, and others.

"It is very exciting for Prosum to be ranked by *Inc.* magazine", says Chatwani. "This benchmark recognizes our founders and all of our employees for their tremendous contributions, strong teamwork, and consistently high quality customer service. The ranking also recognizes our clients, whose relationships have contributed to our success."

Started in 1982, the Inc. 500 ranks the nation's leading entrepreneurial firms according to sales growth over the previous five years. Former Inc. 500 companies that have gone on to become household names include Microsoft, Timberland, Domino's Pizza and Patagonia.

On August 1, 2002, The Salt Lake Tribune announced that **Lt. Col. Grant Webb** (BSAE '83) would take command of the Salt Lake City Recruiting Battalion. The battalion spans over 372,000 square miles, which is the largest geographical recruiting battalion under the U.S. Army Recruiting Command.

Staff News

Joyce Oo (BSG '99, MSG '02), director of development operations in the engineering office of External Relations, celebrated her marriage to Christopher Mayne (BSBUAD '99) on September 21, 2002. The two honeymooned in Costa Rica.

Lisa Van Ingen Pope (BAAMLT '94), director of development in the engineering office of External Relations, and husband Mark Pope, celebrated the birth of their twin daughters, Penny Jeanne and Peyton Leigh, on July 8, 2002.

This edition of class notes represents updates received between April 2002 and September 2002.

Ling Xian Gu, electrical engineering student, and Carlos Arroyove, QUALCOMM recruiter have a conversation.

Rebekka Daily, mechanical engineering student, speaks to ExxonMobil recruiter Sally Morton (BS CHE '00).

The Career Expo drew a throng of students. Here are some lining up in front of the Skyworks booth.

Engineering Career Expo

During the first week of October 2002, representatives from dozens of companies including Boeing, Microsoft, Raytheon, Lockheed Martin and QUALCOMM, erected booths on Archimedes Plaza, also known as the Engineering Quad. Hundreds of engineering students (and a few of their friends from other schools), dropped by to talk to the corporate representatives, most of whom are also alumni of the School of Engineering, about possible job opportunities at their companies. The Career Expo is a service of the Engineering Career Services Office and Student Affairs. If you are interested in participating in a future Career Expo, you may contact the office at 213/740-4530.

YoungAlumni**profile**

Maricela Rodriguez, BS BMEC '00

Like many Americans, Maricela Rodriguez' family came from someplace else. Her father came from Mexico, and her mother from El Salvador. But Maricela's dreams are pure American, and they are coming true.

This fall she started at UCLA medical school. She has just completed her Master's thesis after excelling in the demanding undergraduate biomedical engineering curriculum at the USC School of Engineering. Her own interpretation of the American dream is richly textured, and has not always come easy.

Maricela was born and raised in Hollywood, California. When she saw the troubles her older sister encountered in public school, Maricela decided to attend Immaculate Heart High School. Her parents could not afford the tuition, so she worked several after-school jobs while maintaining a high grade point average.

"Immaculate Heart is an all-girl private school and that was a great step for me. I really wanted to go to college, and I was determined to attend a college preparatory high school that would help me to be the first person in my family to attend college. My older sister and cousins struggled in the local public school due to the lack of academic support. I had a supportive environment at Immaculate Heart, and at home."

Initially Maricela looked toward UCLA, but she chose USC specifically because of its biomedical engineering department. Her interest in biomedical engineering developed for a very personal reason. "My best friend Carol passed away from leukemia when we were juniors in high school. That event fueled my desire to study medicine. Beyond that, I was very good in math and science so biomedical engineering was a perfect path for me."

Following acceptance to USC, Maricela secured grants and scholarships covering her tuition and living expenses, and allowing her to focus entirely on her studies for the first time in her life. She credits Raul Vargas, executive director for Mexican-American Programs, for helping her secure the grants and scholarships necessary to complete both her bachelor's and master's degrees.

While an undergraduate, Maricela completed a summer internship with Merck Pharmaceutical, where she helped write a research software program. She spent another summer at Rancho Los Amigos Hospital, working on prosthetic devices for infants. She also interned at Medtronic, Inc., in Minneapolis, which develops a range of medical devices. Finally, there was a health research project in Ecuador.

"The summer after starting my master's program," Maricela says, "I entered the Multi-Disciplinary International Research Training Program based at the University of Washington. We had to evaluate the health of a rural community in Ecuador that has no access to health care. You might think the people would be healthy because they are in a rural area, but the reality is that hypertension and other serious health problems are prevalent."

Professor David D'Argenio, chair of the biomedical engineering department, played a key role in guiding Maricela's academic studies. "Maricela has excelled at USC and will become a fine medical doctor, or will spend her life as a successful biomedical researcher," he predicts.

Gerald Loeb, a professor of biomedical engineering who is also a physician, was Maricela's academic advisor during her graduate studies. Loeb's early research focused on development of cochlear implants for the hearing impaired, and he is now developing the BION muscular stimulation implant. While Maricela intends to become a primary care physician, she also hopes to follow a secondary career path similar to Loeb's, and develop advanced prosthetic devices.

"More than anything else this past year, I've enjoyed working with Maricela on the design of an eyeblink prosthesis," says Loeb. "The project itself was an intriguing mix of different sub-problems in the materials science of shape memory alloys, mechanical engineering, thermal dissipation, and electrical power."

"What amazed me was how Maricela jumped right into each of these different disciplines and came back in a matter of days with a perceptive and well-executed analysis," Loeb continues. "She never worries that something looks difficult or unfamiliar; she just goes for it and succeeds. That's the mark of a real researcher. I have no doubt that she will succeed in medical school and I hope she applies her instincts for research and her skills in engineering to solve important clinical problems."

It looks like Maricela is on her way to doing just that.

Please keep us informed of your personal and professional progress, as well as changes in your contact information by visiting www.usc.edu/engineering and clicking on Alumni. Or by writing to the Alumni Relations Office at the USC School of Engineering, Olin Hall 300, Los Angeles, California 90089-1454

Board of Councilors News

Making a Difference

On August 6, 2002, Randy Smith Training Solutions (RSTS) named **Gordon M. Anderson** (BSME '54) to its board of directors. RSTS is a leading worldwide provider of management, technical, behavior-based safety and experiential training. Before joining RSTS, Anderson was chairman and chief executive officer of the former Santa Fe International Corporation. He began his career with Santa Fe International Corporation in 1954, and recently retired.

Easy Street Becomes Merwyn C. Gill Way

M.C. Gill (BSCHE '37) is no longer on Easy Street. In a ceremony held on August 15, the City of El Monte officially renamed a portion of Easy Street "Merwyn C. Gill Way" in honor of the founder and chairman of the board of the M.C. Gill Corporation, which until that day had been located on El Monte's Easy Street.

Dean Nikias, Hester and M.C. Gill, and Christopher Stoy at the M.C. Gill street naming celebration in El Monte.

photo by Annelize Bester

"M.C. Gill is an exceptionally creative engineer and entrepreneur whose company has dominated the field of composites for more than half a century. But he is also one of finest and most generous people I've had the pleasure of knowing. No one deserves this honor more than he does," says Dean Nikias who attended the ceremony. Others from the School in attendance included Steven Nutt, who is a professor of materials science and mechanical engineering, as well as holder of the M.C. Gill Chair in Composite Materials, and Christopher Stoy, chief executive officer of external relations at the School.

Gill, a member of the School of Engineering's Board of Councilors, last year pledged $7 million to the School's composite center, which was renamed the Merwyn C. Gill Foundation Composites Center.

The M.C. Gill Corporation is currently the world's largest manufacturer of compartment liners, and the second largest producer of floor panels for commercial passenger and freight aircraft. His company now has annual sales approaching $90 million and its products can be found on most commercial passenger and freight aircraft in the world today. A USC Engineering graduate with a degree earned in 1937, Gill first began thinking about uses for composite plastic materials in the mid-1940s.

Grateful to USC and an enthusiastic supporter of composites research, he first pledged a gift to the School in 1986 to fund the chair currently held by Nutt. He also supports a postdoctoral fellowship. Gill is a member of the Presidential Associates, Cardinal and Gold, and the USC Norris Auxiliary. In 1988, he received Engineering's Distinguished Alumnus Award.

In renaming Easy Street after Gill, El Monte city officials honored Gill's many achievements, and the long relationship between his company and the city.

USC Spirit

Wearing USC jerseys, **Rick Stephens,** and his daughter, Becky, ride tandem on a 100-mile bike hike in an Amtrak cycling event as members of the Orange County Wheelmen bike club.

Rick Stephens is vice president and general manager, Homeland Security and Services at Boeing Company, and is also chairman of the School of Engineering's Board of Councilors Education Committee. (*See story on Boeing and Rick Stephens on page 11.*)

In Memoriam

DWIGHT C. "BILL" BAUM, 89, father of School of Engineering Board of Councilor member, Dwight J. "Jim" Baum, passed away in Pasadena, California on June 19, 2002 of pneumonia. Baum was a generous supporter of USC Engineering. In 2000, he gave $2 million to help build a new engineering and multimedia building. Baum was also grandfather to USC alumni Dwight James Baum, Jr. (BSME '99), and Lauren Olivia Baum (BSBME '01).

BEATRICE "BEA" ELEANOR BICKFORD passed away on July 2, 2002 at her home in Palos Verdes Estates, California. Bea and her late husband Gardner L. Bickford, were generous supporters of USC Engineering. They have contributed more than $200,000 to the Bickford Scholarship in Industrial and Systems Engineering. Bea is survived by her son Albert Radcliffe, stepdaughter Betty Ann Martin, stepson Gardner L. Bickford, Jr. and six grandchildren.

THOMAS JAY DORSETT (MSEE '62) and his son, Timothy Michael Dorsett, died in a plane crash in Wyoming on July 27, 2002. Thomas is survived by his wife Loretta, two daughters, Anne and Valerie, two sons, Chris and Patrick, and seven grandchildren. Timothy is survived by his wife Nancy, daughter Rebecca, and son Geoff.

FREDERICK STEPHEN DUKE (MSSM '85) passed away on April 24, 2002 at M.D. Anderson Cancer Center in Houston, Texas. He is survived by his parents, Sam Frank Ditty Duke and Thelma Felts Duke, and son Theron Arthur Erickson.

LYLE FRANK HANSEN (MSSE '79) of Alpine, Wyoming passed away on August 2, 2002. He is survived by his wife Nancy, and two children, Laura Huemer and Jeffrey Hansen.

ROBERT C. KINSELL (BSME '49) passed away on August 5, 2002 in San Luis Obispo, California. He is survived by his wife Marie, children, Janet, Elizabeth, and Kenneth, eight grandchildren, and two great-grandchildren.

"Notebook" is a new section in USC Engineer that will end each edition. It may include an editorial from a guest writer, a cultural event highlight, an important letter or story from a reader, or a montage of photos. For our first selection we are featuring "Travels with the Dean". This past summer, Dean Nikias vacationed in Paris, France with his family. Finding himself there on July 4th, he spent a patriotic day visiting the French stomping grounds of several of America's founding fathers.

Travels with the Dean:
An American's Pilgrimage in Paris

17 Rue de Richelieu

During John Adams' second visit to Paris, John and Abigail Adams lived at the Hotel de Valois on 17 Rue de Richelieu. John Quincy Adams would remember it as "magnificent", one of the most fashionable streets in Paris.
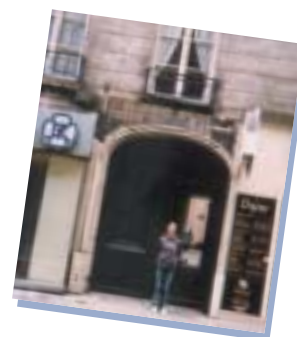
Corner of the Champs-Elysees and the Rue de Berri

While Thomas Jefferson lived at the corner of the Champs-Elysees and the Rue de Berri, the newly built Hotel de Langeac, had 24 rooms, an indoor toilet, and a 'clever garden'. Not satisfied with it as it was, Jefferson redesigned and reconstructed much of the house.

He enrolled his daughter, Martha (Patsy) Jefferson in the most fashionable and most expensive convent school in Paris, the Abbaye Royale de Panthemont on the Left Bank.

Village of Passy and Village of Auteuil

Benjamin Franklin, as Minister to France, lived in a garden pavilion, part of the magnificent Hotel de Valentois, a columned chateau on the heights of the village of Passy, overlooking the Seine. It was the estate of a generous friend of the American cause, Jacques Donatien Le Ray.

The first time John Adams visited Paris, he stayed with Benjamin Franklin. Adams enrolled his son, John Quincy Adams, at boarding school in Passy. John Adams would take his daily walks or ride horseback by the river Seine.

"Nature and art have conspired to render everything here delightful", said John Adams about the place.

John and Abigail Adams also lived in a large house with a garden on the outskirts of the city, just beyond Passy in the still-rural village of Auteuil. Like Passy, Auteuil was set on an airy hill above the Seine and adjoined the beautiful Bois de Boulogne.

Source: *John Adams* by David McCullough

If you have made an interesting trip, had a fascinating cultural experience, or have a memorable story you would like to share, please write us about it and send photos to USC Engineer at uscengineer@usc.edu. We would love to feature your story in the 2003 Spring/Summer edition.

Your education has carried you this far...
... but is it far enough?
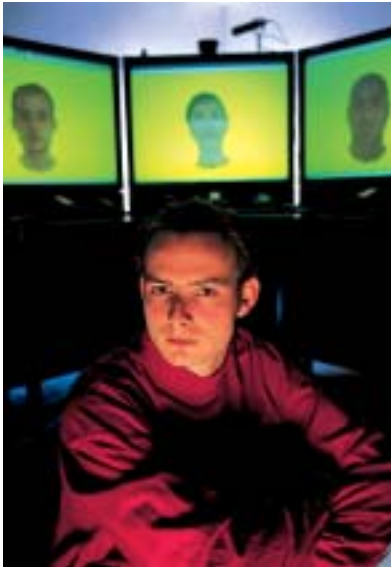
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Ricardo Valerdi, MSSAE '02
Motorola CGISS
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Will Otaguro, Chief Scientist
Boeing Co, MHPCC.
Maui, HI

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