University of Southern California • Spring 2011

USC Viterbi // Engineer

Ming Hsieh: A Clear Vision

HTE@USC AND THE BIOMEDICAL FUTURE // THE NAE CHALLENGE OF SECURING CYBERSPACE
NEXT-GENERATION SOUND RENDERING

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Phil-Alma Mater => Philo-Paideia => Phil-Anthropy

In a recent edition of the *Atlantic Monthly* I read about the interesting new term *philanthrocapitalism* to capture the emerging trend of viewing and practicing philanthropy as an investment or venture capital. From the perspective of an academic institution, and specifically that of an engineering school, this has interesting ramifications.

Philanthropic support of the academic and research mission of universities has been a strong American tradition, since the early existence of the university as an institution, several centuries ago. It recognizes the ethos that advancing society is a matter of individual responsibility, rather than, or in addition to, the burden of a distant government agency. This distinctly American view, also related to that of the ancient Athenians, elevates the concept of citizenship in a truly participatory and enabling way.

Philos *Greek.* "love of"

Alma Mater *Latin.* "nourishing mother"

Paideia *Greek.* "child-rearing" or "system of educational institution"

Anthropy *Greek.* "humanity, mankind"

Traditionally, the support of the *alma mater* has captured the lion's share of educational philanthropy. It is deeply rooted and remarkable. It emanates from the emotional connections with the university and its essence: the cultivation of the mind and the spirit, the campus life, the university traditions. It reinforces the notion of the university as a *place* and an *environment*. It is a lifetime affiliation without borders. It is a sentimental, an affectionate "push." I tried to coin this affection-driven process by the first word in the title, using a mix of Greek and Latin words. (A Google search resulted in a rather different play on words! Nike's *Phil* Knight Decides To Renew Donations To *Alma Mater*).

Enlightened philanthropy of educational institutions, however, increasingly transcends the emotional "push" from the past. It is also driven by an attraction of the "pull" from a present that has irresistibly grown from an inspiring vision. Trust and confidence in the leadership and goals of the institution and a vision that will benefit humanity in the larger sense cements committing one's legacy in this manner. In the title, I coined for this the term Philo-Paideia, in its modern connotation, which denotes the support and affection for education in general: I guess this is my higher-education version of *philanthrocapitalism*!

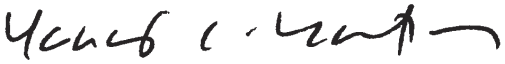
In its literal sense, "philanthropy" means "love of humanity." Whether inspired by loyalty or vision, the support of the educational mission advances and collectively benefits humanity at large. And in our current Knowledge Era, educational institutions, and particularly engineering schools, on behalf of one I can speak, are the catalysts and incubators of these benefits. Indeed, engineering is empowering society in ways unimaginable just a few years ago. At the Viterbi School, we call this transformative, enabling, power "Engineering+." It is a vision with the potential to inspire all the Greek and Latin word versions I concocted above—including *philanthrocapitalism*.

Which brings me to Ming Hsieh, a member of the Viterbi School Board of Councilors, a USC Trustee and an engineering alumnus of our university.

You will read about him at length in this issue. A native of China, Ming named the electrical engineering department where he studied for his undergraduate and master's degrees before going on to achieve great entrepreneurial success. Now he has made a second gift that will marshal the disciplines of engineering and medicine to combat cancer, a disease whose global mortality rate is estimated to double by 2030.

He has moved from the "push" of his Viterbi alumni ties to the "pull" of a vision that has been cultivated in the Viterbi school for several years now, that of Engineering+. His transformative gift will enable engineers and medical scientists to collaborate on a mission that will benefit humanity. In this process, Ming has followed the path from Phil-Alma Mater to Philo-Paideia and is demonstrating that philanthropy has no borders, country of origin, or limits in vision.

He has become the quintessential *philanthrocapitalist.*



Yannis C. Yortsos
Dean, USC Viterbi School of Engineering

Y.H. Cho's Vision Spawns Three Research Centers

AVIATION RESEARCH COLLABORATION SPANS DISCIPLINES AND OCEANS

by Angus McColl

Y.H. Cho

The Korean Air Chairman Creates an Effective Model for R&D Partnership

For almost a decade, the leadership and highly creative vision of Y. H. Cho (MBA'79), chairman and CEO of Korean Air, has been instrumental in funding collaborative research between three leading universities and major global corporations for the advancement of aviation technology.

In 2003 Cho offered the idea of creating the research institutes when USC President C. L. Max Nikias was the dean of the USC Viterbi School of Engineering. Appreciating Cho's talent and passion for education and new technologies, Nikias formed a joint institute called PWICE (Pratt & Whitney Institute for Collaborative Engineering), initiating an academic-industrial collaboration.

Cho's idea eventually led to three institutes that support research at the USC Viterbi School of Engineering, Inha University and Korea Aerospace University as well as benefiting Korean Air, Pratt & Whitney, Airbus and General Electric. The other two institutes are the Aerospace Institute for Engineering Research (AIER), and the Korean Air – General Electric Research Institute for International Collaboration (KAGERIIC).

Viterbi Dean Yannis C. Yortsos notes, "We are doing something that is truly unique and global. We are grateful for Chairman Cho's leadership in articulating and helping implement this vision."

Cho is a member of the USC Board of Trustees and the Viterbi School Board of Councilors, as well as chairman of the boards of trustees of Inha University and Korea Aerospace University (KAU).

Each institute pursues technology research through a multi-pronged collaboration between USC, the Korean universities, Korean Air and a sponsoring company (Pratt & Whitney, Airbus or General Electric). Besides providing research funds for the Viterbi School, the Institutes enable postdoctoral fellows and Ph.D. students to collaborate with Korean colleagues and engineers and project managers from major aerospace companies.

"We are now at the point where engineers of Korean Air and the three aerospace and aviation-related companies, and faculty leadership of Inha, KAU and the Viterbi School really know each other well," says Yortsos. "We have succeeded in bridging continents and cultures and conducting state-of-the-art collaborative research."

Viterbi Dean Yannis C. Yortsos with H.J.Cho of Korean Air (not related to Y.H. Cho)

The Pratt & Whitney Institute for Collaborative Engineering (PWICE)

PWICE began in 2003 with a $5 million endowment from Pratt & Whitney, a long-term supplier of jet engines to Korean Air. Early projects drew heavily on the research expertise of Viterbi faculty in the Signal and Image Processing Institute (SIPI). Because it is endowment-funded, the Institute could continue in perpetuity.

The first PWICE project developed a three-way teleconferencing system prototype. It displays and exchanges jet engine performance data and inspection imagery while enabling discussion among maintenance personnel and staff at the Korean Air Operations Center as well as Pratt & Whitney headquarters. The Viterbi School's Shri Narayanan led the project, working with Yoo-Sung Kim at Inha, and Roger Zimmerman, formerly at USC and now at National University of Singapore. In 2008, researchers at Inha incorporated feedback from Korean Air to develop an additional module to address specific jet engine maintenance needs.

A second PWICE project, led by Viterbi's Jay Kuo, developed a system to embed a "watermark" digital signal on audio CDs for in-flight entertainment. This ensures the audio tracks are free of defects that can occur in the CD copying process.

In 2009, Kuo and Oh Kyu Kwon of Inha began a third PWICE signal processing project to monitor and analyze acoustic and vibration data to measure the health of operating jet engines. This research could lead to a system to detect slight damage or excessive wear in rotating components such as jet engine turbine rotors, compressors, bearings and fuel pumps. Such a system could allow early intervention by maintenance personnel to prevent failure of a jet engine, thus saving time and money. It would be a powerful tool to predict and prolong jet engine service life.

The Aerospace Institute for Engineering Research (AIER)

AIER was funded in 2007 with $5 million from Airbus and three projects begun in 2007 are now complete or on course to be completed by the publication of this magazine.

The first project, "Video Assisted Tracking," produced a prototype to assist the flight crew with last-minute decision-making. Demonstrated successfully in a training aircraft in 2010 at KAU, the system identifies moving objects on the runway, setting off an alarm during final approach if the runway is unsafe. Viterbi's Gerard Medioni led the team, which included Myeong-Jin Lee of KAU and Sanggil Kang of Inha, with USC's Jong-moo Choi playing a key liaison role.

The second AIER project, "Intelligent Augmented Reality" (IAR), is a system that fuses intelligent graphical overlays with real-time video imagery to assist aircraft maintenance workers performing complex repair or maintenance procedures. Led by Viterbi's Ulrich Neumann and Inha's Geun-Sik Jo, the researchers successfully demonstrated a prototype providing IAR capabilities for maintenance and repair of an Airbus A-330 landing gear strut in 2010.

Viterbi's Steve Nutt led the third project. He worked with Won-Jong Choi of KAU and Jin Yeon Cho of Inha to develop two composite materials technologies. "Out of Autoclave Vacuum Bag Only" is a manufacturing process to build composite parts without using an autoclave oven. The second technology simplifies the repair of Airbus' proprietary GLARE composite material in case of in-service damage.

The Korean Air—General Electric Research Institute for International Collaboration (KAGERIIC)

KAGERIIC was organized in 2008 with $5 million from General Electric. USC participated in two of the first three projects, all of which have been completed.

In the first, the research team created software to automate the detection and validation of flaws in composite parts. Viterbi's Steve Nutt and Changzheng Huang collaborated with Oh Yang Kwon of Inha, Joong-Hwan Baek and Wong-Jon Choi of KAU, on the "Automated Defect Evaluation System." This technology liberates skilled operators from the mundane task of manually scanning composite parts to detect flaws using ultrasonic non-destructive test (NDT) equipment. Its adoption may help ease a shortage of skilled NDT equipment operators as the aerospace composites industry expands. Successfully demonstrated in 2010, the software is adaptable to ultrasonic NDT equipment made by various companies, including GE.

For the second project, Viterbi's Ram Nevatia and Peter Tu of GE worked with Inha's Phill-Kyu Rhie and KAU's Joong-Hwan Baek to integrate various video technologies into a perimeter security system and demonstrated it in a field test in 2010. The system can recognize suspicious events, track persons of interest, and alert operators to send security forces. Sung-Chun Lee of USC played an important developmental and liaison role and facilitated communication between team members. //

Humayun, Requicha Elected to National Academy of Engineering

TWO MORE VITERBI FACULTY EARN THE HIGHEST PROFESSIONAL DISTINCTION ACCORDED AN ENGINEER

Retinal prosthetics pioneer Mark S. Humayun and nanorobots expert Aristides A. G. Requicha have been elected to the National Academy of Engineering's Class of 2011.

The two are among 35 academics elected this year; in total, 68 members were elected. This is the third consecutive year that two Viterbi faculty have been tapped to join the NAE, and this year USC is one of only six academic institutions with two or more members elected. Engineers are elected to the NAE by their peers for having distinguished themselves in research, technical positions and leadership in industry, government and academia.

Humayun, a professor of biomedical engineering as well as an ophthalmology, cell and neurobiology professor at the Keck School of Medicine, focuses on the treatment of eye diseases through engineering prosthetics. He is a co-inventor of a revolutionary electronic retinal prosthesis, an implantable artificial device that has restored light perception and form distinction to blind individuals. He holds 18 patents with nearly 90 more pending, and directs the NSF Engineering Research Center on Bio-Mimetic Electronics Systems.

Mark S. Humayun

Aristides A.G. Requicha

Humayun received his undergraduate degree from Georgetown University, his medical degree from Duke University, and a Ph.D. in biomedical engineering from the University of North Carolina. He came to USC in 2001.

A pioneer in the field of nanorobots, Requicha joined the Viterbi School's computer science and electrical engineering faculty in 1986. His research interests include sensor/actuator networks, robotics and automation, computer graphics and artificial intelligence. He was one of the first to develop the technology of 3-D geometric modeling. He is founding director of the USC Viterbi Laboratory for Molecular Robotics and former director of the USC Programmable Automation Laboratory. He is a Life Fellow of the Institute of Electrical and Electronics Engineers and Fellow of the Association for Computing Machinery, among other distinctions.

A native of Portugal who is fluent in four languages, Requicha received his Engenheiro Electrotécnico degree from the Instituto Superior Técnico, Lisbon, and his Ph.D. in electrical engineering from the University of Rochester. //

CROSSING THE BORDER

THE VITERBI SCHOOL PARTNERS WITH THE AUTONOMOUS NATIONAL UNIVERSITY OF MEXICO

Juan Marcos Mendoza, Yannis Yortsos and UNAM Dean Gonzalo Guerrero Zepeda.

The Viterbi School celebrated its ties with the Autonomous National University of Mexico (UNAM) last fall with a meeting in Los Angeles aimed at celebrating a collaborative program launched in 2008.

The group also discussed broadening the scope to include other USC schools.

Mexico City native and biomedical engineering professor Francisco Valero-Cuevas was instrumental in facilitating the December 2008 agreement that launched the USC-UNAM collaboration.

"We look forward to broadening the interaction to include the arts and music, medical science and more," said Valero-Cuevas, who at 19 had received a scholarship to study in the United States. "Engineering is the start, but we hope to expand."

Viterbi Dean Yannis C. Yortsos noted that Mexico is an obvious place for USC to collaborate. "And UNAM is the oldest university on the continent," he said. "Mexico City and Los Angeles share numerous common problems, such as how to best plan for megacities."

A Viterbi contingent of various deans and faculty visited UNAM in 2008, and the trip initiated a series of exchanges, including a program whereby three UNAM undergraduates spent the summer at USC as research interns.

Mexican Deputy Consul General Juan Marcos Mendoza noted that this year is the 200th anniversary of Mexican independence, and the 124th year since the establishment of a Mexican consulate in Los Angeles. "We need to communicate for the common future," Mendoza said. "We can both learn from each other."//

Smart Cars for Megacity Drivers

NEW AUDI INITIATIVE TACKLES CONGESTION, DRIVER INCONVENIENCES

Petros Ioannou

Drivers in the world's biggest cities face a daily stress-fest of traffic congestion and safety hazards.

Petros Ioannou wants to make the ride just a little bit easier for everyone.

The electrical engineering-systems professor and his Center for Advanced Transportation Technologies has been competitively selected to partner with the new "Audi Urban Intelligent Assist" project.

Ioannou will work with Audi, its Electronics Research Laboratory (ERL) in Silicon Valley and three other academic institutions in a three-year effort to develop technologies aimed at easing the congestion, dangers and inconveniences that often confront drivers in the world's biggest "megacities."

The vision is to develop Audi model prototypes that will interact with the urban environment in an effective way, taking the concept of a connected car and infrastructure electronics to the next level.

The car will monitor individual drivers and record their driving characteristics, habits and preferences. Armed with that knowledge, the vehicle's advanced systems will be able to assist the driver by providing information and assistance, boosting safety and mobility, and helping avoid perceived dangerous situations and areas.

For example, the vehicle might tap models of a city's infrastructure to reserve a parking spot near the driver's desired destination. Or the vehicle might plot an optimal path according to what's happening in real-time throughout the city and based on the individual driver's habits and capabilities.

Other universities tapped in the initiative are the University of California at Berkeley, the University of California at San Diego and the University of Michigan Transportation Research Institute.

The USC group, to be led by Ioannou, has considerable expertise in dynamical systems, vehicles, and traffic flow and control. It has completed a wide range of projects in areas such as steer and drive by wire control; modeling and identification of brake dynamics, and microscopic and macroscopic traffic simulations.

Ioannou has received IEEE and IET awards for his work in the area of intelligent vehicle and transportation technologies, in addition to several prior awards in control systems. He is the author or co-author of eight books and more than 200 papers in the area of control systems and transportation. //

WHAT'S POSSIBLE WITH INTELLIGENT ASSIST

1 SMART ROUTING AND DESTINATION

- Connect to remote server to get urban data
- Estimate traffic along the route
- Use micro-simulations to predict traffic flow
- Diagnose driver preferences, stress level, etc.
- Evaluate public transportation options
- Make recommendation based on driver preference and real-time information

2. PARKING ASSIST

- Detect driver's parking preferences
- Connect to remote server to determine parking availability near destination
- Inform driver of available options
- Reserve spot 15 minutes ahead of time

3. ADAPTIVE CRUISE CONTROL

- Detect driver's level of distraction
- Modulate time gap to vehicle ahead
- Warn driver to slow down when car is too close
- Determine distance to traffic lights and stop signs

i-Podia™ Adds Third Partner Institution

NATIONAL TAIWAN UNIVERSITY JOINS PEKING UNIVERSITY AND VITERBI IN THE INNOVATIVE CROSS-CULTURAL EDUCATION INITIATIVE

For the next generation of teaching innovations, engineers are creatively applying advanced distance learning technologies to bring together students from all over the world.

With Peking University (PKU) in Beijing and a new partner, National Taiwan University (NTU) in Taipei, the USC Viterbi School is expanding the cross-cultural cooperative education program i-Podia™ (formerly i-Podium). The program builds on last year's successful pilot course taught in collaboration with PKU.

Deploying i-Podia requires the coordination of 60 students meeting simultaneously in classrooms located in three countries and three time zones. The Distance Education Network (DEN) enabled this effort, which is changing the distance education practice to become the "no-distance learning paradigm."

"i-Podia is best explained as an evolution of pedagogy," says Stephen Lu, the David Packard Chair in Manufacturing Engineering, who started the program in 2009. "Some assume it's an advancement of technology, but the same technology has existed for years."

During nearly 40 years, the Viterbi School's distance education programs have grown enormously in popularity as new technologies rapidly evolved. But the fundamental format continues to be based on the classic model of higher education learning: A teacher at a podium using the Internet to deliver lectures to remote students.

What if the question is of a socio-technical nature, and the answer depends on contextual understanding among stakeholders? What if the instructor doesn't have all the answers? What if dialogue is more effective than monologue? What if we let students exploit cultural diversity at home to inspire global innovation?

i-Podia posits those pedagogical questions and ramps them up in practice to a global scale to break the physical, organizational and cultural boundaries of learning. i-Podia becomes a multi-nodal interaction among many students from multiple universities in different disciplinary, physical and cultural environments. With i-Podia, one podium at USC becomes a world classroom for all.

"In this new global landscape, leadership is no longer about being in front. It's about being the hub," says Viterbi Dean Yannis C. Yortsos. "The Viterbi School will develop and refine this global education innovation to link top institutions around the globe. This is just the beginning."

The addition of NTU this semester raises the bar to the scale at which i-Podia was originally envisioned when it was launched in spring of 2010 with PKU as partner. The latest course, entitled "Principle and Practice of Global Innovation," leverages the i-Podia platform by using case studies and team projects. Principles taught in class are validated by real-world cases, and students have dynamic conversations within the interactive learning environment to construct solutions in a collaborative manner. //

USC students in classroom on campus in Los Angeles, watching as a live video stream connects the classroom with counterparts at Peking University in Beijing and National Taiwan University in Taipei. Viterbi professor Stephen Lu and Dean Yannis C. Yortsos are in the foreground.

Onscreen are images of student counterparts at National Taiwan University, Peking University and two presenters from Blackberry.

A New Home for ICT

EXCEEDING EXPECTATIONS— AND ITS ORIGINAL RESEARCH FACILITIES

Photo by Steve Cohn

John Miller, left, Randall W. Hill Jr., USC President C. L. Max Nikias, Bill Allen, Scott Seigler and Karen Kukerin at the opening of the new Institute for Creative Technologies building.

The USC Institute for Creative Technologies (ICT) drew a group of luminaries to its new location in Playa Vista last fall for a ribbon-cutting ceremony.

USC President C. L. Max Nikias and guests from the military, state, city and entertainment industries were on hand, along with ICT executive director Randall W. Hill Jr.

The event showcased the Institute's new LEED-certified building and the latest immersive technologies being developed. These technologies have already had a dramatic impact on military training, mental health treatment and movie special effects.

"In many ways, ICT represents USC at its very best," Nikias said at the podium. "As a university, we truly shine in the area of applied research. We focus on solving societal problems. We concentrate on improving people's lives."

Hill read from the original U.S. Army contract that established ICT as a university-affiliated research center at USC: "ICT will be a joint effort of the Army, the entertainment industry and academe—an innovative team to advance dazzling new media and ultimately benefit training and education for everyone in America."

ICT's technology prototypes can be found on close to 70 military installations and have benefited more than 50,000 troops. Its virtual human technologies teach negotiation skills to soldiers, train clinicians in how to interview patients and answer students' questions about science and technology.

Its visual effects techniques are used in major motion pictures and were recognized with an Academy Award last year.

The move to the new building, which features a large theatre, was prompted by the institute's growth from just a handful of researchers a decade ago to a current staff of close to 200. Its researchers include 13 faculty members from the USC Department of Computer Science. //

PH.D. STUDENT WINS ONE OF IEEE'S HIGHEST HONORS

AWARD RECOGNIZES HIS 'DIGITAL BATTLEFIELD' CREATION

IEEE

Neil G. Siegel is not your typical Ph.D. student.

For one thing, he's a member of the National Academy of Engineering. For another, he has more than 20 patents spanning real-time manufacturing, medical systems, communications protocols and computing systems.

And now Siegel is receiving the 2011 IEEE Simon Ramo Medal after becoming an IEEE Fellow, the organization's highest grade of membership. A doctoral candidate in the Daniel Epstein Department of Industrial and Systems Engineering, Siegel is a vice president and chief engineer for Northrop Grumman Corporation's Information Systems sector.

"It isn't too often that you have a grad student who's a member of the National Academy," said Barry Boehm, Siegel's principal faculty advisor. "I've been very impressed with him." Coincidentally, Boehm, the Thompson Ramo Wooldrige (TRW) professor of software engineering, received the Ramo Medal last year. In 2008 the honor went to USC President C. L. Max Nikias.

The medal honors exceptional achievement in systems engineering and systems science, and commemorates the distinguished engineering contributions of Simon Ramo. Ramo was one of the founders of TRW, which was acquired by Northrop Grumman in 2002. His wife, Virginia Ramo, who passed away in 2009, was a longtime member of the USC Board of Trustees.

Siegel was honored for pioneering engineering at Northrop Grumman "that led to the successful development of the digital battlefield, a life-saving and integral part of U.S. Army operations," according to IEEE.

His system is deployed on tens of thousands of vehicles worldwide, including in Bosnia, Kosovo, Afghanistan and Iraq. It is credited with significantly increasing U.S. Army combat effectiveness and for saving the lives of hundreds of soldiers.

Siegel also helped develop the Army's first unmanned aerial vehicle and invented important techniques for the development of large-scale, real-time software systems. He has worked in the steel, movie and other commercial industries.

Siegel earned his bachelor's and master's degrees in mathematics at USC. He became a vice president at Northrop Grumman in 1998. //

Astronautical Engineering at USC

FILLING THE EDUCATIONAL GAP

Dan Erwin

In 2010 the Viterbi School officially changed to departmental status a unit that had been launched in 2004 as an academic division.

The Department of Astronautical Engineering— formerly the Astronautics and Space Technology Division—is now at par with all other academic departments in the USC Viterbi School of Engineering.

This field of space engineering is critically important for national security and economic competitiveness, yet studies predict an alarming shortfall in astronautical engineers.

Academia usually combines astronautics and aeronautics into aerospace departments and programs, where non-aerospace faculty dominate the curriculum.

"The academic world is almost devoid of professors with real experience in the space industry," says Mike Gruntman, a professor of astronautics who served as founding chair of the division from 2004-2007.

A National Research Council study on NASA-university relationships notes that "interest in space-related disciplines is burgeoning among undergraduates, but the universities are ill-prepared to capitalize on the opportunity."

Not USC. Viterbi faculty and staff developed a full set of degrees within the program, and all are successful.

"We look forward to continuing to meet the needs of the space industry and government R&D Centers by graduating bright young astronautical engineers," says Dan Erwin, the department's current chair.

The department master's program, in particular, is among the largest in the nation, reaching students across the United States through the Distance Education Network. During the last four years, the Viterbi School awarded more than 150 master's degrees in astronautical engineering. //

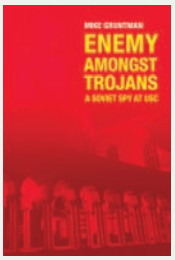
L-R: NASA Administrator Charlie Bolden at the USC booth at the 2011 AIAA Aerospace Sciences Meeting in Orlando, Fla, with staffer Billy Schwerin and astronautics professor Mike Gruntman.

Asia Meetings

In the fall of 2011, Viterbi Dean Yannis Yortsos embarked on a trip to Shanghai, Beijing and Hong Kong to meet with students, USC parents and supporters of the School. Here, Yortsos meets with several parents and alumni at a reception in Hong Kong. Katherine Aschieris from the Viterbi Office of External Relations holds the red USC banner.

Enemy Amongst Trojans

TELLING THE STORY OF A USC INSTRUCTOR—AND SOVIET SPY



A part-time political science instructor at the University of Southern California vanished from a California beach in 1945.

Several years later the U.S. Congress described the man as an important Soviet spy whose true identity remained a mystery.

Recently de-classified documents reveal what happened to this enigmatic Soviet military intelligence officer in Los Angeles.

And Viterbi professor Mike Gruntman reconstructed the story in his book *Enemy Amongst Trojans: A Soviet Spy at USC*, published in 2010 by Figueroa Press.

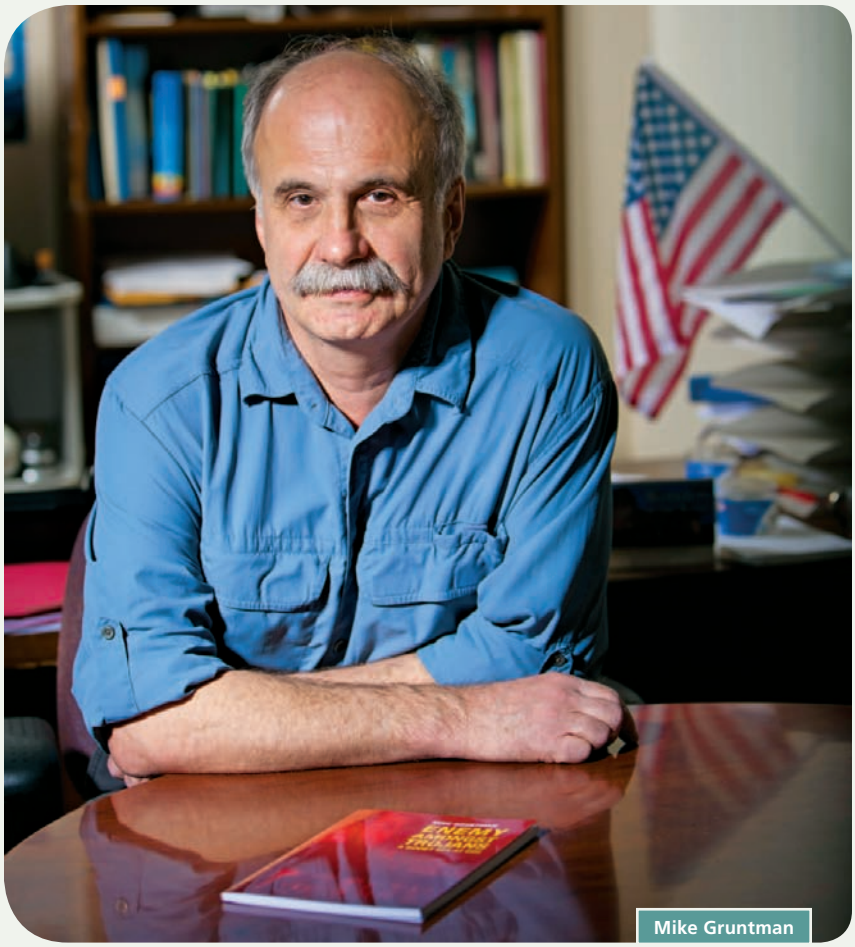
The book traces the story of Ignacy Samuel Witczak, who received his bachelor of arts degree from USC in 1942 and a master's in political science in 1943. He then continued to pursue his doctorate and worked as a part time instructor at the University.

The story goes like this: In 1939 a Soviet military intelligence officer named Zalman Litvin arrived in the U.S. under the name Witczak, an identity borrowed from a naturalized Canadian who fought in the Spanish Civil War in the late 1930s.

The chief spy, or "rezident" of the Soviet military intelligence in Los Angeles, Witczak-Litvin took advantage of his cover as a USC student to support espionage operations against Japan and the United States. His resumé as a USC student was stellar; he even belonged to the Phi Beta Kappa and Phi Kappa Phi honor societies.

The book unravels a plot that includes Witczak-Litvin's recruitment of agents, his achievements as a USC student, fraudulent passports, the Spanish civil war, an FBI investigation, and secret messages. It ends with the eventual unmasking of Witczak-Litvin, who fled to the Soviet Union where he faced hostility and state-directed anti-Semitism.

Gruntman stumbled upon the story of the mysterious Trojan while researching his earlier book on rocket history *(Blazing the Trail: The Early History of Spacecraft and Rocketry)*, in which he looked into the possibility of Soviet espionage in America's ballistic missile program in 1940s.


Mike Gruntman

Throughout much of the last half of the 20th century, there had been no information about Witczak's true identity or even how he came to leave the country.

But in the 1990s new information came to light in an FBI agent's memoirs as well as the National Security Agency's declassification of its Verona project, which included deciphered 1940s-era cables between the chiefs of Soviet intelligence in the United States and Moscow.

Enemy Amongst Trojans is the result of Gruntman's exhaustive search of historical documents, various publications and declassified archives, including those of British counterintelligence MI-5.

Gruntman says that this spy story could be a great "teachable moment." It involves elements of history, international relations, the behavior of politicians, and the concept of the free world versus totalitarian socialist societies.

The story also involves characters prominent in the history of espionage—such as Igor Gouzenko and Kim Philby—and offers a glimpse of life in Los Angeles as well as at USC during the 1940s.

Gruntman is a professor of astronautics who is actively involved in R&D programs in space science and space technology. He served as the founding chairman of the VSOE Department of Astronautical Engineering from 2004-2007. He researched the book while serving as co-investigator on two NASA missions.//

Smart Fence System Recognizes Bad Neighbors

VITERBI TEAM'S INTRUDER RECOGNITION SYSTEM COMING TO AN AIRPORT NEAR YOU

Alireza Dibazar

A prizewinning perimeter-protection system created by Viterbi researchers is now moving to deployment at a Florida airport, and is being considered for use in other airports.

Dubbed "Smart Fence," the system is a multi-sensor program that overlaps sound, impact and seismic data to drastically reduce false-positive alarms.

Led by Alireza Dibazar, assistant professor of computational neural engineering and co-director of the USC Laboratory for Neural Dynamics, the team presented a research paper at the IEEE Homeland Security Conference in November 2010 and took the Best Paper Prize. It was entitled "Intelligent Acoustic and Vibration Recognition/ Alert Systems for Security Breaching Detection, Close Proximity Danger Identification, and Perimeter Protection."

According to a summary by Dibazar, this smart sensor system recognizes spatio-temporal sensor patterns of perimeter intrusion "by foot, by fence, and by vehicle for the purpose of protecting remote fenced or virtual perimeters against unauthorized access or terrorist attack on Transportations Safety Administration airport property." The system's novel approach allows target intrusion sounds to be identified by customers with specific needs.

For example, in its use at airports, the sensors were trained to ignore typical fence manipulation (kicking, leaning, shaking) by visitors who gather at end-of-runway fence lines and watch landings and take-offs. However, the same fence system actively raises alerts if the fence is climbed or if someone attempts to breach the perimeter. In turn, the ground sensors ignore the presence of large jets, but raise alerts for human footsteps in unauthorized areas and can be programmed to either raise alerts or to simply report the presence of vehicles in certain protected areas. Dibazar notes that "all the sensors slew video cameras to the origin of the intrusion event for threat identification."

Counterclockwise from top left: motion sensor installed on a fence; acoustic sensor; seismic sensor, The Smart Fence team setting up ground sensors.

The system builds on previous systems created by team member Ted Berger, a USC biomedical engineering professor who created an alarm system called SENTRI that can distinguish the sound of a gunshot from firecrackers, car backfires and other similar noises, and then, like the Smart Camera application, direct a videocamera to the site of the sound. Marketed by Tucscon-based Safety Dynamics, SENTRI is now in use in many cities.

In testing, Smart Fence showed a perfect (100%) identification of unexpected intrusion events, and an average of less than two false positives per week and zero false negatives for recognition of human footsteps. In addition, no false positives or false negatives were reported by the installed fence sensors for a duration of 45 days of unattended operation, which included several days of seasonal storms.

Another round of tests is scheduled to begin in late February, according to Dibazar. "We are going to install the technology at the new Panama City airport," he says, "for the purpose of obtaining approval and certification by Naval technology assurance officers to sell the system to the TSA." Dibazar said the Dallas Fort Worth airport and Randolph Air Force Base in San Antonio, Texas are also looking to vet the cutting-edge technology.

The research grew out of an initiative by the Transportation Safety Administration (TSA), which approached the U.S. Navy to create a perimeter safety system. In 2010 the USC system was selected for intensive development. Research funding came from the Office of Naval Research and from a Navy CPP grant.

In addition to Dibazar and Berger, the Smart Fence team includes research associates Hyung O. Park, Bing Lu, Ali Yousefi , Hisham Qureshi, and Sageev George. //

New Viterbi School Faculty

THIS VERY DISTINGUISHED GROUP IS LED BY A NEW CHAIRED PROFESSOR

Dorit S. Hochbaum joins the Daniel J. Epstein Department of Industrial and Systems Engineering from UC Berkeley, where she was a professor of business administration and of industrial engineering and operations research. A full professor, she holds the Daniel Epstein Chair.

Hochbaum's distinguished career spans the fields of mathematics and management. Her research interests are in areas of supply chain management, efficient utilization of resources, computer algorithms and discrete optimization.

She earned a B.Sc. in mathematics from Tel Aviv University, an M.Sc. in mathematics from Hebrew University Jerusalem and a Ph.D. from Wharton School of Business at the University of Pennsylvania.

Vasilis Marmarelis has returned to the Viterbi School faculty after taking a break to create a startup company in Greece. He has appointments in the Department of Biomedical Engineering—which he chaired from 1990 to 1996—and the Ming Hsieh Department of Electrical Engineering.

His research interests lie primarily in systems analysis and signal processing with applications to physiology and medicine, in particular, the role and importance of dynamic nonlinearities and nonstationarities in physiological function.

Marmarelis is co-director of the Biomedical Simulations Resource (BMSR). He received his diploma in electrical and mechanical engineering from the National Technical University of Athens, his M.S. in information science, and his Ph.D. in engineering science from the California Institute of Technology (Caltech).

Mike Shuo-Wei Chen joined the Ming Hsieh Department of Electrical Engineering in January 2011 as an assistant professor. From 2001-2006, he was a member of the Berkeley Wireless Research Center, and also worked on mixed-signal and RF circuits for various wireless and wireline communication systems at Atheros Communications.

He received his B.S. from National Taiwan University and his Ph.D. and M.S. from UC Berkeley.

Yan Liu, a new assistant professor in the Computer Science Department, comes to USC from IBM Research, where she was a research staff member.

Her research interests include developing scalable machine learning and data mining algorithms with applications to social media analysis, computational biology, climate modeling and business analytics. She received her M.Sc and Ph.D. degree from Carnegie Mellon University.

Alejandro Toriello joined the Daniel J. Epstein Department of Industrial and Systems Engineering as an assistant professor in 2010 after earning his Ph.D. in Industrial Engineering from Georgia Tech.

His research interests are in supply chain management, logistics and transportation, discrete optimization and dynamic programming. His thesis covered a time decomposition of supply chain models, with specific applications in maritime transportation and inventory management.

Jongseung Yoon has joined the Mork Family Department of Chemical Engineering and Materials Science as an assistant professor.

Yoon's research interests are in exploiting various classes of micro/nanomaterials and heterogeneously integrating them in two and three-dimensional layouts into functional devices so that their electrical, optical, mechanical, and thermal properties are optimally combined for advanced applications in energy-harvesting, photonics, electronics, and sensor technologies.

Yoon received his B.S. from Seoul National University in South Korea and his Ph.D. from MIT. //

Dorit S. Hochbaum

Vasilis Marmarelis

Mike Shuo-Wei Chen

Yan Liu

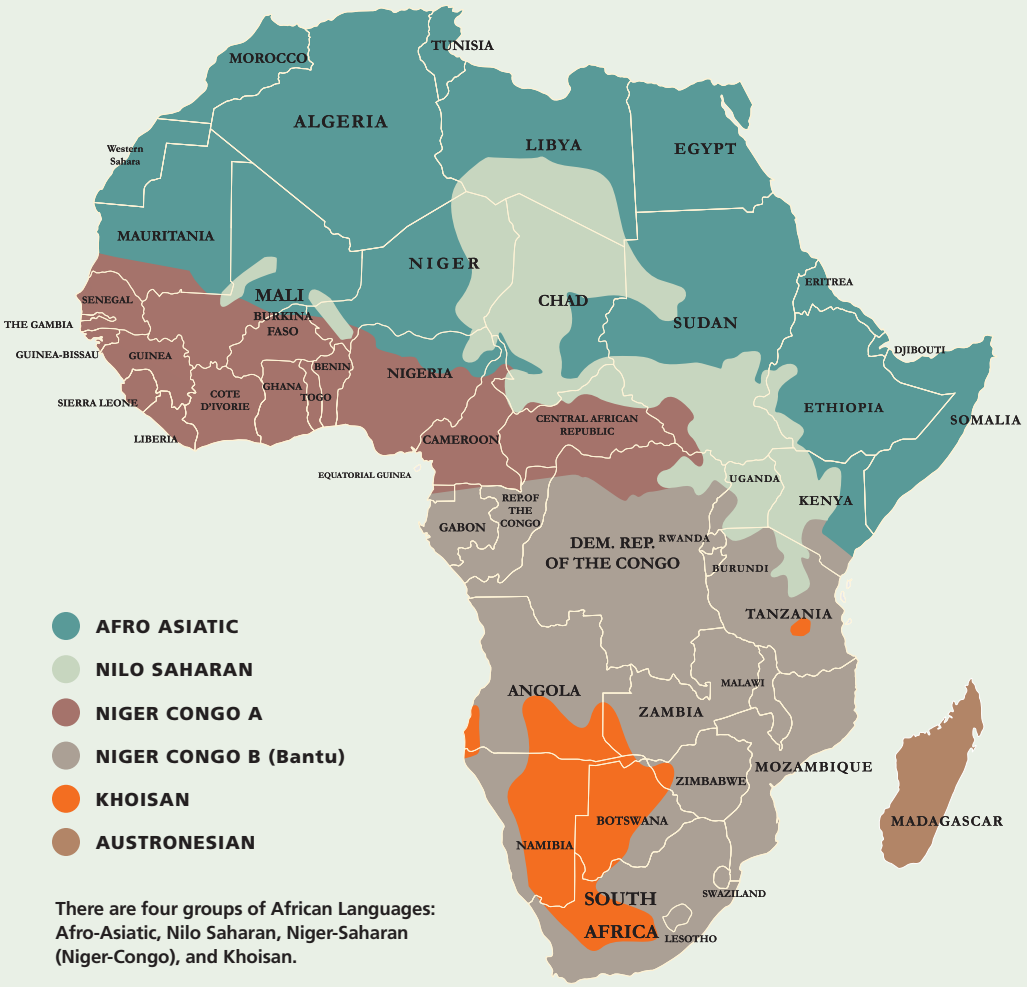
Alejandro Toriello

Jongseung Yoon

Out of Africa, Into Grammatical English

TRANSLATING THE WORLD'S LESS-WIDELY SPOKEN LANGUAGES

Map of the Distribution of African Families and Some Major African Languages



There are four groups of African Languages: Afro-Asiatic, Nilo Saharan, Niger-Saharan (Niger-Congo), and Khoisan.

Millions of texts exist in electronic form for languages such as Chinese and Russian. They provide computer scientists ample resources for creating programs that translate, say, English to Chinese.

Yet such abundant text resources don't exist for most of the world's less-spoken languages.

Translating "low-resource" languages such as those from the Bantu family—spoken in parts of Africa—is the next challenge for Kevin Knight of the Information Sciences Institute (ISI).

Knight, an ISI researcher who helped pioneer early machine language translation systems, will be part of a new five-year, multi-university effort to develop less statistical, more semantic points of attack on low-density languages such as Kinyarwanda and Malagasy.

Funded by the U.S. Army, the team's work also aims to improve state-of-the-art translation for traditional high-resource targets such as Chinese and French.

Current machine translation systems have limited knowledge of linguistic structure, and instead rely on statistical patterns found in large volumes of parallel text (databases which contain the human translated texts in two or more languages).

The team will take an alternative approach by attempting to incorporate the kind of information that human learners of a new language must learn— the wild variations in grammatical structure that characterize symbolic speech.

"Bantu languages have around 18 noun classes," says Knight. "That's an enormous amount of variation that can make existing translation methods ineffective. We need to take it a step further."

New advances will require deeper, more linguistically realistic models of translation, according to the research summary, "integrating what we know about how syntax, word formation, and semantics operate across a wide range of natural languages."

The team will amplify hand-crafted syntactic and semantic knowledge to:

1. *Uncover language-specific and language-neutral semantic representations through comparative language analysis*

2. *Apply these structures to a variety of linguistic tasks including information extraction and summarization as well as translation*

Other participating institutions include Carnegie Mellon University's Language Technologies Institute, the University of Texas at Austin's Linguistics Department, and the Massachusetts Institute of Technology EECS Department. David Chiang of ISI will also be working with Knight.

Knight and Chiang see a future in which everyone reads, writes, talks, and listens in their own language in real-time, with computer software ironing out any language mismatches. //

Shortipedia Wins Prize at Semantic Web Challenge

AIR FORCE FUNDS SOCIAL NETWORK RESEARCH

It's a Little Like Wikipedia, But Shorter

The Knowledge Technologies Group at the Viterbi School of Engineering's Information Sciences Institute has created a system called Shortipedia. The system configures facts contributed by human users through a wiki into a form that the digital Semantic Web system can understand and reason about. The application won third place in the 2010 Semantic Web Challenge.

Shortipedia was developed by Denny Vrandel, a post-doctoral researcher, Varun Ratnakar, a research programmer, and Yolanda Gil, director of the Knowledge Technologies Group at ISI. They collaborated with Markus Krötzsch, a postdoctoral researcher at the University of Oxford.

"I was extremely happy that we were selected as finalists," Vrandelć said. "Many people saw the demonstration and were interested in using our approach for their own work."

The 2010 Semantic Web Challenge accepted only 14 entries that met the minimum criteria for the competition. Six of these entries were selected as finalists by the judges. In the final round, the finalists gave presentations and demonstrations of their system. The awards were announced at the final session of the conference, where the conference's Best Paper Award went to Paul Groth who is a former member of the ISI Knowledge Technologies group.

ISI Studying Social Networking Threats

The Air Force Office of Science Research working through a UCLA-headquartered Multidisciplinary University Research Initiative (MURI) is funding a study at the Viterbi School's Information Sciences Institute to look at social networking threats..

Social networks underpin a new generation of potential terror threats. They play a role in the formation of extremist identities, disseminate propaganda, recruit followers, transmit operational and tactical skills and ultimately aid in the execution of hostile acts.

Yolanda Gil

Kristina Lerman

Kristina Lerman, a project leader at ISI, will work with Aram Galstyan, Yu-Han Chang, and Alex Tartakovsky (USC Mathematics), coordinating with colleagues at UCLA.

The research is data-driven and will bridge gaps between social science, mathematics, and computational approaches to networks by developing models and metrics that will be tested against diverse empirical data sets on human social networks from field, laboratory and web-based settings. //

Celebrating an Environmentalist's Legacy

DAVE YEN'S SYMPOSIUM AND SCHOLARSHIP

Elizabeth Hsiao Yen, Jean-Pierre Bardet, Yannis C. Yortsos

In memory of Teh Fu "Dave" Yen, the Sonny Astani Department of Civil and Environmental Engineering hosted an International Symposium on Advances in Sustainable Environment at USC.

At the event, his widow Elizabeth Hsiao Yen announced a $100,000 scholarship fund in her husband's honor. Viterbi Professor Emeritus George Chilingar also donated $20,000 to the fund.

The October symposium celebrated the Viterbi environmental engineering researcher and Astani professor with research presentations by engineers, academics and students that he had inspired, with speakers coming from all over the United States as well as Mexico, Taiwan and South Korea.

"He was a highly creative geochemistry researcher who specialized in developing innovative green technologies," said Dean Yannis C. Yortsos.

Hung-Li Chang, an engineer from the Cal/EPA Air Resources Board, said he learned two things from Yen: "First is the importance of interdisciplinary study," Chang said.

"The second is that we need passion to fight for a cleaner environment. This is not just a job, and the importance of that passion is what I learned from him."

Yen declined to take a sabbatical year in nearly five decades of service to USC, and was also a published poet in English and Chinese. //

Faculty Accolades

VITERBI PROFESSORIAL AWARDS AND ACHIEVEMENTS

Jernej Barbic, of the Department of Computer Science (CS), has won a CAREER award, which he will use to support research in computer graphics and animation.

Melvin A. Breuer, a pioneer in computer-aided design for digital systems and very-large-scale-integrated circuits and professor in the Ming Hsieh Department of Electrical Engineering (EE), has won the coveted Lifetime Achievement Award of the European Design and Automation Society, and the Educator of the Year Award from the San Fernando Valley Engineers Council.

A Fellow of the Institute of Electrical and Electronics Engineers (IEEE), and an active member and editor of various IEEE journals for many years, EE's **Giuseppe Caire** was elected 2011 president of the IEEE Information Theory Society.

Elaine Chew of EE and the Daniel J. Epstein Department of Industrial and Systems Engineering (ISE) was selected to be one of 15 presenters at the National Academy of Engineering's 16th annual U.S. Frontiers of Engineering Symposium.

Professor **Fokion Egolfopoulos** of the school's Department of Aerospace and Mechanical Engineering (AME) and the Combustion and Fuels Research Laboratory was elected an Associate Fellow of the AIAA.

Panayiotis Georgiou and **Shri Narayanan,** both of EE, received a best paper award at the International Speech Communication Association's Interspeech 2010 annual conference. The group's work was selected over more than 700 papers presented. Narayanan also won a 2010 IBM Faculty Award, which will fund research in behavioral informatics, with a specific focus on applications in healthcare and business services.

EE's **Solomon W. Golomb**, University Professor, Distinguished Professor of Mathematics and Engineering, and holder of the Andrew J. Viterbi Chair in Electrical Engineering, received an honorary doctorate from the Technion-Israel Institute of Technology. Often referred to as the "father of digital communications," Golomb also celebrates his 50th year on the school's faculty.

Martin Gundersen of EE won the Sol Schneider Award of the 2010 IEEE Power Modulator and High Voltage Conference for outstanding research on high voltage electronics and its applications.

Andrea Hodge of AME was appointed the new holder of the Philip and Cayley MacDonald Early Career Chair.

Rahul Jain of EE won a 2010 IBM Faculty Award, which he will use to fund a "smarter cities initiative" study with real-time data-based incentive pricing schemes to promote efficient energy usage and design smart grid markets for selling electric power.


Jernej Barbic


Melvin A. Breuer


Giuseppe Caire

Yan Jin of AME was elected a Fellow of the American Society of Mechanical Engineers for his work in the field of engineering design covering areas of organization modeling; collaborative design; design cognition; and design methods.

Bart Kosko of EE and the Gould School of Law, a prolific scholar and writer with diverse interests across academia and pop culture, has been elected a Member of the College of Fellows of the International Neural Network Society for his research in neural and fuzzy systems.

C.C. Jay Kuo of EE was elected a Fellow of the American Association for the Advancement of Science, and is listed in the top two of faculty featured on the Mathematical Genealogy Project's roster of faculty with the highest number of Ph.D.s graduated. Jay has 105!

Richard Leahy of EE received the 2010 IEEE Nuclear and Plasma Sciences Society Edward J. Hoffman Medical Imaging Scientist Award, for innovative applications of signal and image processing theory to the formation and analysis of biomedical images.


Andrea Hodge


Rahul Jain


Yan Jin


Bart Kosko


C.C. Jay Kuo


Richard Leahy


Maja Matarić


Gaurav Sukhatme


Urbashi Mitra


Elaine Chew


Fokion Egolfopoulos


Panaylotis Georgiou


Shri Narayanan


Solomon W. Golomb


Martin Gundersen

Collaborators **Maja Matarić** and **Gaurav Sukhatme** of CS were elected Fellows of the IEEE, for their research in robotics. Matarić has also received a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring (see accompanying story). Adding to her lengthy list of press appearances, Matarić's work in socially assistive robotics was recently featured in an IEEE.tv video on engineering careers.

Urbashi Mitra of EE was selected a Fellow of the USC Center for Excellence in Research for 2010-2011. She is the first EE faculty member to receive this distinction. CER Faculty Fellows are selected for their accomplishments and commitment to promoting a culture of excellence in research at USC.

Wireless technologies specialist **Andreas Molisch** of EE won a 2010 Okawa Research Grant to support his studies in wireless systems for healthcare.

Donald L. Paul, William M. Keck Professor of Energy Resources at USC and executive director of the USC Energy Institute, was appointed to a two-year term on the U.S. National Petroleum Council.

Terence Sanger, of the Department of Biomedical Engineering and the Keck School of Medicine at USC, was recognized for his work in pediatric cerebral palsy with the 2010 Goldenson Technology and Rehabilitation Award by the Cerebral Palsy International Research Foundation. Sanger also leads the HTE@USC Program. (For more about HTE@USC, see page 34.)

Professor and AME Chair **Geoff Spedding** was elected a Fellow of the American Physical Society. Spedding has also been featured recently in the *Los Angeles Times, CNN.com, NPR* and the *Times of India* for his group's bird aerodynamics technology.

Milind Tambe of CS and ISE was selected to the National Academies Soldiers Systems Panel for the 2011-2012 term. The panel assists the U.S. Army in assessing the quality of its soldier systems and human factors research.

Professor **Alan Willner** of EE, recently appointed the inaugural holder of the Steven and Kathryn Sample Chair in Engineering, also won the Optical Society of America's 2010 Paul F. Forman Engineering Excellence Award.


Andreas Molisch


Donald L. Paul


Terence Sanger


Geoff Spedding


Milind Tambe


Alan Willner

'MENTORING IS IRRESISTIBLE'

PRESIDENT OBAMA HONORS MAJA MATARIĆ FOR "HELPING TO PREPARE" THE NEXT GENERATION


Maja Matarić and President Obama

President Barack Obama has recognized Viterbi's renowned roboticist for her success in mentoring next generation of engineering leaders.

Maja J. Matarić received a Presidential Award for Excellence in Science, Mathematics, and Engineering Mentoring at a White House ceremony in late January.

"These individuals and organizations have gone above and beyond the call of duty to ensure that the United States remains on the cutting edge of science and engineering for years to come," President Obama said in recognizing the awardees, who included 10 other individuals and four organizations.

"Their devotion to the educational enrichment and personal growth of their students is remarkable, and these awards represent just a small token of our enormous gratitude."

The awards are given each year by the White House to recognize the crucial role that mentoring plays in the academic and personal development of students studying science or engineering—particularly those who belong to groups that are underrepresented in those fields.

Their mentoring work helps ensure that "tomorrow's innovators reflect the full diversity of the United States," said a White House statement.

Matarić said it was an honor to be a part of this group of presidential awardees. "Mentoring is irresistible," she said. "It is a generally powerful yet always a unique and individual opportunity to positively impact people—kids, students, colleagues—and to leave a meaningful legacy."

Matarić is a professor of computer science, neuroscience and pediatrics as well as Viterbi School's senior associate dean for research. She is also a founding director of the USC Center for Robotics and Embedded Systems and director of the USC Robotics Research Lab. //

Viterbi Nanosatellite Blasts Off

STUDENT-DESIGNED PACKET NOW ORBITING EARTH

All systems were go December 8, 2010 at Cape Canaveral where the newly developed *Falcon 9* heavy lift vehicle sent into orbit a packet of nanosatellites. The packet included a unit that the Viterbi School's Information Sciences Institute (ISI) and its Space Engineering Research Center played a key role in developing.

The Viterbi School supplied one of the three units, named Caerus after the Greek word for opportunity, to support communications.

The orbiting packet, a three-unit cubesat called Mayflower, is a next-generation technology nanosatellite that is a joint effort of USC, Northrop Grumman's Novaworks Division and other companies.

Mayflower is now orbiting Earth about every 90 minutes at an altitude of more than 300 kilometers.

The launch was the second flight of the *Falcon 9* and the first commercial flight of a recoverable capsule, the Dragon. By demonstrating the ability to carry astronauts to the International Space Station, the launch was regarded as a breakthrough for the private space industry.

The Caerus team included ISI's David Barnhart, senior design engineer Tim Barrett, and technical specialists Will Bezouska, Michael Aherne and Jeff Sachs.

Working with a host of Viterbi students, the team delivered Caerus just 14 weeks after receiving authorization to proceed on the project.

Professors Joseph Kunc and Daniel Erwin led the campus teams from the Department of Astronautical Engineering and the Space Engineering Research Center.

The Viterbi School and ISI will go back into space this year with another three-unit cubesat called Aeneas. Caerus components and software are similar to Aeneas, allowing USC a rare risk-mitigation test of its hardware. //

For more information about Caerus, see http://www.isi.edu/projects/serc/caerus.

SpaceX

Space X, Chris Thompson

SpaceX

Top: Dragon spacecraft in the hangar at Cape Canaveral
Bottom: Falcon 9 Dragon Launch on December 8, 2010

ARCS FOUNDATION SUPPORTS OUTSTANDING VITERBI STUDENTS

The ARCS Foundation congratulated seven Viterbi School scholarship recipients in January 2011 at its annual luncheon at the California Club in downtown Los Angeles.

The all-volunteer women's organization has a stated mission of promoting U.S. leadership in science, medicine and engineering fields.

Viterbi Dean Yannis Yortsos praised the ARCS Foundation—whose funding comes from corporations, other foundations, and individual gifts—for its generosity and success in recognizing future leaders in the fields of science and engineering.

"These are bright, talented young people who will, I am certain, repay ARCS and society many times over during the course of their careers with their knowledge, creativity and dedication," said Yortsos. Cheryl M. Craft, chair of vision research at the Doheny Eye Institute and professor at the USC Keck School of Medicine, delivered a keynote address at the luncheon.

The Foundation was formed in 1958 in Los Angeles in response to Sputnik and the lack of U.S. supremacy in the technology race. Today the organization includes 17 chapters throughout the country, and has granted more than $66 million in scholarships to students at 46 colleges over five decades. //

Taking Silver in South Korea

CS STUDENTS PLACE AT INTERNATIONAL CAPSTONE DESIGN COMPETITION

Viterbi computer science students headed to the 2010 international Capstone Design Fair last fall to showcase their entry of computerized medical checklists that aim to minimize the spread of infection in a hospital setting.

The Viterbi School team, led by lecturer David Wilczynski, competed against 41 other entrants from 20 universities and rose above the pack with a 2nd place finish at the fair, which was hosted at the Seoul National University of Science and Technology.

Their entry, entitled "eChecklists in Healthcare," was inspired by the research of Johns Hopkins anesthesiologist Peter Pronovost. Pronovost found that many infections are caused following the insertion of central line catheters into patients.

His research showed that strict adherence by doctors and nurses to steps on a paper checklist during catheter insertion reduced the likelihood of infection to nearly zero. The "eChecklist" was a natural evolution; its technology allows checklists to be tailored to individual patient profiles and specific settings, and also called up post-conditions as doctors checked off items.

The Viterbi School team was led by seniors Darryl DeWeese and William Everton, whom Wilczynski described as "constantly bright eyed, enthusiastic, friendly, and stupendously competent."

"I feel refreshed by the whole experience," says Wilczynski. "and have an entirely new outlook on international design influencers, concepts and level of competition."

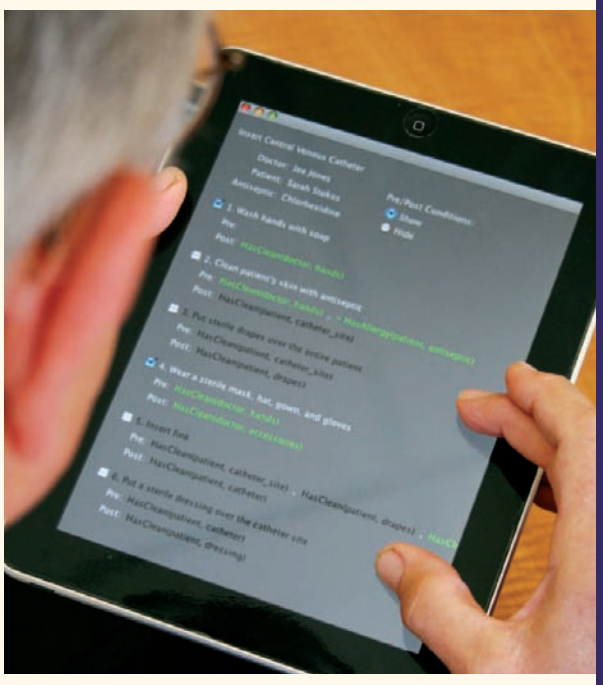
This marked the first time USC has entered competitively at the annual international Capstone Design Fair, which aims to foster student awareness of and aptitude for engineering professions and research.

Celebrating internationalism was also a goal as students from institutions all over the globe showcased their talents in a variety of disciplines.

The design entrants included projects as diverse as home pollution monitoring systems and home safety devices centered around smart phones. //

Lower Left: CS senior Darryl Deweese, who partnered with fellow senior William Everton, explains their prizewinning project to visitors

Lower Right: The Viterbi student team's iPad app "eChecklists in Healthcare"



Students Run the Show @ GamePipe Lab

"DEMO DAY" IS SCOUTING GROUND FOR TALENT AND IDEAS More than 70 game industry reps joined several hundred spectators, faculty, students, reporters and friends at Ronald Tutor Hall for the 11th semiannual GamePipe Lab "Demo Day." They gathered to showcase the next generation: The students and the game projects they built at the Viterbi School's GamePipe Lab the previous semester.

Recruiters and game company executives have long known that Demo Day is a prime scouting ground for talent and new ideas and the companies that turned out included Disney Interactive, Sony, LucasArts, MTV Networks, Electronic Arts, Intel, Zynga and Mozaic.

Mike Zyda, GamePipe's executive director and a Viterbi computer science professor, said he "couldn't be happier with the level of innovation displayed in the student projects and the positive feedback I received from industry execs."

Projects presented included a fast-paced multi-player Xbox 360 game called Quicksilver: Infinite Story, which involves procedural story generation. Paradox Shift is an action game where players hop between two time periods to solve a destruction conspiracy. (One of the project leads, Jared Greiner, secured a full-time job offer with Microsoft Games Studio.) The iPad application Dance Pad involves finger dance competition, and is set to launch in Apple Stores this summer.

The GamePipe Lab's mission is research, development and education on technologies and design for the future of interactive games and their application. The Lab boasts 2,000-sq. ft. of laboratory space, with 30 development pods outfitted with the latest in gaming technology. //

For more information about the Lab, visit http://gamepipe.usc.edu.

Game Pipe Executive Director Mike Zyda

GAME PIPE

ALL PHOTOS BY VICTOR LEUNG
www.victorvicphoto.com

The Speed of Light

IT'S NOT CONSTANT, OR WE WOULDN'T SEE RAINBOWS *by Eric Mankin*

If you use a telephone, watch television, or send an email, chances are you have benefitted from Alan Willner's research. Television broadcasts, telephone conversations and the data processed by computers mostly exist today in the form of electronic signals consisting of ones and zeros. These digital signals, representing the rich multimedia harvest of information—words, images, audio, video—travel from one location to another over transmission lines that have been steadily evolving.

Once the lines were metal wires—coaxial cable. But around 1970, researchers discovered that ultraclear glass cables could potentially carry a greater volume of information if the electronic signals were converted into optical signals generated by lasers. Such signals could go much farther using less energy at a much higher data rate. By the 1980s, fiber optic cables were replacing the coaxial wire cables and now make up the core of phone and data networks around the world.

The propagation speed of light in a vacuum is a constant. But Willner, a professor in the Ming Hsieh Department of Electrical Engineering, notes that the speed of different wavelengths, or colors, of light varies slightly in different transparent materials like glass. This means that light of different colors can be separated out by time delay.

Willner's devices utilize this delay property either to clean up degraded transmitted photonic data or to manipulate the bits themselves. His research has been supported by data movers like Cisco, HP and Intel, as well as by several government agencies and private foundations.

First, manipulating data by accurate delays forms a key element in the field of digital signal processing. Before he started, controlled slowing of light required exotic technologies, such as atomic vapors. Willner and his co-workers used a creative alternative, changing the color of the data before sending it through a color-dependent optical element. The color change adjusted the speed and the delay, which can range from a long millionth of second to a short trillionth of a second.

Second, photonic pulses can 'wash out' during transmission because they are made up of photons of slightly different colors, which meant each photon traveled at a slightly different speed. To compensate for this, Willner's group created an ingenious tunable fiber element that synchronized the signals and produced a clean output.

In 2000, Willner's tunable fiber element work led to a startup called Phaethon Communications. (The name is that of the son of the Greek sun god Helios, who asked to drive his father's sun chariot, but went off track, scorching the earth.) The company was bought by TeraXion, some of whose photonic products originated from Phaethon and are now in wide use.

On one hand, Willner's research is immensely complex. A typical title of one of his papers is formidably intimidating: "Continuously tunable 1.16μs optical delay of 100 Gbit/s DQPSK and 50 Gbit/s DPSK signals using wavelength conversion and chromatic dispersion."

On the other hand, this powerful, elegant technology is as simple to understand as a rainbow produced by sunlight shining through a waning rain cloud or the stark separation of colors that occurs when a beam of light passes through a prism. //

Willner (right) in Stockholm with Nobel laureate Charles K. Kao and his wife May-Wan.

Prince Philip congratulates new Royal Academy of Engineering member Alan Willner (far right) as Lord Browne, president of the Academy, looks on (far left).

Alan Willner

Alan Willner, the Viterbi School's internationally recognized photonics expert was very nearly a lawyer.

As a lawyer, he might not have found himself personally toasted last year by the Duke of Edinburgh, or in Stockholm the year before as an invited foreign dignitary representing the sciences.

He would not have been a professor in the Ming Hsieh Department of Electrical Engineering nor the first holder of the recently endowed Steven and Kathryn Sample Chair in Engineering.

Instead of filing patents, he might have been arguing about them.

And his field, the use of light—'photons'—to complement and make more powerful the transmission and processing of electronic digital signals would very likely not have advanced as far as it has. (See *Speed of Light*.)

The Brooklyn native and orthodox Jew who was his high school class valedictorian, wanted to be an attorney, a specialist in intellectual property, all the way through his undergraduate years in Yeshiva University. (Today, his lab is a model of diversity celebrating Ramadan, Hanukkah and Christmas.) After taking his LSAT, he decided to get an M.S. in electrical engineering at Columbia.

"I thought it would help with patent law," he explained. One electrical engineering class led to another until one day a professor invited him to stay for the Ph.D. program. So he did.

In 2010, he was one of only four Americans to be named an international fellow of the United Kingdom's Royal Academy of Science. He was cited for "advanced engineering solutions to some of the most challenging, critical and fundamental problems in optical communications, directly underpinning the development of the field and the growth of the Internet. He is distinguished for his leadership roles in the international optical communications community." This resulted in a trip to London and his encounter with Prince Philip.

A few months later, Willner received the 2010 Paul F. Forman Excellence Award from the Optical Society of America, adding to a remarkable panoply of honors that includes a Presidential Faculty Fellows Award from the White House in 1994.

The awards stem from his 900 publications in the field of optical communications and signal processing, which includes a book, 25 patents, 17 keynotes/plenaries, 16 book chapters, and 250 refereed journal papers. He has been editor of three major optics journals.

Dean Yannis C. Yortsos noted the impact of Willner's work on real world applications, with his "extraordinary contributions to the profession, including in no small measure to the mutually beneficial collaboration between academia and industry."

Systems chair of the Hsieh Department, Sandy Sawchuk said, "Alan is a brilliant professional with an exceptional record of significant awards that document his many research achievements."

Willner positively beams when he recalls the reception from his Viterbi colleagues after he arrived in 1992.

"When I came," he remembers, "they gave me a lab in the Denney building. After a few months (NAE member and Shannon Award recipient) Lloyd Welch came to me, and said, 'you seem to need more space,' and gave me his entire lab."

His research continued to expand and stress the limits of the available space, which is one of every academic community's most valuable commodities. "Then [NAE member and Shannon Award recipient] Irving Reed came to me. 'You seem to need more space.'" The next helpful voice was that of (NAE member] Bob Scholtz.

"It was amazing. They had no obligation. In every other place I've ever been, you have to fight for every square inch. I can't say enough good about USC and its people," said Willner. "I simply love this place." //

The Next Generation of Sound Rendering—in an Apple Store Near You

by Lenora Chu

THE ENGINEER: CHRIS KYRIAKAKIS

Being a household name in audio is what Chris Kyriakakis calls his utopian dream.

And with the launch of his company's newest technology in iPhone docks, Land Rovers, Jaguars, Volvos, IMAX theaters, TVs and three of four home entertainment systems the world over, he's pretty close.

"We want to be to audio what Apple is to computers," says Kyriakakis, an electrical engineering professor who launched the audio technology company Audyssey out of his Viterbi School research lab six years ago. "If Apple went out of business, I guarantee there would be people out on the street protesting," he says. "There's no brand like that today in audio. And that's something we think about at Audyssey."

Kyriakakis' journey from concept to commercialization started in 1996 when he joined USC's faculty and launched his state-of-the-art Immersive Audio Laboratory to experiment with what he calls the "next generation of sound rendering." Having spent years thinking about sound problems most of the world doesn't know exist, Kyriakakis realized that with the rapid march toward mobile, the next generation of sound technologies needed to address portability for cars and desktop applications.

"Anyone can create great sound with an unlimited amount of speakers and wires in a room," he says. "It's harder to bring great sound to a small space." So Kyriakakis charged his research team with the task of understanding the intersection of signal processing, room acoustics, and psychoacoustics, or the human perception of sound. The goal? Reproducing studio recordings, movies and live performances to make it sound like "being there."

To collect the data for their research, Kyriakakis ran experiments aimed at learning how to best translate a good sounding space. Their work included camping out at Boston Symphony Hall to capture and analyze live recordings. They also worked with Duran Duran, Herbie Hancock, Quincy Jones, former Dizzy Gillespie band members and, of course, the USC Trojan Marching Band.

The team ultimately devised an algorithm Kyriakakis calls Virtual Microphones, which creates the necessary perceptual and acoustical cues to fool you into thinking you are in the actual room where the performance is happening.

Next up, the team sought to minimize the distortion of sound caused when sound emits from a speaker and bounces around a room. They eventually developed a method to measure these interactions and create audio equalization filters to remove them.

With this innovation and its patent in hand, Kyriakakis and acoustics pioneer and USC Cinematic Arts professor Tomlinson Holman launched Audyssey in 2004 as a technology licensing company. Over six years the company grew to include 48 full-time employees, many of whom are USC engineering graduates, as well as marketing and sales personnel with international offices in Japan and China. Annual revenues are in the several millions of dollars, and funding has come from venture capital as well as Best Buy Capital.

Last year, following several years developing technologies only for license, Audyssey launched a product of its own. Released in November 2010, its iPhone dock and computer speaker packs a powerful processor to run Audyssey's advanced algorithms. Named the South of Market Audio Dock, it received a "Best of What's New" award from *Popular Science* magazine.

Kyriakakis notes that consumer electronics is considered "lowbrow" in the academic world. But he considers it the "ultimate challenge" to engineer amazing sound within serious price and size constraints.

"Plus, we've got technology out of Viterbi that's in millions of homes," he says, "and for the first time a product in the Apple Store. I am very proud of that." //

THE SCIENCE: FOCUSING ON HUMAN PERCEPTION

Innovations in audio had already tackled the problem of representing sound signals in the digital domain.

To develop the next generation of sound technologies, Chris Kyriakakis and his team had to go deeper. The area of signal processing inspired by human perception was relatively untouched—and that's where the greatest breakthroughs were yet to come.

Kyriakakis explains that humans can perceive sound from more than 10,000 different directions, and the ear has strong preferences for certain angles. "But we'd never be able to put 10,000 speakers in a room," he says. "So the idea is, how can we cheat?"

You cheat, the team ultimately found, by adding a few speakers to the standard five found in surround sound systems, and devising an algorithm that creates the information needed to fool human perception. Their creation, which they called Virtual Microphones, converts content created for fewer channels and morphs the signals to make it seem as if additional microphones were in place during recording.

The results can be astounding. Imagine a monophonic recording from 60 years ago coming to life as a 10-channel surround performance.

"It's like time travel," says Kyriakakis. "You really can go back and place virtual mics in a performance that happened decades ago." The technologies are so effective that the majority of 500 participants in a Kyriakakis study preferred the sound of the virtual representation to a live performance of a string quartet in a concert hall at the University of Texas at Austin.

Kyriakakis then began looking at the next big challenge in audio: the room. "Even the world's best speakers don't sound right once you place them in a room," he explains. "That's because sound from the speakers bounces around the room and reaches our ears at different times. That is a form of unwanted distortion."

Kyriakakis' research group developed a novel method for measuring these interactions and creating audio equalization filters to remove them. The patent that resulted from this research served as the seed that started Audyssey Laboratories.

Kyriakakis and his engineers now aim to tackle what he calls true three-dimensional sound. Even the latest advances in surround sound can only create a seamless, immersive bubble of sound around a listener.

"I want to break that bubble surface and move sound even closer, as if it's whispering in your ear," he says. "That's going to be a tough one, but we have some early results that are promising." //

Do you prefer the real or virtual? Nearly all of the 500 audience members in a Kyriakakis study preferred the sound of a virtual representation (right) to the live performance (left) of the Miro Quartet at a concert hall in Austin, Texas.

Tackling the NAE Grand Challenge of Securing Cyberspace

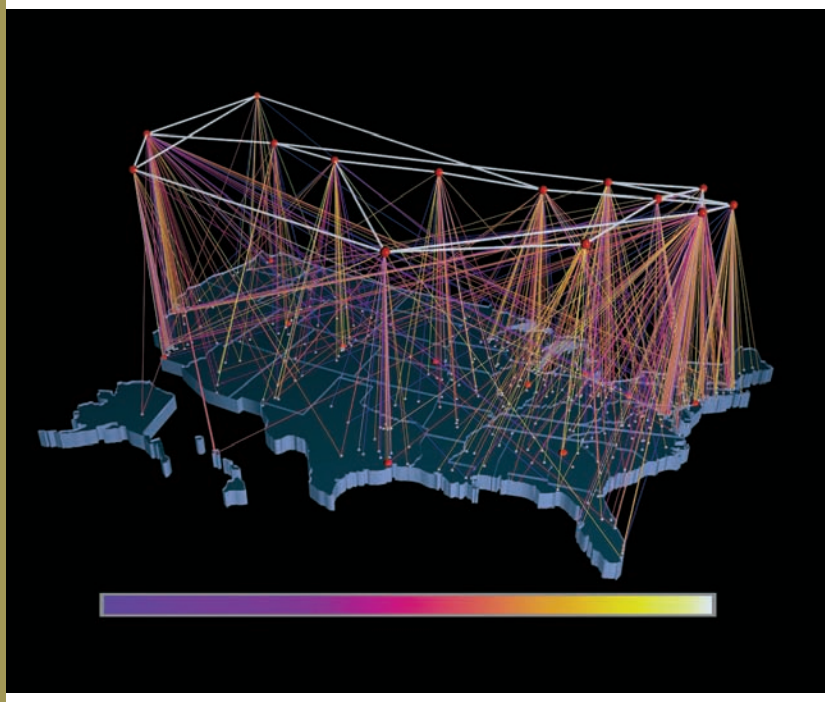
HOW DO WE KEEP THE INTERNET SAFE AND OPEN? *by Eric Mankin*

More than six years ago, Terry Benzel arrived at the Viterbi School's Information Sciences Institute (ISI) with a mission: create a center to secure cyberspace.

Today that center is a research behemoth with 20 scientists, thousands of users and leadership that has been recognized nationally in the field.

Its roots began in 2003 with a $5.5 million grant from the Department of Homeland Security with additional support from the National Science Foundation. Benzel set out to build an advanced experimental facility around the model of an astronomical observatory or infectious disease lab, with the idea of creating a place specialists could come together to address computer network security issues.

Headquartered at the ISI, the result was the DETERlab testbed, a general-purpose experimental infrastructure that supports research and development on next-generation cyber security technologies. The testbed allows repeatable medium-scale Internet emulation experiments for a broad range of network security projects, including experiments with malicious code. The lab is a sealed-off mini-Internet where experimenters can work with dangerous malware without endangering the real Internet. DETERlab provides an innovative, ongoing environment for research addressing the Grand Challenges due to two key factors surrounding its work:



A multi-dimensional visualization of Internet traffic that can be represented in the DETER testbed and used for cyber security experimentation and analysis. (Credit: Image courtesy of the National Center for Supercomputing Applications and the Board of Trustees of the University of Illinois.)

Science: The researchers' understanding of and work regarding security issues is general, systematic and widely-tested. It isn't anecdotal, based on one experimental team's work on one system, or on the response to one attack, but rather, it is repeatable and verifiable by other researchers.

Safety: The specialists are able to study the most dangerous, advanced viruses and superviruses. They address codes with the capability of infiltrating the Internet and taking over up to hundreds of thousands of computers. Yet, these studies are done without exposing the billions of users of the Internet to the codes.

DETER research ranges from testing specific threats and defenses to the development of advanced methodologies to meet future cyber threats. Early on, DETER was used to explore dynamics of global worm propagation particularly with respect to investigating "scaledown" techniques for approximating global Internet worm dynamics. These techniques were used to reproduce the empirically observed behavior of the Slammer worm in 2004. Other significant research projects using the testbed include the Telcordia cyber early-warning system which used DETER to evaluate prototypes and demonstrate early capabilities to potential customers, a process which later led to commercialization.

Creating the physical testbed facility—ISI collaborated with UC Berkeley and private partners for the hardware and software—was only part of the security-building process. Equally critical was establishing consistent discipline-wide consensus on the procedures and experimental parameters. The DETER project has been a leader in the field of the science of cyber security, including introducing the concept of creating tools for cyberscience. Some significant capabilities that have been deployed in the community include 10,000 node botnet experiment, worm spread and multi-party experiments .

The team presented these concepts in a variety of venues within the government and the research community, and this important research topic is now being incorporated into the DHS Roadmap for Cyber Security and the Federal Cybersecurity R&D Agenda. That framework will now be spreading to an expanding network of experimental labs. Also late last year, the Department of Homeland Security signed a five-year $16 million contract with USC to expand and improve the DETERlab.

The new project, DETECT, will enhance DETERlab to:

- Support larger and more complex experiments;
- Advance the quality and accuracy of experimental results;
- Build a knowledge base of experimental designs and results;
- Provide a user-friendly interface for both novice and experienced users;
- Support a significantly larger and more diverse research community.

DETERLab Director Terry Benzel (at center) with (L-R) Douglas Maughan, Director, Cyber Security Division, Department of Homeland Security; Luke Berndt, Program Manager, Cyber Security Division, Department of Homeland Security; Cliff Neuman, Director, USC's Center for Computer Systems Security; and ISI research programmer Mike Ryan.

This will be accomplished through creation of a framework of an advanced scientific instrument, advanced testbed technologies and support for new applications domains including botnet research and cyber physical systems.

"DETECT builds on efforts at ISI over the past six years and would not have been possible without the contributions of the entire DETER team," said Benzel. "John Wroclawski set an ambitious research program; Ted Faber, Jelena Mirkovic and Mike Ryan developed and delivered new capabilities under that program; and Bob Braden crafted the proposal capturing all of the prior work and proposed new challenges."

The DETERlab is expanding its specialist training programs, and provides the foundation for a number of other education initiatives. Ten institutions, including USC, UC Berkeley, Colorado State, Vanderbilt, Stevens Institute of Technology, and Johns Hopkins already use the facilities to offer classes in computer security to nearly 400 students.

"Use of hands-on materials in education has been shown to improve student learning and retention in many scientific fields," said Mirkovic, the ISI specialist who is coordinating the effort and is also leading an NSF-sponsored effort to create publicly-available cyber-security education materials for teachers. "With DETER we can bring the same benefits to the cyber security area."

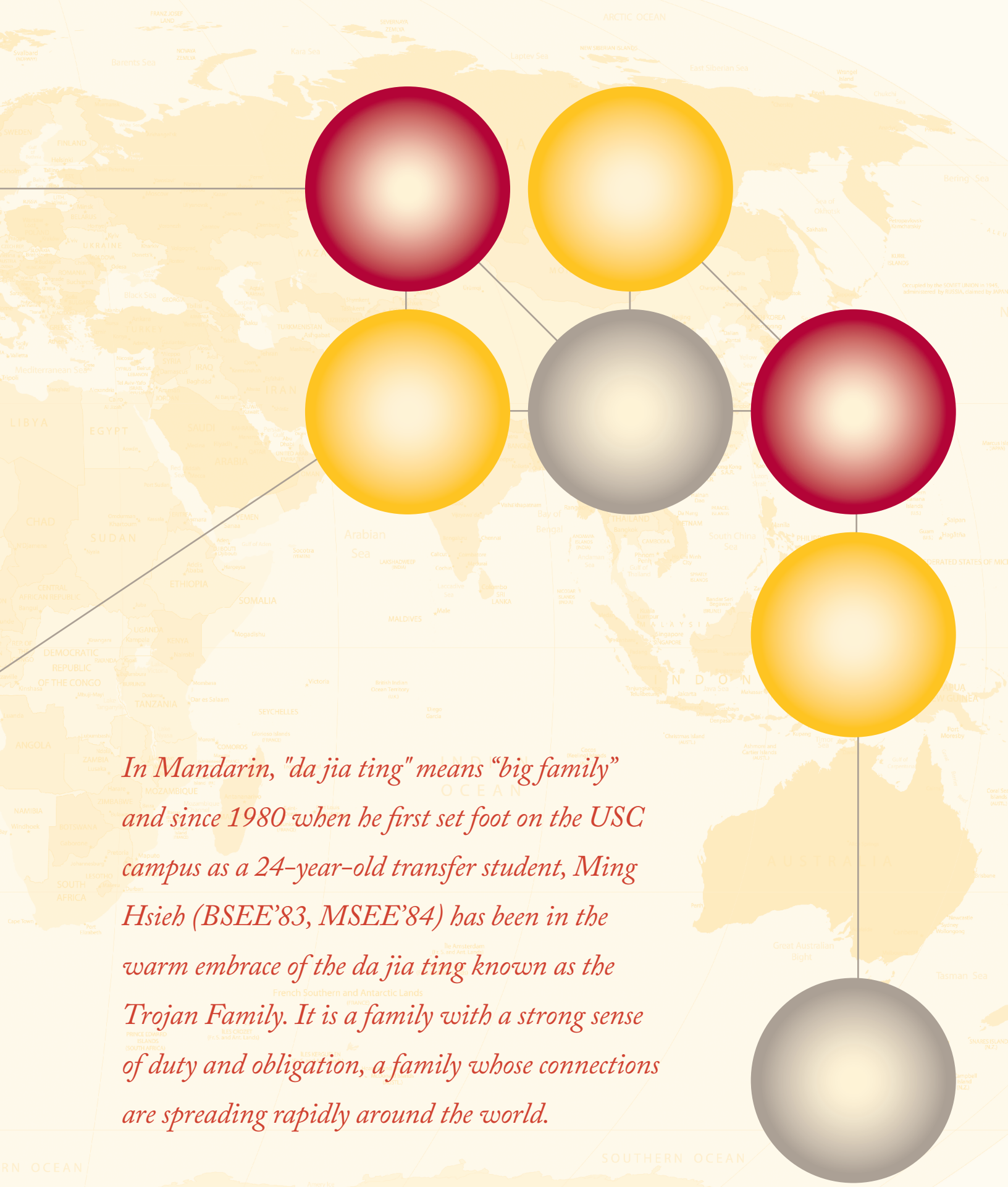
In addition, the TRUST (Team for Research in Ubiquitous Secure Technology) Center—an NSF-sponsored collaboration between eight universities—has used DETER to introduce undergraduates to cyber-security research. In summer 2010 DETERlab partnered with the TRUST Center on a Research Experiences for Undergraduates site award from NSF to train 16 undergraduate students. Students were recruited from all over the U.S. and worked on various research projects gaining hands-on experience with cyber security technologies. //

For more about DETER, visit www.isi.edu/deter

Ming Hsieh: A Clear Vision

ENGINEERING A CURE FOR CANCER AND CONNECTING A GLOBAL TROJAN FAMILY

by Bob Calverley



In Mandarin, "da jia ting" means "big family" and since 1980 when he first set foot on the USC campus as a 24-year-old transfer student, Ming Hsieh (BSEE'83, MSEE'84) has been in the warm embrace of the da jia ting known as the Trojan Family. It is a family with a strong sense of duty and obligation, a family whose connections are spreading rapidly around the world.

"This kind of creative collaboration is our best hope for dealing with this devastating disease." **USC PRESIDENT C.L. MAX NIKIAS**

And for the second time, Ming Hsieh is answering its subtle call.

Hsieh is the entrepreneurial engineering superstar—born and raised in China but now an American—who named the USC Ming Hsieh Department of Electrical Engineering in 2006. Last year when his good friend C. L. Max Nikias was inaugurated as the 11th president of the University of Southern California, Hsieh made a second transformative gift of $50 million. This gift established the Institute for Research on Engineering Medicine for Cancer and will fuel the revolutionary collaboration between the Viterbi School and the Keck School of Medicine of USC.

"This kind of creative collaboration is our best hope for dealing with this devastating disease," said Nikias. "On a personal level, I am deeply moved that Ming Hsieh chose to make this visionary gift commitment on the day of my inauguration."

The gift was Hsieh's second multimillion-dollar donation to USC. The founder of Pasadena-based 3M Cogent (formerly Cogent, Inc.) had previously donated $35 million in the naming gift, which Viterbi School Dean Yannis C. Yortsos called "a landmark in the history of the school."

"The new institute," Yortsos continued, "is another testament to Ming's vision. Working with our colleagues at the Keck School and elsewhere at USC, gifted engineering faculty and students working on nanotechnology will utilize their remarkable talent and expertise to attack cancer and hopefully lead to effective cures. With this transformative gift we are positioned to become world leaders in the field."

Keck School Dean Carmen A. Puliafito, noted that the donation would help Keck and other USC researchers in their quest to translate cancer discoveries into effective therapies for patients.

"The fight against cancer has gained a powerful ally in Ming Hsieh," said Puliafito. "This gift illustrates the critical synergy of healthcare and technology that has the potential to dramatically change the lives of cancer patients. We are grateful for his visionary gift."

When Hsieh speaks of cancer, a shadow dims his normally sunny and expressive face. "We are all getting older and we are living longer," he says. "I see more and more people... getting cancer. If you look at heart disease or HIV/AIDS, both very lethal diseases, we have some ways to treat them now. We're getting some control. But with cancer—no control. A third of cancer patients do not survive."

While this motivation seems clear, understanding Hsieh's deeply felt personal regard for the Trojan Family reveals more. The connections people make in an increasingly interconnected world, where rewards of successful projects can be far greater than the sum of individual contributions, are crucial.

"So making friends at university is very, very important. Spend time with your classmates and friends," Hsieh advises students. Now, when he travels the world and meets fellow Trojans, he says conversations quickly turn to how Trojans can help each other.

"I think there are a lot of options that open once people are connected," Hsieh says.

Hsieh started both of his successful companies with friends he met at USC. Now a member of the USC Board of Trustees and the Viterbi School's Board of Councilors, he speaks fondly of the relationships he has formed and clearly feels loyalty and obligation both to his fellow trustees, and to USC.

"We work together and try to understand how the university can advance, where funding is needed. I am not the only one who has contributed. Each year you see some of the trustees, or successful alumni, contribute."

Success did not come easily for Hsieh. When he was a young child, his family's comfortable middle class lifestyle—his father was an engineer—suddenly ended with the onset of China's Cultural Revolution. His family was uprooted and sent to a small village and his formal education essentially ceased for a decade. After China's political reform, Hsieh attended a technical institute in China for two years. Next, with an inheritance from his Taiwanese grandparents, he came to USC.

Hsieh says he chose USC because an uncle, P.Y. Hsieh, had graduated from USC with a degree in mechanical engineering in 1952. He also remembers watching the Rose Parade on a television broadcast in China.

Hsieh thrived at USC, academically as well as socially. He formed a network of friends, which became instrumental to the companies he started. Also key was the entrepreneurial spirit he believes is one of the Viterbi School's greatest assets. He earned his bachelor's in electrical engineering and year later his master's. He passed on studying for a Ph.D. to go to work. He started AMAX Information Technologies, which specialized in servers, storage systems and other hardware, in 1987. Three years later, he co-founded Cogent Systems, which pioneered high-speed fully automated fingerprint identification. At the end of 2010, he finalized the sale of Cogent to 3M.

"The reason I sold the company to 3M is that we reached a level and needed to break through into the next frontier," Hsieh says. "We were working with various national governments and they want to see a larger enterprise to handle their national security work. 3M opens new doors."

Hsieh felt grateful and strongly connected to USC, especially the engineering school, when he made the gift to name the USC Ming Hsieh Department of Electrical Engineering. He says he is

The USC Ming Hsieh Institute for Research on Engineering Medicine for Cancer

Nanotechnology is creating a new frontier in cancer research. The USC Ming Hsieh Institute will fuel and expand the groundbreaking basic and translational research already taking place across many academic disciplines on the USC University Park and USC Health Sciences campuses.

The objective is to get the best minds from many fields working together to create breakthrough solutions and get them to the cancer patients as quickly as possible.

"Recent advances in nanomedicine are creating an exciting new era for cancer research," Hsieh said. "Bridging the gap between the laboratory and patient care is the challenge today. USC has world-class engineers, scientists and physicians who know how to work together to make real progress. It's my hope that their efforts will lead to better survival rates, longer remissions, new treatments and cures for this horrible disease that leaves an indelible mark on so many."

The Institute will conduct research on nanoscale delivery platforms for drugs and therapeutics targeting cancerous cells and tumors. Researchers will work on encapsulating nanoparticles and other promising applications of nanotechnology. They also will seek to create advances in biomedical imaging to help determine the delivery and targeting efficiencies of these treatments and therapies.

At the same time, clinical research will assess the effectiveness of the resulting drug delivery on actual cancer patients. The goal is to apply what is learned in the laboratory at the bedside and also to take what is learned at the bedside to inspire further study in the laboratory.

The Institute will bridge research from both engineering and medicine disciplines. The recently launched program HTE@USC (Health, Technology and Engineering at USC) between USC Viterbi and the Keck School has laid a strong foundation for such collaborations and will be leveraged to augment educational and training opportunities for medical and doctoral students who participate in the institute's research.

"Ming Hsieh is an exemplary trustee and alumnus," said Edward P. Roski Jr., chairman of the USC Board of Trustees. "His generous gifts continue to advance the university and improve the lives of people in our community, nation and world. All of us in the Trojan Family are very proud of him. He is the embodiment of the American dream and a role model for domestic and international students alike."

Engineering a Cure for Cancer

Ming Hsieh's first exposure to engineering was during the Cultural Revolution, when he helped his electrical engineer father bring electricity to the rural village where they had been sent. Noting his interest in technology, his parents gave him a transistor radio to take apart and reassemble. Soon he was repairing radios, televisions and anything electronic.

Deng Xiaoping's political reform swept away the Cultural Revolution and the young Hsieh spent two years at the South China Institute of Technology in Guangzhou (now the South China University of Technology).

"No matter who you are, no matter what your family background is, you are eligible to go through the college system," he said. "Students are admitted on academic merit."

Arriving at USC in 1980 as a 24-year-old transfer student, he was quickly excited by computers and almost as quickly frustrated with how slow they were. But the fascination continues today. He recalls that when he first did computer chip design, the simulation and modeling programs were only about 80 percent accurate.

"After we repeated it three or four times, we could build a successful chip," Hsieh says. "But today you get 99 percent accuracy with the first simulation."

He notes that computers are vastly more powerful today. When he started Cogent, a single fingerprint extraction took about 20 seconds on the most expensive workstation, which at the time cost $50,000. Today, the same image extraction can be done on a $5 chip in one second.

"These kinds of efforts have not been applied to medicine, to fighting against a disease like cancer," says Hsieh. A little glumly, he adds that when he was an engineering student, "we only knew about engineering. We knew very little about human biology."

To Hsieh, creating a new drug is a systems engineering problem, and the single engineering tool he is most excited about is nanotechnology. But he believes it will take large teams of medical researchers, chemists and a host of engineering specialties—chemical, biomedical, electrical and computer science. And all of these researchers will be working at the nano level to build drugs that target specific cancer cells.

"With the engineering resources we have, we can probably build a drug quicker, and with simulations we will know how the human body will react before the drug ever goes into the body," he says. "I think there are many areas that we could exploit to build a new generation of drugs to treat cancer."

Hsieh is desperate to connect engineering with medicine. Engineering is solving problems under constraints. The problem is cancer and it involves the immensely complex issue of human biology, which he says engineers are working hard to catch up in their understanding.

"The medical doctors work with patients and gain a lot of experience but the information they gain has not been sufficiently passed on to the engineers," he says. "Engineering students need to know more about medicine and medical students need to know more about engineering. Once they share their knowledge, I think they will come up with some fresh ideas."

"very pleased" with the results of this historic gift, citing the department's newly-recruited faculty who are advancing an ambitious research agenda, as well as benchmarks showing increasing student quality.

Hsieh has been watching USC's relentless march toward the ranks of elite universities since he was a student, and as a trustee gained more insight. He noticed the focus of two USC presidents turn to medicine. "First Steve Sample, and then Max saw that we did not have our own hospital, so they pushed hard to purchase the hospital," says Hsieh.

Perhaps because both of them were engineers, the focus on medicine resonated strongly with Hsieh. "I agree with Max that it is important to focus on medicine because bioscience is going to be so big in the 21st century.

"Half of our budget at USC is the medical enterprise—our medical school and our hospital. It is very, very significant," he continues. "Nationally, we spend almost 20 percent of our GDP on healthcare, and we are still having problems."

"We are seeing a convergence of disciplines take place. The boundaries are melting." **DEAN YANNIS C. YORTSOS**

Meanwhile, another of Hsieh's friends, the engineering dean, Yortsos, has in recent years been articulating his concept of "Engineering+" or, engineering empowering society.

"We are seeing a convergence of disciplines take place. The boundaries are melting," says Yortsos. "Engineering has often been called the applied science, but more and more, it is an enabling discipline. Engineering tools are used to probe the very small, the highly complex and the very distant."

And Yortsos believes that nowhere is the convergence of disciplines currently happening more rapidly than with engineering and medicine. He says engineering is at the core of new medical imaging, surgical techniques, health informatics and the creation of new medicines.

"This gift is going to both engineering and medicine. It is hard to connect these two together and I find that to be very interesting," Hsieh says. "Engineers can bring fresh ideas to the medical school. Engineers can help."

Hsieh's gift can be seen as the fulfillment of an obligation, the act of a successful alum who is grateful to USC for the opportunities his education provided. But the gift could also be viewed as an investment, much as someone funds a new business enterprise in which he believes. Hsieh is bringing innovative ideas that he believes will be able to help solve what is a difficult problem for medicine, and troubling for Hsieh. (See *Engineering a Cure for Cancer*)

The news of Hsieh's first gift resonated strongly in China where Hsieh quickly heard from old friends and acquaintances. Why had he not given to a university in that country? Did he not also receive some of his education there?

Hsieh says that American universities such as USC have endowment systems that are audited and tracked. Donors can see the results of their philanthropy, and that appeals to Hsieh the business entrepreneur. "When you provide an endowment, you want to see results. Each year Dean Yannis Yortsos provides me with a summary of how we are advancing in different programs," he says.

So while he may have obligations in China, he is not ready to fulfill them yet. He says that China needs to first build a philanthropy system like the one at USC and that he may well support some research programs in China once there is an endowment system he knows that works.

"But I was mostly educated here," says Hsieh, from his offices in Southern California. "I had my success here. I am an American citizen and this is my home,"

Hsieh's story is not only a quintessentially American one, but also an increasingly common USC and Viterbi School story. The school is named after immigrants Andrew and Erna Viterbi while another immigrant alumnus, Sonny Astani (MSISE'78) named the USC Sonny Astani Department of Civil and Environmental Engineering.

USC has for many years been a leader, and often leads all U.S. universities, in the number of foreign students that it enrolls. And the Viterbi School has the most international students at USC. Most of the international students are Asian, with large numbers coming from India and China, where the economies are expanding more rapidly than in the U.S. Unlike Hsieh, many of those students no longer stay in the U.S. but choose to return home.

The Trojan Family is now spread across the globe, and Hsieh wants to keep them connected. He says globalization means that USC needs its alumni everywhere. As this issue of *USC Viterbi Engineer* was in production, Hsieh was travelling in India with a high-level USC delegation that included President Nikias, several trustees and four deans (including Yortsos). Hsieh was most anxious to meet USC alums.

"USC has alumni everywhere," Hsieh says. "They may not be attending games in the Coliseum, but they are not without influence. They can help us bring new students and new talent to our campus."

"I was a foreign student from China. I came to the U.S. and USC. My dreams were fulfilled and I was successful. I was able to give back to the university. I think many future generations of foreign students will bring endowments and be a generation that helps build our university."

It *is da jia ting,* a big family, the Trojan Family. //

HTE @ USC

REACHING TOWARD THE BIOMEDICAL FUTURE

BY ERIC MANKIN & LESLIE RIDGEWAY

In August 2011, a class of 12 carefully selected candidates, half medical students and half graduate students of engineering, will begin studying and working together in a way never before done at any other university.

On day one, says Terry Sanger, the visionary researcher/practitioner who has helped conceive and create the new program, "supervised matchmaking" will be used to group students into four-person teams of two doctors and two engineers, which will stay together throughout the four-year program. (Medical students will start the program when they enter medical school, while engineers will start in their second year of graduate studies.)

The students will start "with problems, not expertise," says Sanger. They will learn what they need to know while researching and inventing what's needed, helping each other along the way.

Collaboration, he emphasizes, is not just part of the program. In a crucial way, it *is* the program. The aim is not just to teach engineering and medicine, but to train engineers and doctors who know how to effectively collaborate, because their teachers have coached them to work together. The teachers will be guiding the process of identifying problems, producing designs, creating and testing prototypes, and ideally, applying for patents.

HTE@USC is Health, Technology, and Engineering at USC. For students, the timeframe is right, says George Tolomiczenko, the HTE administrative director who has been working with Sanger painstakingly assembling the institutional nuts and bolts of this unusual program. "Peter Diamandis says people reach their creative peak between about 25 and 29," Tolomiczenko notes, referring to the X Prize founder who is on the Viterbi School's Board of Councilors and has helped forge a strong partnership with the Viterbi School, including an X Prize class.

Tolomiczenko's background neatly complements Sanger's. He is neither a physician nor an engineer but combines a Ph.D. in clinical psychology with master's degrees in public health and business administration, where he specialized "in energizing interactions with students, faculty, staff and clinical personnel in a variety of settings."

Energizing interactions is, of course, the essence of the collaboration training.

As the description for prospective students notes: "Upon graduation

Postdoctoral fellow Eric Wade (right) works with students in Maja Mataric's Interaction Lab. One of the lab's projects is exploring assistive human-robot interaction.

from HTE@USC…you will also have begun lifelong relationships with a select group of students and faculty from very different backgrounds who will be your contacts and collaborators for future projects. Our graduates will look at healthcare with critical eyes, always thinking of ways to make processes and devices better."

The program is unique in academia. Sanger methodically ticks off points of difference between HTE@USC and programs elsewhere. Stanford has a bio-design program – in which Sanger taught –with similar goals. But the Stanford program is a one-year research effort that enrolls participants who have completed their education. The Harvard/MIT program has some similarities. However, making it the central part of Ph.D. and M.D. programs is new. And the HTE students will learn by working together to solve real medical problems.

HTE@USC grew from the first joint retreat between Viterbi and Keck faculty in Fall 2008 under the joint leadership of the two senior associate deans, Maja Matarić and Betty Fini of the two schools, respectively. Martha Gray of the Harvard/MIT HST program was an important catalyst for that collaboration. It has now morphed into a program that nicely reflects Sanger's unique career. Sanger, recruited to the Viterbi and Keck Schools two years ago as the Provost Associate Professor of Biomedical Engineering and Neurology, is a practicing pediatrician who treats children with cerebral palsy. He is an inventor of medical devices he can use in his practice. (See "Fixing Johnny," Viterbi Engineer Spring 2010.) and a product of the HST program.

Sanger regards a framework that can pull together the disparate elements and foster collaboration as critical. And he is emphatic that USC is the place where he can help bring this to reality.

Among Sanger's close Viterbi friends are hand movement specialist Francisco Valero-Cuevas, Viterbi roboticist Stefan Schaal and Bartlett Mel, an associate professor at the school's Center for Vision Science and Technology. Sanger is also a former MIT classmate of Matarić's. Beyond personal connections, Sanger says, "USC is very serious about the combination between medical, biology and engineering applications.

"A lot of places will say, if you're an oncologist and want to work with a molecular biologist, that kind of makes sense. But if you're a child neurologist, and you want to work with an engineer, that's further out there. I think that USC really sees those links as equally important as the nontraditional links. I think it is because of the strength of

THE STUDENTS WILL START "WITH PROBLEMS, NOT EXPERTISE," SAYS SANGER. THEY WILL LEARN WHAT THEY NEED TO KNOW WHILE RESEARCHING AND INVENTING WHAT'S NEEDED, HELPING EACH OTHER ALONG THE WAY.

the engineering program. And this really appeals to me.

"It's profound," he continues. "There are a lot of people who talk about medical engineering and transdisciplinary studies, but I think USC has really put a lot of effort behind it, has put its money where its mouth is."

The connection between USC engineering and medicine deepened further with the announcement by Ming Hsieh of a $50 million contribution to create an institute for the interdisciplinary study of cancer at USC. (See feature story, this issue) HTE students may well become part of this effort as it matures.

Linking engineering and medicine "is a fantastic marriage," says David Agus, co-leader of the National Cancer Institute Physical Science-Oncology Center, established in October 2009. The center, established by a $16 million grant from the National Institutes of Health, is led by principal investigator W. Danny Hillis, a renowned technology innovator and entrepreneur who is a research professor at both the Viterbi and Keck schools, and Agus, professor at Keck and Viterbi, and director of the USC Center for Applied Molecular Medicine and the USC Westside Cancer Center.

"Engineers look at new and different ways of describing a system," Agus says. "They see cancer and say, 'What is its shape and structure? For example, if I poke it, how resistant is it to poking?' They are good at boiling things down to key elements and developing modeling systems from those elements. That's what we need to control cancer."

That's one aspect of HTE@USC that appeals to Thomas Cummins, a Ph.D. student in biomedical engineering at Viterbi. Cummins, who plans to apply to the program, envisions a continuum of research enabled by bringing medical students and engineering students together to ponder the clues to controlling or eliminating disease.

"You need both sides of the story to conduct translational research," he says. "You need doctors to define the needs and engineers to provide the solutions. A classmate of mine, who is in his second year of medical school at Keck, agrees with me that there are things I know that he could benefit from, and things he knows that I can benefit from. Many problems will become apparent by physicians and engineers talking to each other."

Cummins is attracted by the opportunity to shadow physicians in the hospital and operating room as part of the program. Agus says that meshes with the Physical Science-Oncology Center's ambitions.

"We want engineering students to be in the clinic with us," he says. "We want them to see cancer patients and see what they go through. We want them to live and smell cancer, so they are part of the process, not just studying textbooks."

Incoming Keck medical student Christina Yen, another prospective HTE@USC participant, applauds the program's potential to transform healthcare into a pathway of discovery that pushes the limits of what is considered possible today.

"Based on my personal experiences in the lab and the clinic, the future of medical progress must come from integration between disciplines," she says. "This program could lead to new discoveries in bioengineering and the medical field and revolutionize the way we perceive medical and engineering education and discovery in the future."

Students accepted into the program are the kind of people who aren't satisfied with things the way they are and are excited by change, says HTE@USC administrative director Tolomiczenko. The entrepreneurial aspect of the program, plus the enthusiasm and support for research and development at USC, will give these students the tools and contacts they need to turn groundbreaking ideas into real solutions for healthcare improvement.

"These students see the impact of their creativity and ingenuity on a short timeline," he says. "I think that's why people pick engineering. They want to make a change in the world and see the difference they made. That connects with physicians -- who want to help people and also see the difference they made."

"Healthcare and technology are changing rapidly," agrees Keck School Dean Carmen A. Puliafito, who says future physicians and engineers need the intellectual tools to stay ahead of this change.

Viterbi Dean Yannis C. Yortsos remarks that USC has long emphasized interdisciplinary work at the interface between medicine, biology and engineering. But this new educational effort goes far beyond, in a new direction, he notes. "We are delighted to be pioneering this new path." //

ALUMNI NEWS

VITERBI ALUMNI RELATIONS

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

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

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

Stay Connected

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

Widening the STEM Pipeline

INSPIRING SCIENTIFIC CURIOSITY IN DISADVANTAGED COMMUNITIES

iridescent

Her students know her as Ms. C, but local communities from Los Angeles to New York call her Wonder Woman.

Tara Chklovski noted that science, technology, engineering and math (STEM) get scant attention in the American classroom.

Four years ago, Chklovski set out to fix this problem—and head off the long-term decline in the number of American students studying science and engineering—by launching Iridescent Studios while juggling doctoral studies in aerodynamics at the Viterbi School.

The chain of science learning and discovery community centers targets the K-12 set, particularly in underserved minority communities.

The aim? To provide a place for students and their parents to engineer and imagine with interactive and hands-on learning activities.

"Iridescent Studios are about the love of learning," says Chklovski, 32, who was once a principal of a 300-student K-6 school in India.

Parental involvement and mentorship is also a key strategy, says Chklovski, and the studio has taught more than 300 engineers how to effectively mentor 5,000 students.

Most students are from inner-city schools, and many of the Iridescent staff are Viterbi student volunteers.

Funding from the Office of Naval Research and other partners has allowed her to scale up; Iridescent has launched in L.A. and New York City, and will open in the Bay Area in 2013.

Viterbi Dean Yannis Yortsos notes that K-12 outreach is an essential part of the mission of engineering schools in the country. "Armed with new educational vehicles such as Ms. Chklovski's science studios," Yortsos said, "we can focus precisely and relentlessly on STEM challenges." //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> "Iridescent Studios are about the love of learning,"


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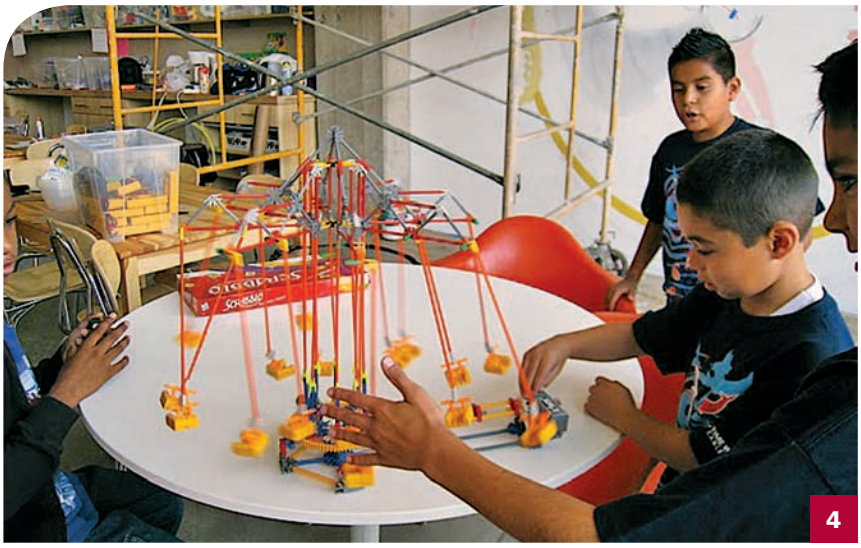
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PHOTO CAPTIONS: 1. Iridescent founder and Viterbi School doctoral candidate Tara Chklovski **2.** Middle school students learning about kinetic and potential energy with roller coasters **3.** Testing "Good Vibrations" at the Los Angeles studio **4.** Building K-nex creations at the Iridescent summer engineering boot camp **5.** Exploring the physics of roller coasters **6.** Learning about squid at the Iridescent Science Festival


5


6

Blood Clots, Battlefield Wounds...and Wine

ENGINEERING HEALTHCARE'S FUTURE

When Kenton Gregory (BSCHe '76, MD '80) was contemplating career paths as an undergraduate at USC Viterbi, nothing quite seemed to fit.

So the enterprising young engineer built his own path — one that would take him through engineering *and* medical school and lead him to develop the earliest laser systems used to treat heart attack and stroke. He also solved a battlefield problem as old as the Civil War.

"My driving force was I wanted to make a contribution," says Gregory, who is a member of the Viterbi School's Board of Councilors and executive director of the Oregon Laser Medical Center at the Providence St. Vincent Medical Center in Portland, Ore. "I wanted to do something for the planet."

He got right to it while pursuing his bachelor's in chemical engineering at USC. At just 20 years old he launched a business that provided word processing and billing software for the medical industry. The experience, he recounts, became his first exposure to the magnitude of challenges facing healthcare, and the beginnings of his ambitions to help solve them.

Gregory enrolled in medical school at USC, figuring he needed at least one year of training to communicate effectively about the medical side of biomedical engineering. He ultimately decided to finish the M.D., inspired to find that problem-solving in the medical world was similar to engineering: "You go about systematically finding solutions."

In 1985 Gregory finally wed cardiology with his longtime fascination with lasers. His research eventually led to a process that transformed the treatment of heart attacks and strokes -- a minimally invasive procedure using a megawatt of energy to blast a blood clot. He explains: "Heart attacks and strokes are almost always caused by blood clots that suddenly form. They travel to an artery and abruptly block all blood flow. Lasers instantly vaporize the clot, restore blood flow and can save the heart or brain tissue."

Gregory's research led to more than a dozen patents and the development of new cardiac and stroke treatments. It also caught the attention of the U.S. military. At the time government researchers were trying to address trauma bleeding, which has been the leading cause of death on the battlefield since the 1800s. "The contents of a combat medic's bag haven't changed much since the Civil War," he notes.

Gregory and his team turned to nature for an answer, creating a combat dressing derived from the natural substance chitosan, which is found in shrimp shells. The team's applications revolutionized battlefield medicine by accelerating blood-clotting. The military deployed Gregory's creation during the second Gulf War and saw the number of battlefield bleeding deaths drop for the first time since the Civil War. His success led to more military research projects, but he likes to clarify that he "only plays defense, not offense."

When he's not revolutionizing medicine, Gregory applies his engineering skills to another passion — winemaking. Under his private label Gregory Vineyards, he is developing ultra-biodynamic grapes and bottling 100% organic and natural wines.

Asked how his time at Viterbi shaped him, the doctor deadpans, "My chemical engineering training at USC taught me how to make a world-class margarita." //

Gregory on the Oregon Coast Range farm he has converted to a vineyard, where he will cultivate pinot noir and chardonnay grapes.

Engineering Christina

TACKLING BIOMEDICAL PROBLEMS WITH INTERDISCIPLINARY VIGOR

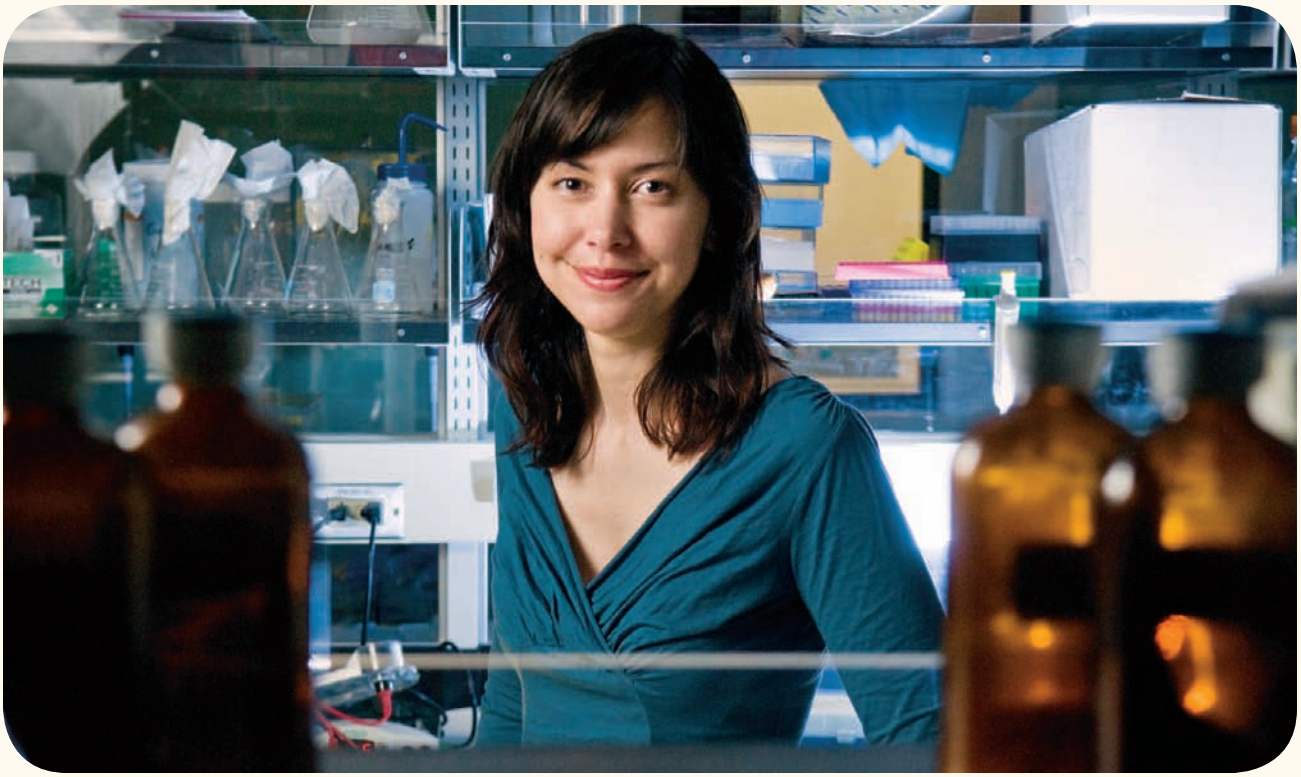


Photo: Linda A. Cicero / Stanford News Service

Christina Smolke in her bioengineering laboratory at Stanford University.

Christina Smolke's (BSCHe '97) interest in biological engineering has made her work more timely than ever.

Deciding early on in her education that her goal was to change the world by designing and constructing useful objects, Smolke focused her eyes on USC's engineering school as a multidisciplinary platform that married chemical engineering with a biology emphasis.

Her father, an electrical engineer and a major continuing influence in her life, counseled her as she narrowed the choices: Chemical engineering, she decided, was an expanding field, particularly biotechnology. "There's a lot of new research, and a lot of new technology," she says.

Where to study turned out to be a relatively easy decision, as she wanted to stay in Southern California where she grew up. Her then advisor and now Viterbi Dean Yannis C. Yortsos had recruited her to USC with a Trustee Scholarship.

"The value of recruiting engineering talent such as Christina is an essential element of our educational philosophy here at USC," says Yortsos, who followed up with Smolke repeatedly and emphasized the research she could be involved in as an undergraduate.

After earning her bachelor's in chemical engineering with a minor in biology, Smolke went on to pursue her Ph.D in chemical engineering from the University of California at Berkeley. From there she became an assistant professor at the California Institute of Technology, and later moved to Stanford University to seize an opportunity to shape a new bioengineering program and access what she calls best-in-class for translating technology from clinic to industry.

At Stanford, Smolke runs a research laboratory of approximately 16 full-time researchers and a handful of undergraduates who deal with programming cellular behavior, from the development of microbial drug factories to next-generation therapeutic platforms. In particular, Smolke examines the development of new technologies that will transform how we engineer and manipulate biological systems.

One lab research program deals with the design of RNA molecules that regulate cell behavior, and may have the potential to result in safer and more effective strategies for diagnosing and treating diseases such as cancer.

Yortsos notes that Smolke's interdisciplinary approach to the engineering practice is a shining example of the Viterbi School's engineering philosophy.

Aside from her research, Smolke teaches both undergraduates and graduate students, and has authored more than 30 research papers, publications and books. Major recognitions include being named to the Massachusetts Institute of Technology Review's Top 35 Innovators Under 35 List in 2004 and winning the World Technology Network Award in Biotechnology.

Smolke and her husband—also a bioengineering professor at Stanford— live in Menlo Park, California. //

Busting Science Myths

CRAFTING AN UNCONVENTIONAL CAREER

Constructing a 1.5-ton ball of Legos to roll down a road. Beating a lie detector. Predicting how large a chasm a full-size bus can jump.

Grant Imahara (BSEE'93) doesn't have a typical engineering job — but he likes to say he has more fun than most. The Viterbi grad tests urban legends for the Discovery Channel series *MythBusters*.

A roundabout path and a series of false starts led him to this unconventional job; Imahara dropped out spring semester of his sophomore year because he couldn't envision a future in engineering.

Dreams of screenwriting beckoned instead, but he found it difficult to transfer into USC's exclusive School of Cinematic Arts.

Instead, he volunteered to be the personal assistant to Tomlinson Holman, a professor of cinematic arts who also has an appointment in the Viterbi School's Ming Hsieh Department of Electrical Engineering. Imahara says he was awed by Holman, who is known for developing the renowned sound quality-assurance system THX (Tomlinson Holman eXperiment) for Lucasfilm.

"Not many people came in and asked to work for free," Holman recalled of his encounters with Imahara. "The cinema students didn't have the time. He had dropped out, so he had the time."

It was time well spent.

"After working with Tom and being introduced to this world of engineering that has a more creative edge to it," Imahara said, "it showed me where I was getting bogged down before. He introduced me to something I could potentially do."

With Holman's help, Imahara interned at THX, which led to a full-time job after the re-inspired Imahara re-enrolled at USC and completed his bachelor's degree in electrical engineering.

Three years later, Imahara moved across Lucasfilm's Skywalker Ranch to join Industrial Light & Magic (ILM). During nine years at ILM, he lived a sci-fi fanatic's dream building the updated version of R2-D2 for the Star Wars prequels and creating models for the two *Matrix* sequels, *Terminator 3: Rise of the Machines* and *The Lost World: Jurassic Park*.

More recently, he built the skeleton robot sidekick Geoff Petersen for *The Late Late Show With Craig Ferguson*.

During this time, Imahara also worked with future *MythBusters* hosts Adam Savage and Tory Belleci. He joined them on the show in 2005.

Imahara is the go-to electronics expert when a myth calls for building, say, a robotic arm to test if one sword can really slice the blade off another, as shown in many movie fights. Now in its ninth season, *MythBusters* makes science cool.

"We shoot guns and jump out of planes and set off huge explosions, but at the core of it all is science," Imahara said.

And proof that engineering is fun. //

THINKING LIKE THE BAD GUYS, AND EDUCATING THE GOOD ONES

A VITERBI ALUM'S MILITARY INTELLIGENCE DAYS

To defeat a terrorist, William McGill (BSAE '01) had to think like one.

As an analyst for the Department of Defense in Washington D.C., McGill searched out weaknesses in power plants, dams, and other infrastructure.

With computer models and a healthy dose of imagination, he and his colleagues sought hidden weaknesses that would otherwise go unnoticed by infrastructure owners and operators.

"What are the creative things a really determined bad guy could do to cause harm?" asked McGill, 32. "We should anticipate potential problems before they occur, and use this insight to fix the holes."

This work was one turn in a career full of fascinating twists and turns. And McGill, now an assistant professor of Information Sciences and Technology at The Pennsylvania State University, credits his advisor, Aerospace and Mechanical Engineering Professor and Chair Geoff Spedding, and the Viterbi School, for making him a better researcher and educator.

At USC, McGill tailored his aerospace major to include courses in risk analysis, composite structures and soil mechanics; he also met his now-wife Jinny Harris (BSAE '01) in Physics 1 their sophomore year.

Following graduation, McGill began working as a structural engineer for Swales Aerospace in Washington, D.C. In 2003, he served as the first ASME fellow to the newly-created Department of Homeland Security, and later moved to the Defense Intelligence Agency. He then left to complete a doctorate in reliability engineering at the University of Maryland, focusing on assessing risk when data is limited.

In 2008, the father of three joined the faculty at Penn State, where his research centers on using games and other information technologies to help people assess, communicate and control risks of all sorts. //

In Memoriam

Col. Rodney Bricker (MSSM, '84), 77, of St. Petersburg, Fla., passed away November 28. He served in the USAF for 31 years as an intelligence officer. He is survived by his wife of 55 years Nona, children Scott and Laura; two grandchildren; and two great-grandchildren.

Joe Denk (MSEE, '71), 71, of Manhattan Beach, passed away on December 6. He worked at Honeywell as an aerospace engineer and was part of the team that designed the Lunar Rover Module. He was born in Budapest, Hungary and was a freedom fighter during the Hungarian Revolution, later escaping to the United States at age 17. He is survived by his wife of 44 years Barbara.

John "Jack" Peter Eppinger (BSME '62), 72, passed away at his home on January 18. He served in the U.S. Navy as an F-8 fighter pilot, test pilot and safety instructor, retiring in 1967 after tours in Vietnam. Upon retirement from the Navy, he began a career as a commercial pilot for Continental Airlines, and continued his professional life with Lockheed Martin (formerly Martin Marietta). He is survived by his wife Ellie; children, Michael, Daniel and Catherine; and 13 grandchildren.

Robert Fabbro (MSEE, '65), 75, of Los Angeles, passed away on December 19. He played football at Michigan Tech and later became an Air Force fighter pilot. He spent the remainder of his career as a civil engineer with the Los Angeles County Flood Control District. He is preceded in death by his wife Gail, and is survived by his three children, Scott, Alexandria, and Chris, and two grandchildren.

William Guffey (MSEE '65) 80, passed away peacefully at his home in Palm Desert, Calif., on November 2. He served in the Korean War and earned his bachelor's in electrical engineering from the University of Illinois. He is survived by his wife, Shirley; three children Jeff, Brett and Dee Ann; and five grandchildren.

Charles Ivey (BSME, '56), 89, died on July 2010 of an aortic aneurysm. He was a long-serving Lane County Commissioner in western Oregon. He served in the Navy in the South Pacific during World War II with a shaved head and a gold earring, and worked at Douglas Aircraft and Mattel Corp. in Los Angeles before moving to Oregon in 1972. He started his political career by hanging out at local city council meetings. He was preceded in death by his wife Bel.

Herbert A. Johnson (MS, '58), 82, passed away at home in Union City, Calif. on December 6. He served in the U.S. Army, earned degrees in industrial engineering and worked for Lockheed Martin, Bechtel and Sygnetics. He is survived by his wife Lois.

Phillip Knouse (MSEE, '68), 73, of Tennessee, died November 29 after a long battle with pancreatic cancer. He served for four years as a naval officer and also embarked on a career in engineering. He taught electronics technology at Black Hawk College in Moline, Ill. and Virginia Highlands College in Abingdon, Va. He is survived by his wife of 46 years, Joyce; and two daughters Kathryn and Linda.

John Allen Long (MSSM, '74), 72, of Newport News, Va., died September 2 after a long battle with cancer. He served in the U.S. Air Force for 29 years as an accomplished and decorated research and development engineer and pilot. He flew 10 different types of aircraft and accumulated over six thousand hours of flight time. He is survived by his high school sweetheart and wife of 50 years, Jean; three children Deborah, Steven and Jennifer; and six grandchildren.

Walter Leland Marks (BSME, '62) passed away on December 27 in Roseville, Calif. He served in the U.S. Army beginning in 1957, and later worked for Texas Instruments in Dallas. In 1966 he and his wife moved back to California, and Walter became a business owner in Santa Cruz. He is survived by his wife Betty; three children Anne, Melanie and John; and three grandchildren.

Irvin Peters (BSME, '48), 94, of North Hollywood, passed away November 24. He was a Los Angeles resident for more than 50 years and spent his career in aeronautical design. He was preceded in death by his wife of 48 years, Ada Beauchamp Peters.

Eugene E. Polito (BSME, '42), 92, of Irvine, Calif., passed away peacefully at his home on November 28 after a three-year battle with esophageal cancer. Throughout WWII he worked as an engineer for Douglas Aircraft, and later became a director of photography, working on hundreds of productions with Hollywood's finest directors and actors over a 40-year career. At 62, Gene became a professor at USC's School of Cinematic Arts. He is survived by Lucy, his wife of 66 years; nine children Gregory, Stephen, Mary, Christine, Richard, Michele, Joan, Douglas and Lisa; 24 grandchildren; and five great grandchildren.

Edwin Whiffen (MSISE, '68), 82, of Santa Ana, Calif., passed away on December 11. He served with the U.S. Navy and later worked as an engineer in the aerospace industry for 35 years before retiring to San Clemente. He was preceded in death by his wife, Jean and son Richard. He was survived by his beloved Betty and three children James, John and Charles; eight grandchildren; and three great-grandchildren.

Q&A

Q&A: John Brooks Slaughter's Mission of a Lifetime

Driving diversity in science, technology, engineering and math, as told to Lenora Chu

John Brooks Slaughter began his career in 1956 as an electrical engineer and eventually went on to head two universities and lead the National Science Foundation (NSF) as its first African American director.

Along the way, he has been both a pioneer and intrepid advocate for increasing underrepresented minority participation in higher education, particularly in the areas of science, technology, engineering and mathematics (STEM).

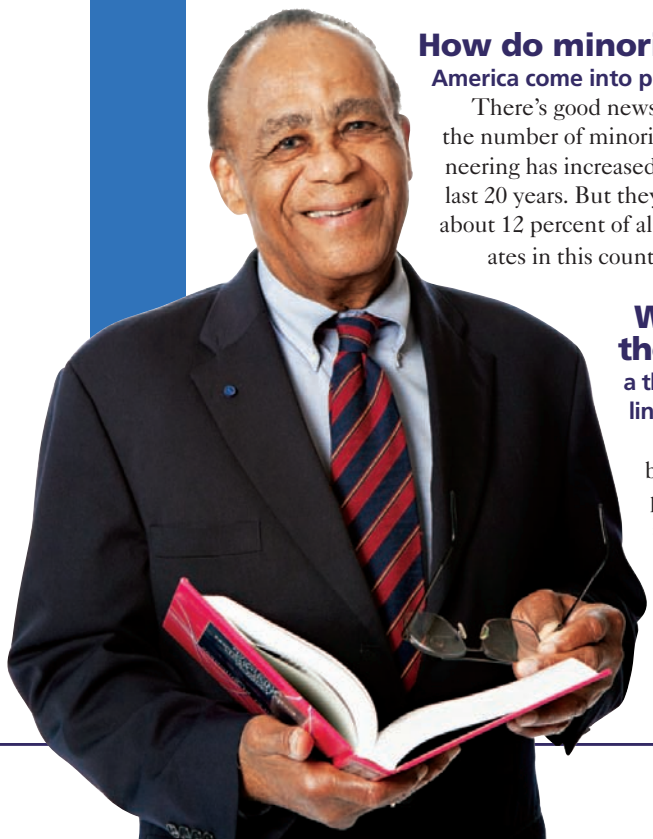
In his new position as professor of engineering and education at USC, Slaughter will continue to focus on this lifelong quest. His legacy is already clear at the University of Maryland, where he served as chancellor, and at Occidental College, which he transformed during his 11-year presidential tenure into the most diverse liberal arts college in America.

For nearly 10 years, he also served as president and CEO of the National Action Council for Minorities in Engineering (NACME), whose mission is to increase the number of engineers of color.

Here the National Academy of Engineering member and distinguished educator talks about his journey—and thoughts on how to cultivate the next generation of engineering leaders at USC.

Why is it critical to increase the number of students studying science and engineering?

We are losing the race to other countries. Fewer and fewer American students are entering science and engineering at the moment, and that means we are behind in our ability to compete in science and technology. We're finding ourselves lacking in interested domestic students, particularly at the graduate levels.



How do minority students in America come into play?

There's good news to report there, in that the number of minority students in engineering has increased somewhat over the last 20 years. But they still represent only about 12 percent of all engineering graduates in this country.

Where does the problem with a thinning STEM pipeline begin?

Engineering has become 'lost' in our primary and secondary schools. There are too few science and math teachers. The problem is especially acute in our urban schools, where those teachers often don't have majors or even minors in math or science. They can't communicate an enthusiasm for STEM subjects, so students don't get turned on by it.

Do you think students' use of social networks and stories of millionaire Internet entrepreneurs have helped incite a newfound curiosity in engineering?

You know, young people use the tools, they use Facebook, they use social media. But I don't sense that they're really interested in finding out how they work, or creating the tools themselves.

Then there's the perception that business majors make more money.

Sure. For the last decade we've seen a huge increase of students going into business, and that has drawn away from STEM fields. We need to do a better job of helping young people make decisions based upon the opportunities and rewards that exist in STEM fields. Plus, I would hope we can convince people that making money is not the best goal for their education. It should be about making a real contribution, and finding something to enjoy for the long term.

What worked for you? Why did you decide to become an engineer?

It was a decision I made independently and not because I had, say, an early mentor. In fact, I grew up during a period where African American children went to segregated schools and weren't encouraged to pursue higher education. I had to overcome those things. I didn't have any engineers in the family; but I was lucky in the sense that my family believed in me and supported my dream. I was just always fascinated with building things and taking them apart to see how they worked.

What are you telling students when you talk about engineering?

That there are so many opportunities and urgent needs that require engineering minds. The environment. Energy independence. Climate change. Healthcare. Improving our infrastructure. We will have to address all of these through improvements in science and technology, and I tell young people to prepare themselves so that they can respond.

How should we tackle the problem?

We need to educate both students and teachers. Improve teachers' ability to teach science and math. Put forth incentives to get more of our students educated in STEM subjects. At the university level, we need to support our students, help them through retention to graduation, and prepare them for the workforce. It's a continuum. //

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– Dennis Lee, MS in Engineering Management, 2007
Northrop Grumman

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